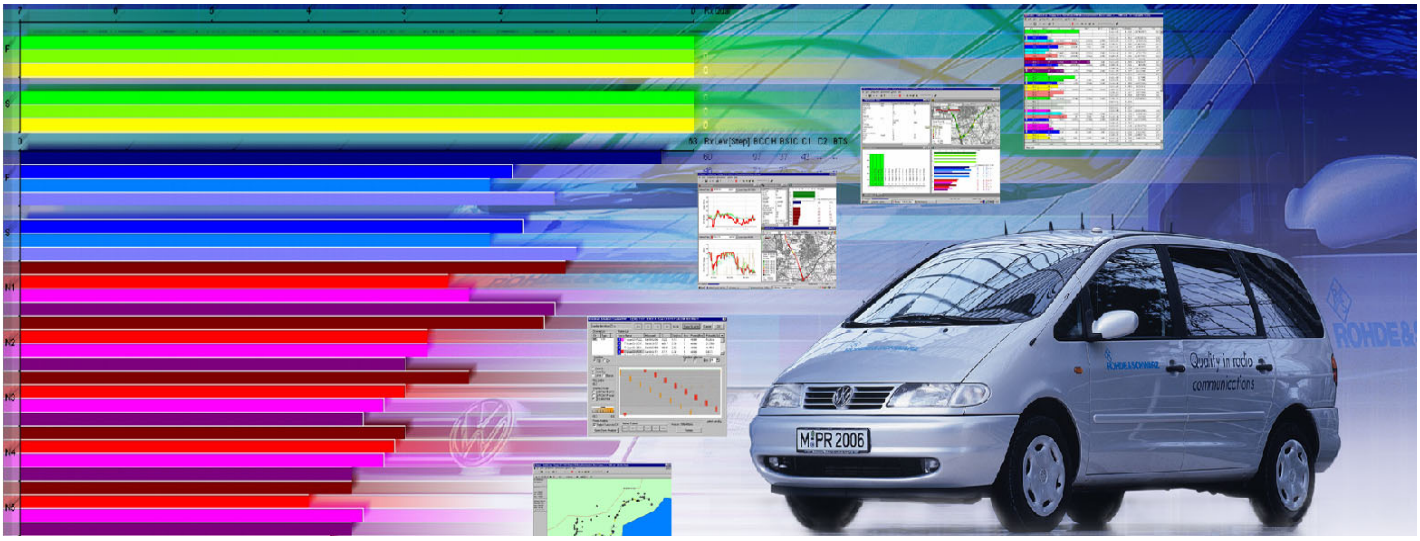
Operating Manual



R&S Coverage Measurement System

R&S® ROMES

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Version 3.60

Printed in Germany

ROHDE&SCHWARZ
Test and Measurement Division

Dear Customer,

throughout this manual, ROMES is generally used as an abbreviation for the coverage measurement system R&S® ROMES.

Tabbed Divider Overview

Volume 1

Contents

List of Figures
List of Tables
Safety Instructions
Certificate of Quality

Tabbed Divider

1	**Chapter 1:**	**General Description**
2	**Chapter 2:**	**Getting Started**
3	**Chapter 3:**	**User Interface**
4	**Chapter 4:**	**Display and Evaluation of Results**
5	**Chapter 5:**	**Carrier to Interference Measurement**

Volume 2

Tabbed Divider

6	**Chapter 6:**	**Hardware Components and Drivers**
7	**Chapter 7:**	**Data Processing and Data Formats**
8	**Chapter 8:**	**Installation Instructions and Background Information**
9	**Chapter 9:**	**Messages**
10	**Index**	

List of Figures

Fig. 1-1 Overview of a measurement tour 1.2
Fig. 1-2 Principle of a measurement 1.3
Fig. 1-4 Workspace and measurement files 1.4
Fig. 1-5 Data tree and data selection 1.5
Fig. 3-1 ROMES' main window 3.2
Fig. 3-2 File menu 3.4
Fig. 3-3 View menu 3.12
Fig. 3-4 Configuration menu 3.36
Fig. 3-5 ROMES Configuration – General 3.37
Fig. 3-6 ROMES Configuration – Available Signals 3.40
Fig. 3-7 ROMES Configuration – Available Events 3.43
Fig. 3-8 ROMES Configuration – Technologies 3.47
Fig. 3-9 ROMES Configuration – Shortcuts 3.48
Fig. 3-10 ROMES Configuration – Advanced Settings 3.49
Fig. 3-11 Configuration of Software Modules – Views 3.52
Fig. 3-12 Configuration of Software Modules – TEC for GSM 3.54
Fig. 3-13 BTS List Editor 3.59
Fig. 3-14 TEC for UMTS Test Mobiles– Node B List Database 3.60
Fig. 3-15 Tx Database Editor 3.61
Fig. 3-16 TEC for UMTS Test Mobiles – UMTS Technology Settings 3.62
Fig. 3-17 TEC for CDMA – CDMA BTS List Database 3.63
Fig. 3-18 Configuration of Software Modules – TEC for UMTS PNS 3.64
Fig. 3-19 Configuration of Software Modules – TEC for CW Devices 3.66
Fig. 3-20 Measurement menu 3.67
Fig. 3-21 Database menu 3.77
Fig. 3-22 Window menu 3.78
Fig. 3-23 Help menu 3.80
Fig. 3-24 Loaded Modules dialog 3.81
Fig. 4-1 General view properties 4.1
Fig. 4-2 Info tab 4.3
Fig. 4-3 C/I Analyser Views 4.5
Fig. 4-4 View – Basic menu 4.6
Fig. 4-5 Alphanumeric View 4.6
Fig. 4-6 Alphanumeric View: Configuration 4.7
Fig. 4-7 Alphanumeric View: Configuration 4.8
Fig. 4-8 General Status View 4.9
Fig. 4-9 General Status View: Configuration 4.10
Fig. 4-10 2D Chart View 4.11
Fig. 4-11 UMTS phone mode during autodial 4.13
Fig. 4-12 2D Chart View: Parameter selection 4.14
Fig. 4-13 2D Chart View: configuration 4.15
Fig. 4-14 Event View 4.16
Fig. 4-15 Message View 4.17
Fig. 4-16 Statistic Histogram View 4.21
Fig. 4-17 Statistic Histogram View: parameter selection 4.24
Fig. 4-18 Statistic Histogram View: configuration 4.25
Fig. 4-19 Polar View 4.26
Fig. 4-20 Polar View: parameter selection 4.28
Fig. 4-21 Compass Views 4.29
Fig. 4-22 Compass Info view 4.29
Fig. 4-23 Navigation Views 4.30
Fig. 4-24 GPS Info view 4.30
Fig. 4-25 GPS Info configuration 4.32
Fig. 4-26 Route Track 4.32
Fig. 4-27 Route Track configuration: Values 4.36

Fig. 4-28 Route Track configuration: Route Tracking 4.37
Fig. 4-29 Route Track configuration: Archive 4.39
Fig. 4-30 Route Track configuration: Technology modules 4.40
Fig. 4-31 Route Track configuration: Calibration of raster image maps 4.41
Fig. 4-32 GSM BTS Layer submenu 4.45
Fig. 4-33 GSM BTS Layer dialog: Settings 4.46
Fig. 4-34 GSM BTS Layer dialog: Extended Settings 4.48
Fig. 4-35 BTS Selection dialog (GSM networks) 4.49
Fig. 4-36 UMTS Layer submenu 4.50
Fig. 4-37 UMTS Layer dialog: PNS Settings 4.51
Fig. 4-38 UMTS Layer dialog: Mobile Settings 4.52
Fig. 4-39 UMTS Layer dialog: General Settings 4.53
Fig. 4-40 BTS Selection dialog (UMTS networks) 4.54
Fig. 4-41 CDMA BTS Layer submenu 4.57
Fig. 4-42 BTS Selection dialog (CDMA networks) 4.57
Fig. 4-43 CDMA BTS Layer dialog 4.58
Fig. 4-44 C/I Layer submenu 4.59
Fig. 4-45 UMTS/GSM Views 4.61
Fig. 4-46 UMTS/GSM Layer 3 View 4.62
Fig. 4-47 UMTS/GSM Layer 3 View: GSM L3 Messages 4.64
Fig. 4-48 UMTS/GSM Layer 3 View: GPRS RLC/MAC messages 4.65
Fig. 4-49 UMTS/GSM Layer 3 View: UMTS RRC messages 4.66
Fig. 4-50 UMTS/GSM Layer 3 View: Extended Configuration 4.67
Fig. 4-51 UMTS/GSM Layer 3 View: Export 4.70
Fig. 4-52 UMTS/GSM NQA View (for 3 mobiles) 4.71
Fig. 4-53 UMTS/GSM ETSI QoS View 4.72
Fig. 4-54 UMTS/GSM ETSI QoS View: Configuration 4.75
Fig. 4-55 UMTS/GSM Handover Analyzer View (list) 4.76
Fig. 4-56 UMTS/GSM Handover Analyzer View (statistics, 3G –> 3 G handover) 4.79
Fig. 4-57 UMTS/GSM Handover Analyzer View Configuration 4.81
Fig. 4-58 UMTS/GSM NQA State View 4.82
Fig. 4-59 UMTS views 4.84
Fig. 4-60 UMTS Finger Data View 4.85
Fig. 4-61 UMTS Finger Data View: Finger Data View Configuration 4.87
Fig. 4-62 UMTS Layer 1 View 4.88
Fig. 4-63 UMTS Layer 1 View: TOP N List Configuration 4.91
Fig. 4-64 UMTS CellSet View 4.91
Fig. 4-65 UMTS CellSet View: CellSet List Configuration 4.94
Fig. 4-66 UMTS NAS Status View 4.95
Fig. 4-67 UMTS TrCH View 4.97
Fig. 4-68 UMTS TrCH View: TrCH List Configuration 4.99
Fig. 4-69 UMTS Physical Channels View 4.99
Fig. 4-70 UMTS Physical Channels View: Physical Channel View Configuration 4.102
Fig. 4-71 UMTS SIB View 4.103
Fig. 4-72 UMTS RLC/MAC View 4.104
Fig. 4-73 UMTS RLC/MAC View: RLC/MAC View Configuration 4.106
Fig. 4-74 UMTS Measurement Report View 4.106
Fig. 4-75 UMTS Reselection View 4.108
Fig. 4-76 UMTS Reselection View: Reselection View Configuration 4.110
Fig. 4-77 UMTS Power Control View 4.111
Fig. 4-78 UMTS Layer 1 Graph View 4.112
Fig. 4-79 UMTS Neighborhood Analyzer View 4.113
Fig. 4-80 UMTS/GSM Neighborhood Analyzer View Configuration 4.117
Fig. 4-81 UMTS views (HSDPA) 4.121
Fig. 4-82 HSDPA signals 4.122
Fig. 4-83 HS-DPCCH frame structure 4.122
Fig. 4-84 UMTS HSDPA UL HS-DPCCH View 4.123
Fig. 4-85 UMTS HSDPA HS Decode Status View 4.124
Fig. 4-86 UMTS HSDPA HARQ Statistic View 4.126

Fig. 4-87 UMTS HSDPA HARQ Statistic View Configuration....4.127
Fig. 4-88 UMTS HSDPA Configuration View....4.128
Fig. 4-89 UMTS MAC Configuration View....4.131
Fig. 4-90 UMTS HSDPA MAC Status View....4.132
Fig. 4-91 UMTS HSDPA Status View Configuration....4.134
Fig. 4-92 UMTS MAC-hs PDU....4.134
Fig. 4-93 UMTS HSDPA MAC Header View....4.135
Fig. 4-94 UMTS HSDPA Header View Configuration....4.136
Fig. 4-95 UMTS HSDPA Performance View....4.137
Fig. 4-96 UMTS HSDPA Performance View Configuration....4.140
Fig. 4-97 UMTS HSDPA Decode Statistic View....4.141
Fig. 4-98 UMTS HSDPA Decode Statistic View Configuration....4.142
Fig. 4-99 GSM views....4.143
Fig. 4-100 GSM Layer 1 View....4.144
Fig. 4-101 GSM Layer 1 View: GSM Layer 1 Parameters....4.145
Fig. 4-102 GSM Layer 2 View....4.146
Fig. 4-103 GSM Layer 2 View configuration....4.147
Fig. 4-104 GSM Measurement Report (for 3 mobiles)....4.148
Fig. 4-105 GSM Measurement Report View: Configuration....4.150
Fig. 4-106 GSM System Information View....4.151
Fig. 4-107 GSM System Information View configuration: parameter list....4.152
Fig. 4-108 GSM Handover View....4.153
Fig. 4-109 GSM Handover View configuration....4.154
Fig. 4-110 GSM Frequency Hopping View....4.155
Fig. 4-111 GSM Scan View....4.157
Fig. 4-112 GSM Scan View configuration: parameter list....4.158
Fig. 4-113 GSM SMS View....4.159
Fig. 4-114 SMS parameters in the Alphanumeric View....4.160
Fig. 4-115 GSM CBCH View....4.160
Fig. 4-116 GSM QoS View....4.162
Fig. 4-117 GSM QoS View: GSM QoS View Configuration....4.164
Fig. 4-118 GSM GPRS State View....4.165
Fig. 4-119 GSM GPRS System Information View....4.166
Fig. 4-120 GSM GPRS PDP Info View....4.166
Fig. 4-121 GSM GPRS RLC/MAC View....4.168
Fig. 4-122 GSM RLC/MAC View: GPRS RLC/MAC View Configuration....4.172
Fig. 4-123 GSM GPRS TS/CS View....4.173
Fig. 4-124 GSM TS/CS View: GPRS TS/CS View Configuration....4.174
Fig. 4-125 GSM GPRS RLC/MAC Header View....4.175
Fig. 4-126 GSM GPRS/EGPRS View....4.178
Fig. 4-127 CW views....4.181
Fig. 4-128 CW Info View....4.181
Fig. 4-129 ETACS views....4.183
Fig. 4-130 ETACS Signaling View....4.183
Fig. 4-131 ETACS Scan View....4.184
Fig. 4-132 CDMA views....4.185
Fig. 4-133 CDMA Pilot View....4.186
Fig. 4-134 CDMA NQA View (for 3 mobiles)....4.187
Fig. 4-135 CDMA Markov Statistic View....4.188
Fig. 4-136 CDMA Vocoder Rate View....4.189
Fig. 4-137 CDMA Vocoder Rate View configuration....4.190
Fig. 4-138 CDMA Frame Error Rate View....4.191
Fig. 4-139 CDMA CAI View....4.192
Fig. 4-140 CDMA CAI View: Messages configuration....4.194
Fig. 4-141 CDMA CAI View: Extended configuration....4.195
Fig. 4-142 CDMA Searcher View....4.196
Fig. 4-143 CDMA Power View....4.197
Fig. 4-144 CDMA Finger View....4.199
Fig. 4-145 Indoor views....4.200

Fig. 4-146 Indoor View....4.201
Fig. 4-147 Indoor View configuration: Values tab....4.204
Fig. 4-148 Indoor View configuration: Indoor Configuration tab....4.205
Fig. 4-149 DVB views....4.206
Fig. 4-150 DVB DVQ Meter View (weighted parameters)....4.207
Fig. 4-151 DVB DVQ Meter View configuration....4.207
Fig. 4-152 DVB EFA-T Status View....4.208
Fig. 4-153 DVB EFA-T Status View configuration....4.210
Fig. 4-154 DVB EVA-T CIR View....4.210
Fig. 4-155 DVB EFA-T CIR View configuration....4.211
Fig. 4-156 DVB Atlas View....4.212
Fig. 4-157 DVB EVA-T ATSC Histogram View (Q amplitude, linear scale)....4.214
Fig. 4-158 DVB EFA-T Amplitude Distribution View....4.215
Fig. 4-159 DVB EFA-T CCDF (RF) View....4.217
Fig. 4-160 DVB EFA-T Echo Pattern View....4.219
Fig. 4-161 View – UMTS PNS menu....4.220
Fig. 4-162 PNS P-SCH View....4.221
Fig. 4-163 PNS P-SCH configuration: P-SCH View....4.223
Fig. 4-164 PNS CPICH View....4.224
Fig. 4-165 PNS CPICH configuration: CPICH View....4.228
Fig. 4-166 PNS CPICH configuration: Color Settings....4.229
Fig. 4-167 PNS Spectrum View....4.230
Fig. 4-168 PNS Spectrum configuration....4.232
Fig. 4-169 PNS Spectrum History View....4.233
Fig. 4-170 PNS Spectrum History configuration....4.234
Fig. 4-171 PNS SC Tracer View....4.236
Fig. 4-172 PNS SC Tracer configuration – SC Tracer Target Selection....4.239
Fig. 4-173 PNS SC Tracer configuration – SC Tracer View....4.240
Fig. 4-174 PNS Pilot View: Min - Max - Average - Current Graph....4.241
Fig. 4-175 PNS Pilot configuration....4.243
Fig. 4-176 PNS Top N View....4.244
Fig. 4-177 PNS Top N configuration: Top N View....4.246
Fig. 4-178 PNS Rake Finger View....4.247
Fig. 4-179 PNS Rake Finger View Configuration....4.248
Fig. 4-180 PNS Rake Finger Chart View....4.249
Fig. 4-181 PNS Rake Finger Chart View Configuration....4.251
Fig. 4-182 PNS BCH View....4.252
Fig. 4-183 PNS BCH View Configuration....4.253
Fig. 4-184 QoS views....4.254
Fig. 4-185 QoS Message View....4.255
Fig. 4-186 QoS Progress View (Video Streaming)....4.256
Fig. 4-187 QoS Progress View (HTTP Download)....4.257
Fig. 4-188 QoS DQA View....4.258
Fig. 4-189 QoS Report View – Session, ETSI, Job Report, HTTP Download and Video Streaming..4.261
Fig. 4-190 QoS Report View configuration....4.263
Fig. 4-191 QoS Throughput View....4.264
Fig. 4-192 QoS Throughput View configuration....4.266
Fig. 4-193 QoS RAS Statistics View....4.267
Fig. 4-194 QoS Object View....4.268
Fig. 4-195 SQA Message View....4.269
Fig. 4-196 Mapping of PESC score (P862) and ITU P.800 values according to ITTU P862.1....4.272
Fig. 4-197 Spectrum views....4.273
Fig. 4-198 Spectrum View....4.273
Fig. 4-199 Spectrum configuration....4.276
Fig. 4-200 Spectrum History View....4.277
Fig. 4-201 Spectrum History configuration....4.278
Fig. 4-202 GSM NWS views....4.279
Fig. 4-203 GSM NWS Transmitter Scan View....4.280
Fig. 4-204 GSM NWS Frequency Reuse View: Co Channel Interferer....4.281

Fig. 4-205 GSM NWS Frequency Reuse View: Configuration 4.284
Fig. 4-206 GSM NWS Frequency Reuse View: Threshold Values 4.285
Fig. 4-207 GSM NWS Frequency Reuse View: Adj. Channel Interferer 4.287
Fig. 4-208 GSM NWS Frequency Reuse View: Event List....................4.288
Fig. 4-209 GSM NWS Frequency Reuse View: Event List Configuration 4.289
Fig. 4-210 CDMA2000 PNS views....................4.290
Fig. 4-211 PNS F-PICH View 4.291
Fig. 4-212 PNS F-PICH configuration: F-PICH View....................4.294
Fig. 4-213 PNS F-PICH configuration: Color Settings....................4.295
Fig. 4-214 PNS F-SYNC View 4.296
Fig. 4-215 PNS F-SYNC configuration: Color Settings 4.298
Fig. 4-216 WLAN views....................4.299
Fig. 4-217 WLAN signals....................4.300
Fig. 4-218 WLAN Scan View....................4.300
Fig. 4-219 WLAN Scan View configuration: Configuration....................4.302
Fig. 4-220 WLAN Scan View configuration: Colors....................4.303
Fig. 4-221 WLAN Signal View 4.304
Fig. 4-222 WLAN C/I View....................4.305
Fig. 4-223 WLAN S/N View 4.306
Fig. 4-224 WLAN Survey View 4.307
Fig. 4-225 WLAN Survey View configuration 4.309
Fig. 5-1 C/I Analyzer View menu 5.1
Fig. 5-2 Route Track View: C/I Layer 5.2
Fig. 5-3 C/I Layer dialog: Settings 5.4
Fig. 5-4 BTS Station 5.6
Fig. 5-5 BTS Information 5.7
Fig. 5-6 List of Measurement Results....................5.9
Fig. 5-7 BTS Selection (Search Sector) 5.11
Fig. 5-10 K6 CI Main View....................5.13
Fig. 5-11 K6 CI Measurement View....................5.17
Fig. 5-12 Structure and representation of the FCCH signal 5.22
Fig. 5-13 Interference diagram: channel identification 5.23
Fig. 5-14 Interference diagram: CoCx and CxCx interferences 5.24
Fig. 5-15 Interference diagram: Example of a traffic channel signal....................5.25
Fig. 5-16 Interference diagram: Identification of signals....................5.25
Fig. 5-17 Interference diagram: Spectrum (plane) 5.26
Fig. 5-18 Interference diagram: Spectrum (distribution)....................5.27
Fig. 5-19 K6 CI Power Analysis View 5.28
Fig. 5-20 K6 CI Remark Editor View....................5.32
Fig. 5-21 K6 Trigger View....................5.33
Fig. 5-22 Trigger Simulation 5.34
Fig. 5-23 K6 TS View....................5.36
Fig. 5-24 TS Notification....................5.37
Fig. 5-25 K7 Transmitter Scan View....................5.39
Fig. 5-26 Display of the K7 Transmitter Scan View time measurements 5.41
Fig. 5-27 Transmitter Scan View Configuration....................5.43
Fig. 5-28 K7 Scan View Configuration: Matching Entries: Range 5.45
Fig. 5-29 Matching Entries: Range Parameter Explanation 5.46
Fig. 6-1 ROMES Hardware Configuration 6.1
Fig. 6-2 Driver indication....................6.11
Fig. 6-3 System driver configuration....................6.12
Fig. 6-4 Performance counter signals 6.13
Fig. 6-5 Driver configuration – Setup (AEG, RS TM, Sagem, Kapsch, Caesium, Siemens)....................6.17
Fig. 6-6 Driver configuration – Nokia Settings....................6.20
Fig. 6-7 Driver configuration – GPRS Forcing....................6.21
Fig. 6-8 Measurement mode (AEG, RS TM, Sagem, Kapsch, Caesium, GSM/GPRS Motorola).....6.24
Fig. 6-9 Driver Configuration – Remote Receiver tab (all drivers)....................6.28
Fig. 6-10 Driver Configuration – Autodialing tab (all drivers, single call type) 6.31
Fig. 6-11 Driver Configuration – Autodialing tab (Sagem x6, multi call type) 6.33

Fig. 6-12 Call Settings (Sagem x6, multi call type) ... 6.34
Fig. 6-13 Driver Configuration – NQA tab (all drivers) ... 6.34
Fig. 6-14 Driver Configuration – Antenna tab (all drivers) ... 6.37
Fig. 6-15 Driver Configuration – Slaves tab (all drivers) ... 6.37
Fig. 6-16 Driver Configuration – SMS Tester tab ... 6.38
Fig. 6-17 Driver Configuration – Layer 3 Uplink frames tab ... 6.39
Fig. 6-18 Driver Configuration – QoS Tests tab (all drivers) ... 6.40
Fig. 6-19 Driver Configuration – QoS Statistics tab ... 6.42
Fig. 6-20 Driver Configuration – Templates ... 6.43
Fig. 6-21 Driver Configuration – HOA ... 6.44
Fig. 6-22 Driver Configuration – Speech Quality ... 6.45
Fig. 6-23 SQA Settings ... 6.46
Fig. 6-24 Basic SQA Test Setup ... 6.48
Fig. 6-25 Driver Configuration – Serial Port Driver Info tab (all drivers) ... 6.49
Fig. 6-26 Loading of symbol files ... 6.50
Fig. 6-27 Action menu for different driver types ... 6.51
Fig. 6-28 UMTS driver configuration – Configuration ... 6.56
Fig. 6-29 UMTS driver configuration – Expert Mode ... 6.57
Fig. 6-30 UMTS driver configuration – Nokia Settings ... 6.61
Fig. 6-31 UMTS driver configuration – RAT Settings ... 6.63
Fig. 6-32 Driver Configuration – NQA tab ... 6.65
Fig. 6-33 Driver Configuration – Autodialing tab ... 6.67
Fig. 6-34 Driver Configuration – HOA tab ... 6.67
Fig. 6-35 Driver Configuration – Remote Receiver tab ... 6.68
Fig. 6-36 Driver Configuration – Speech Quality tab ... 6.69
Fig. 6-37 Driver Configuration – Antenna tab ... 6.69
Fig. 6-38 Driver Configuration – Templates tab ... 6.70
Fig. 6-39 Driver Configuration – Serial Port Driver Info tab ... 6.70
Fig. 6-40 Action menu for different driver types ... 6.71
Fig. 6-41 CDMA driver configuration – Define Measurement ... 6.74
Fig. 6-42 CDMA driver configuration – Autodialing ... 6.76
Fig. 6-43 CDMA driver configuration – RF parameters ... 6.77
Fig. 6-44 CDMA driver configuration – Serial Port Driver Info ... 6.78
Fig. 6-45 ETACS driver configuration – Measurement settings ... 6.79
Fig. 6-46 ETACS driver configuration – Antenna parameters ... 6.80
Fig. 6-47 ETACS driver configuration – Driver Info ... 6.81
Fig. 6-48 Action menu (ETACS driver) ... 6.81
Fig. 6-49 Philips752 driver configuration – Measurement settings ... 6.84
Fig. 6-50 Philips752 driver configuration – Antenna ... 6.85
Fig. 6-51 Philips752 driver configuration – Driver Info ... 6.85
Fig. 6-52 Action menu (DAB driver) ... 6.86
Fig. 6-53 Atlas Measurements ... 6.87
Fig. 6-54 Atlas Settings ... 6.88
Fig. 6-55 Barco Atlas driver configuration: Antenna ... 6.90
Fig. 6-56 CAS3173 CONFIG ... 6.91
Fig. 6-57 DVB driver configuration – Driver Info ... 6.92
Fig. 6-58 DVMD Settings ... 6.93
Fig. 6-59 DVMD Properties ... 6.94
Fig. 6-60 Transport Stream ... 6.95
Fig. 6-61 DVQ Settings ... 6.95
Fig. 6-62 EFA-T Mode Settings ... 6.97
Fig. 6-63 Analog TV Configuration ... 6.98
Fig. 6-64 DVB-T / ATSC Measurement Configuration ... 6.99
Fig. 6-65 DVB-T / ATSC Configuration ... 6.101
Fig. 6-66 DVB-T / ATSC Ext. Configuration ... 6.102
Fig. 6-67 EFA-T driver configuration: Antenna ... 6.103
Fig. 6-68 TSM-DVB Configuration ... 6.104
Fig. 6-69 TSM-DVB calibration – test setup ... 6.106
Fig. 6-70 TSM-DVB Configuration – Calibration ... 6.106

Fig. 6-71 TSM-DVB driver configuration: Antenna 6.108
Fig. 6-72 TSM-DVB driver configuration: Templates....6.109
Fig. 6-73 Action menu (DVB drivers)....6.109
Fig. 6-74 Accessing the test receiver driver configurations....6.113
Fig. 6-75 Test receiver driver configuration – ESVx/Seegull/ESPI/EB200 ....6.114
Fig. 6-76 Test receiver driver configuration – Receiver settings 6.116
Fig. 6-77 Test receiver driver configuration – Measurement settings 6.120
Fig. 6-78 Test receiver driver configuration – Antenna....6.127
Fig. 6-79 Test receiver driver configuration – Templates 6.128
Fig. 6-80 Test receiver driver configuration – driver Info....6.130
Fig. 6-81 Trigger Box driver configuration 6.131
Fig. 6-82 Trigger Box configuration – Serial Port Driver Info....6.132
Fig. 6-83 Action menu (test receiver drivers) 6.133
Fig. 6-84 UMTS PNS Device Chooser 6.138
Fig. 6-85 Test setup for UMTS PN Scanner with TS-PNSYNC 6.139
Fig. 6-86 Accessing the UMTS PNS driver configurations....6.140
Fig. 6-87 UMTS PNS configuration – Receiver (ESPI/FSP and TSMU) 6.140
Fig. 6-88 UMTS PNS configuration – Add Frequency/BCH Demodulation....6.142
Fig. 6-89 UMTS PNS configuration – Measurements (ESPI/FSP and TSMU) 6.143
Fig. 6-90 UMTS PNS configuration – Top N 6.147
Fig. 6-91 UMTS PNS configuration – Pilot Pollution 6.150
Fig. 6-92 UMTS PNS configuration – Ultra High Speed....6.151
Fig. 6-93 UMTS PNS configuration – TSMU....6.152
Fig. 6-94 UMTS PNS configuration – Templates 6.153
Fig. 6-95 UMTS PNS configuration – Antenna....6.154
Fig. 6-96 GSM NWS Device Chooser....6.155
Fig. 6-97 GSM NWS configuration – Setup GSM NWS Driver 6.156
Fig. 6-98 GSM NWS configuration – TSMU....6.158
Fig. 6-99 GSM NWS configuration – Templates 6.158
Fig. 6-101 Accessing the CDMA PNS driver configurations....6.160
Fig. 6-102 CDMA PNS configuration – Receiver....6.161
Fig. 6-103 CDMA PNS configuration – Add Frequency 6.161
Fig. 6-104 CDMA PNS configuration – Measurements....6.162
Fig. 6-105 CDMA PNS configuration – TSMU....6.164
Fig. 6-106 CDMA PNS configuration – Templates....6.165
Fig. 6-107 Accessing the ESPI (Spectrum) driver configurations 6.166
Fig. 6-108 ESPI (Spectrum) configuration – Receiver 6.167
Fig. 6-109 ESPI (Spectrum) configuration – Antenna 6.169
Fig. 6-110 Accessing the WLAN (NDIS) driver configurations....6.170
Fig. 6-111 WLAN (NDIS) configuration – Device Setup....6.171
Fig. 6-112 WLAN (NDIS) configuration – Receiver....6.172
Fig. 6-113 Accessing the DQA driver configurations....6.173
Fig. 6-114 DQA driver configuration – DQA settings....6.174
Fig. 6-115 DQA driver configuration – Connection's Statistics....6.186
Fig. 6-116 DQA driver configuration – Patch Files 6.187
Fig. 6-117 DQA driver configuration: Templates 6.188
Fig. 6-118 Action menu (DQA driver) 6.189
Fig. 6-119 Svee6 driver configuration....6.191
Fig. 6-120 Svee6 driver configuration –Info....6.192
Fig. 6-121 Trimble Placer configuration: Calibration Data....6.192
Fig. 6-122 Trimble Placer configuration: GPS Health Monitoring....6.193
Fig. 6-123 Trimble Placer configuration: Placer Navigation Driver....6.194
Fig. 6-124 Test setup for inactive GPS driver....6.194
Fig. 6-125 Cabling of the T-connector....6.195
Fig. 6-126 Travel pilot – COM port messages....6.195
Fig. 6-127 NMEA Configuration....6.196
Fig. 6-128 Dummy GPS driver configuration....6.197
Fig. 6-129 Indoor submenu 6.198
Fig. 6-130 Indoor driver configuration....6.199

Fig. 6-131 Floorplan Configuration dialog 6.200
Fig. 6-132 Configuration of Indoor Map 6.202
Fig. 6-133 Performing a hot spot measurement 6.205
Fig. 6-134 Performing a continuous measurement 6.206
Fig. 6-135 Mast driver configuration 6.208
Fig. 6-136 Mast driver: Manual Mode Action 6.209
Fig. 6-137 Accessing the C/I driver configurations 6.210
Fig. 6-138 C/I Driver Measurement Selection (C/I driver) 6.211
Fig. 6-139 C/I Driver Measurement Specification 6.213
Fig. 6-140 C/I Trigger conditions 6.214
Fig. 6-141 Accessing the *R&S GSM Demodulator* driver configurations 6.216
Fig. 6-142 Driver settings of the GSM Demodulator 6.217
Fig. 7-1 Export CMD File... ....7.2
Fig. 7-2 Export measurement data 7.2
Fig. 7-3 Export Info 7.4
Fig. 7-4 ASCII Export configuration: Values 7.6
Fig. 7-5 ASCII Export configuration: Options 7.7
Fig. 7-6 Square Trigger condition 7.8
Fig. 7-7 ASCII Export configuration: Info 7.10
Fig. 7-8 ASCII Export configuration: Info 7.10
Fig. 7-9 MIF Export configuration: Values 7.13
Fig. 7-10 MIF Export configuration: Settings 7.14
Fig. 7-11 MES Export configuration 7.16
Fig. 7-12 Nokia Export configuration 7.17
Fig. 7-13 SRS/SER Export Options 7.19
Fig. 8-1 ROMES Tools 8.7

List of Tables

Table 1 Color codes in the UMTS HSDPA HS Decode Status View....................................4.125
Table 4-2 GSM System Information Type 1 to 6 parameters 4.152
Table 4-3 Indoor measurements in different navigation and measurement modes 4.202
Table 4 ITU P.800 PESQ scale 4.271
Table 6-1 GSM mobile drivers and supported devices....................................6.14
Table 6-2 GSM/GPRS message types, views and signals....................................6.20
Table 6-3 Views for Nokia and Qualcomm test mobiles....................................6.54
Table 6-4 GSM properties of UMTS test mobiles....................................6.55
Table 6-5 UMTS message types, views and signals 6.57
Table 6-6 GSM/GPRS message types, views and signals....................................6.58
Table 6-7 GSM/GPRS message types, views and signals....................................6.62
Table 6-8 GSM/GPRS message types, views and signals (Nokia 6630, older firmware versions)6.62
Table 6-9 Supported CDMA mobile phones 6.73
Table 6-10 DVB-T display modes, parameters and Views....................................6.100
Table 6-11 ATSC display modes, parameters and Views 6.100
Table 6-12 Test receiver family ESxx 6.111
Table 6-13 GPS drivers and supported devices 6.190
Table 7-1 Keywords for the extensible *.txt format....................................7.22
Table 7-2 Keywords for *.ndb export 7.24
Table 7-3 BTS List 7.25
Table 7-4 Attributes in an *.atd file....................................7.30
Table 7-5 NQA parameters....................................7.36
Table 7-6 Comparison of TS9954 NQA V2.1 and V3.0x 7.39
Table 8-1 List of drivers and further utilities....................................8.2
Table 8-2 List of further utilities....................................8.14
Table 8-3 Frequency ranges....................................8.18
Table 8-4 Channel numbers (ARFCN) 8.18
Table 8-5 Downlink channels in P-GSM900 (primary GSM) 8.19
Table 8-6 Downlink channels in GSM900: E-GSM and R-GSM....................................8.19
Table 8-7 Downlink channels in GSM1800....................................8.20
Table 8-8 Downlink channels in GSM850....................................8.21
Table 8-9 Downlink channels in GSM1900....................................8.22
Table 8-10 GSM power classes and output powers 8.23
Table 8-11 Definition of RX Level and RX Quality....................................8.23
Table 8-12 UTRA operating bands and channel numbers: Downlink....................................8.24
Table 8-13 UTRA operating bands and channel numbers: Uplink 8.24
Table 8-14 Downlink channels in UMTS operating band I....................................8.25
Table 8-15 Downlink channels in UMTS operating band II....................................8.26
Table 8-16 Downlink channels in UMTS operating band III....................................8.27

Before putting the product into operation for the first time, make sure to read the following

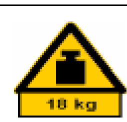
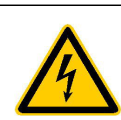
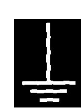
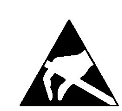
Safety Instructions

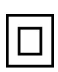
All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standard of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance with the relevant safety standards. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for an intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and a basic knowledge of English. It is therefore essential that the product be used exclusively by skilled and specialized staff or thoroughly trained personnel with the required skills. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation.

Symbols and safety labels

							
Observe product documentation	Weight indication for units >18 kg	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Attention! Electrostatic sensitive devices

					
Supply voltage ON/OFF	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double/reinforced insulation

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before putting the product into operation. It is also absolutely essential to observe the additional safety instructions on personal safety that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories.

Tags and their meaning

DANGER	This tag indicates a definite hazard carrying a high risk of death or serious injury if not avoided.
WARNING	This tag indicates a possible hazard carrying a medium risk of death or (serious) injury if not avoided.
CAUTION	This tag indicates a hazard carrying a low risk of minor or moderate injury if not avoided.
ATTENTION	This tag indicates the possibility of incorrect use that can cause damage to the product.
NOTE	This tag indicates a situation where the user should pay special attention to operating the product but which does not lead to damage.

These tags are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the tags described here are always used only in connection with the related product documentation and the related product. The use of tags in connection with unrelated products or documentation can result in misinterpretation and thus contribute to personal injury or material damage.

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
   prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 2000 m above sea level, max. transport altitude 4500 m above sea level.
   Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.
2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.

4. If products/components are mechanically and/or thermically processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.
6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.
7. Operating the products requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to handle operating the products; otherwise injuries or material damage may occur. It is the responsibility of the employer to select suitable personnel for operating the products.
8. Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.
10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.
12. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.
13. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.
15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
16. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.
18. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.

19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a license electrician.
20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.
21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.
22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.
23. Rohde & Schwarz products are not protected against penetration of water, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.
24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.
25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.
26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.
27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
    If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.
28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.
29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.
30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).
31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.
32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.
33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.

Por favor lea imprescindiblemente antes de la primera puesta en funcionamiento las siguientes

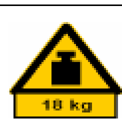
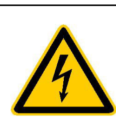
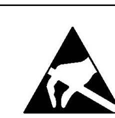
Informaciones de seguridad

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estandards de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los estandards técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las informaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto solamente fue elaborado para ser utilizado en la industria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado dentro de las instrucciones de la correspondiente documentación de producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos profundos y conocimientos parciales del idioma inglés. Por eso se deberá tener en cuenta de exclusivamente autorizar para el uso del producto a personas peritas o debidamente minuciosamente instruidas con los conocimientos citados. Si fuera necesaria indumentaria de seguridad para el uso de productos de R&S, encontrará la información debida en la documentación del producto en el capítulo correspondiente.

Símbolos y definiciones de seguridad

							
Ver documen-tación de producto	Informaciones para maquinaria con uns peso de > 18kg	Peligro de golpe de corriente	¡Advertencia! Superficie caliente	Conexión a conductor protector	Conexión a tierra	Conexión a masa conductora	¡Cuidado! Elementos de construcción con peligro de carga electroestática

I ○	⏻	⎓	~	≂	⧈
potencia EN MARCHA/PARADA	Indicación Stand-by	Corriente continua DC	Corriente alterna AC	Corriente continua/alterna DC/AC	El aparato está protegido en su totalidad por un aislamiento de doble refuerzo

Tener en cuenta las informaciones de seguridad sirve para tratar de evitar daños y peligros de toda clase. Es necesario de que se lean las siguientes informaciones de seguridad concienzudamente y se tengan en cuenta debidamente antes de la puesta en funcionamiento del producto. También deberán ser tenidas en cuenta las informaciones para la protección de personas que encontrarán en el capítulo correspondiente de la documentación de producto y que también son obligatorias de seguir. En las informaciones de seguridad actuales hemos juntado todos los objetos vendidos por el grupo de empresas Rohde & Schwarz bajo la denominación de „producto“, entre ellos también aparatos, instalaciones así como toda clase de accesorios.

Palabras de señal y su significado

PELIGRO	Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas.
ADVERTENCIA	Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas.
ATENCIÓN	Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas.
CUIDADO	Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
INFORMACIÓN	Indica una situación en la que deberían seguirse las instrucciones en el uso del producto, pero que no consecuentemente deben de llevar a un daño del mismo.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación de producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a malinterpretaciones y tener por consecuencia daños en personas u objetos.

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S válido lo que sigue:
   como posición de funcionamiento se define principialmente la posición con el suelo de la caja para abajo , modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4.500 m sobre el nivel del mar.
   A menos que se especifique otra cosa en la hoja de datos, se aplicará una tolerancia de ±10% sobre el voltaje nominal y de ±5% sobre la frecuencia nominal.

2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal perito autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Despues de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se producieran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averigurar los motivos de estas reacciones.
4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.
5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberan ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.
6. Ciertos productos, como por ejemplo las instalaciones de radiación HF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario/usario está comprometido a valorar y señalar areas de trabajo en las que se corra un riesgo aumentado de exposición a radiaciones para evitar riesgos.
7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.
8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del prodcuto.
9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.
10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto. Puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro, que es controlado su estado técnico de seguridad.
11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (según la medida del cable de distribución, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en construciones o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

12. No utilice nunca el producto si está dañado el cable eléctrico. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.
13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A (utilización de fusibles de mayor amperaje sólo previa consulta con el grupo de empresas Rohde & Schwarz).
14. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.
15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.
16. En las mediciones en circuitos de corriente con una tensión de entrada de U_{eff} > 30 V se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos de la EC950/EN60950.
18. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar heridas, fuego o daños en el producto.
19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efecutadas por un electricista especializado.
20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, el circuito de suministro de corriente deberá estar protegido de manera que usuarios y productos estén suficientemente protegidos.
21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir corto circuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.
22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.
23. Los productos R&S no están protegidos contra el agua si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente para el usario o de daños en el producto lo cual también puede llevar al peligro de personas.
24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.
25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.
26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. No cortocircuitar baterías ni acumuladores. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención celulas de Litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Las baterías y acumuladores deben reutilizarse y no deben acceder a los vertederos. Las baterías y acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de evacuación y reciclaje.

28. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.

29. El producto puede poseer un peso elevado. Muévalo con cuidado para evitar lesiones en la espalda u otras partes corporales.

30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).

31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetados de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean tenidas en cuenta. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.

32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo. El fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.

33. Dado el caso de que esté integrado un producto de laser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación de producto. De otra manera pondrá en peligro su salud, ya que el rayo laser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo laser.

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Contents

1 General Description 1.1

Introduction to ROMES 1.1

Performing a Measurement with ROMES 1.2

Basic Concepts of ROMES 1.3

Workspace and Measurement Files 1.3

Data Selection 1.6

File Formats 1.7

Third Party Software for ROMES 3 .... 1.9

Carrier to Interference Measurement 1.10

Measurement Principle 1.10

Measurement Process 1.10

Files Used for the Measurement 1.12

Database Update 1.14

Special Features of Option PCSD-K7 .... 1.14

1 General Description

This chapter gives a general introduction to the Coverage Measurement System ROMES with all its components. It describes the measurement principle, the basic system modules and available options, the measurement process, the file types used and the handling of BTS information stored in the internal database.

For a practical introduction to ROMES, in particular the GSM Carrier to Interference (C/I) analysis (with option ROMES-GS) refer to chapter 2, *Getting Started*. In this chapter a sample session is recorded including the basic configurations, a typical measurement and the essentials for evaluating and interpreting the measurement results.

The reference part describing all menus and functions in detail is split into several chapters: Chapter 3 gives a systematic overview of the user interface and all menu commands, chapter 4 describes the basic views and view configurations, chapter 5 the views for the GSM Carrier to Interference analysis. The following chapters explain the system and hardware driver settings and the options for data export. Technical aspects and background information are relegated to chapters 8 and 9.

System Requirements

ROMES runs under the *MS Windows XP* (SP2) operating system. A standard single-CPU PC with the following characteristics will ensure full functionality:

- 2 GHz CPU clock
- 512 MB RAM or more

Introduction to ROMES

Due to its modular concept, ROMES is a perfect solution for every coverage measurement task. *Rohde & Schwarz* offers various options which can be combined with ROMES, e.g. the options for measuring digital mobile phone networks, for digital audio broadcasting, or analog signal strength measurement in almost every relevant frequency range. The latter can be used as a stand-alone solution or in combination with ROMES.

Depending on the used devices, the complete system is either installed in a portable case or in a van.

The following picture gives an overview of the basic steps taken in a measurement tour.

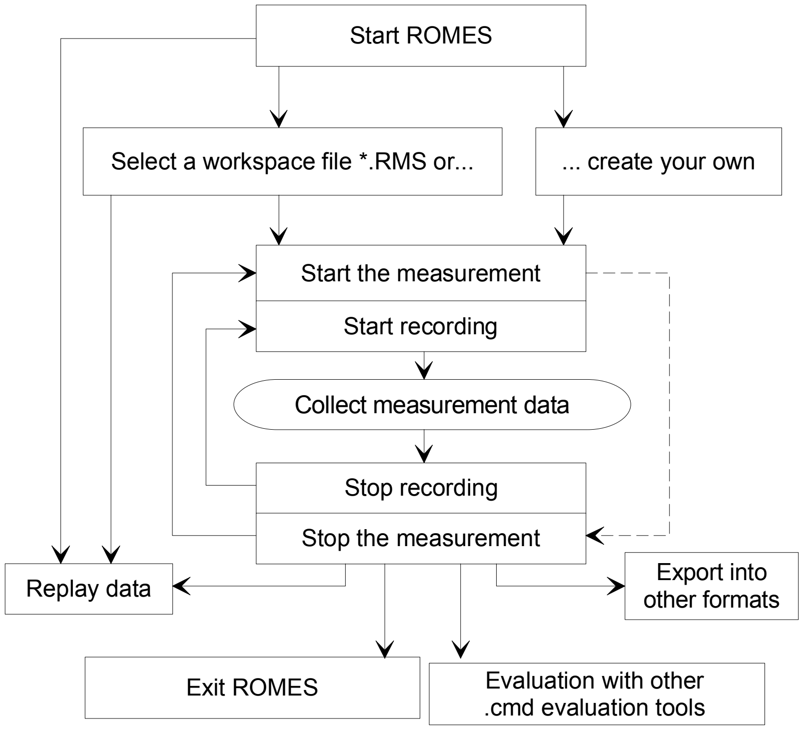


Fig. 1-1 Overview of a measurement tour

The *Replay* mode is an additional feature for pre-evaluation purposes. Replay means that you can load and analyze the stored measurement data after the measurement tour, using the different views that ROMES provides for display and evaluation. You can pause the replay at points of special interest in order to analyze the data replayed so far, print the view contents or copy screen shots to the clipboard using *ALT+PrtSc* (for capturing the active window) or *PrtSc* (for the whole screen).

Performing a Measurement with ROMES

With ROMES, the actual measurement and the evaluation of results can be configured and carried out independently:

- The hardware driver settings determine how the measurement is performed
- The display configuration settings determine how the results are analyzed and viewed

The data can be viewed during the measurement without being stored (*measurement* mode), they can be viewed and stored at the same time (*recording* mode), or data recorded before can be loaded from a measurement file and analyzed (*replay* mode).

The *result file (measurement file)* contents depend on the kind of drivers and their settings, not on the display configuration. In particular, the parameter selections and settings in the *Configuration – Settings* menu generally don't have any influence on the *.cmd file.

There is only one exception: The *Info* tabs in various *Configuration* menus contains information on user-name, test vehicle description and vehicle ID which is saved with the *.cmd file.

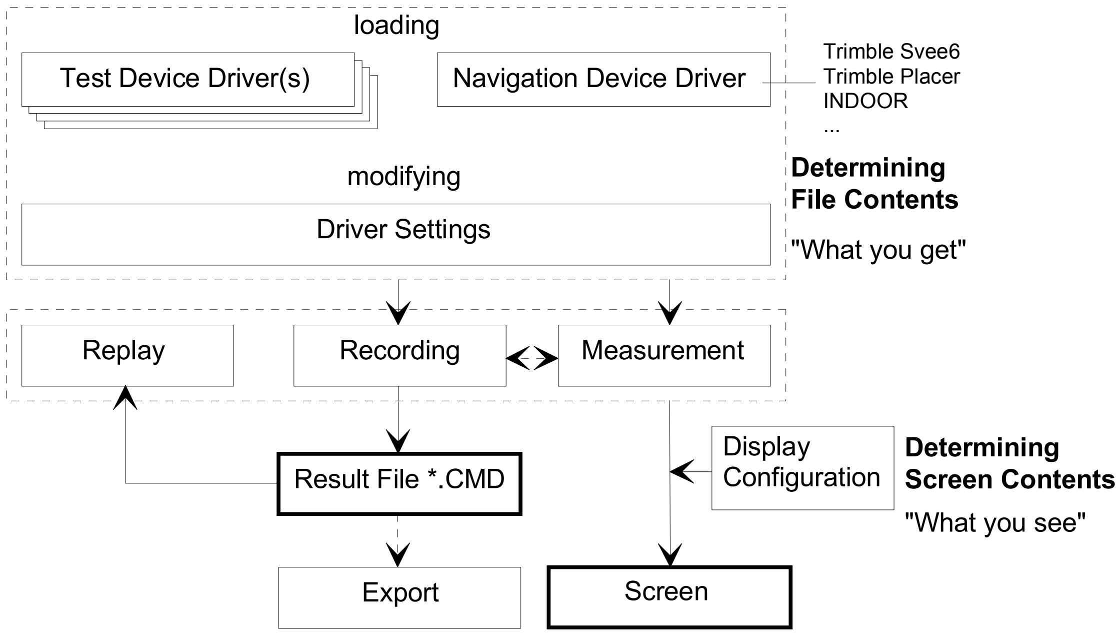


Fig. 1-2 Principle of a measurement

Basic Concepts of ROMES

The following section is to make you familiar with ROMES' basic operating concept, the representation of measurement data, and the file formats used. It also defines frequently encountered terms of the ROMES user interface.

Workspace and Measurement Files

In the lower part of the *File* menu, ROMES indicates the workspace (*.rms) and measurement (*.cmd) files used in the previous sections. The data in these two file types are complementary: Measurement files (*.cmd) contain the measured data, the workspace (*.rms) controls their visualization.

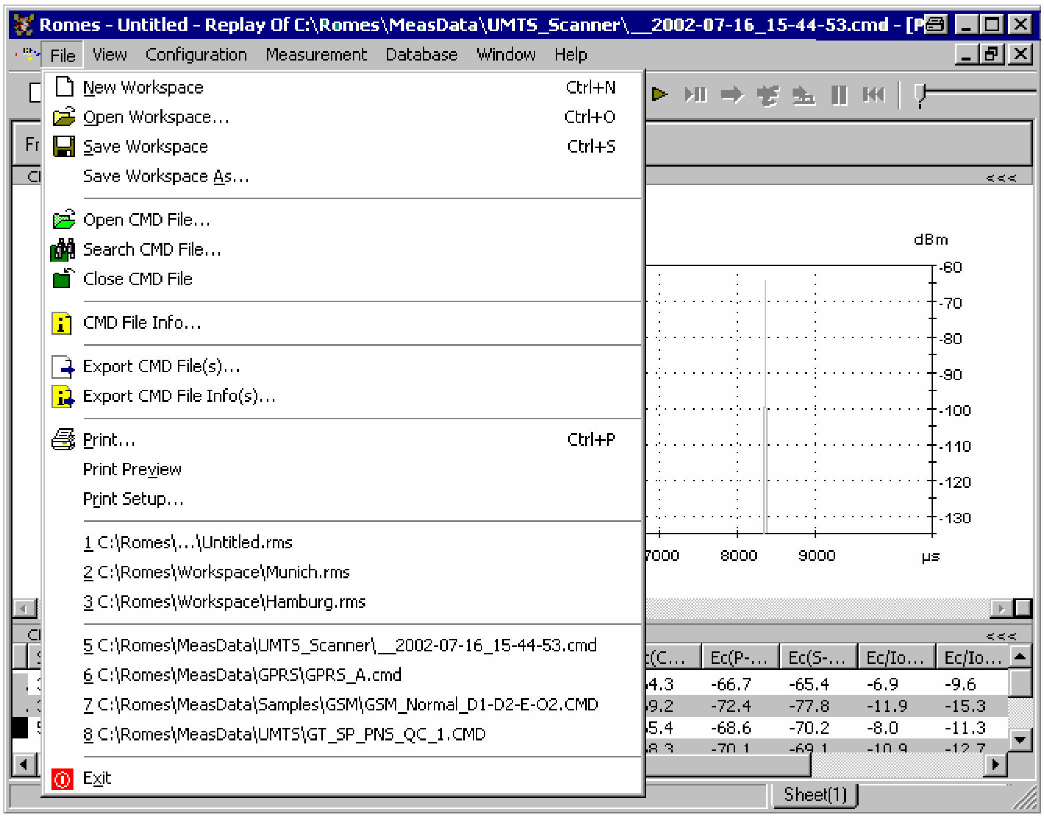


Fig. 1-3 Workspace and measurement files

Workspace

A workspace contains the device driver and screen settings for a ROMES session, including the type, size, and position of all opened view windows, parameter types to be viewed in each view type (if applicable), and a bitmap archive for *Route Track Views*, if defined. A workspace must contain at least one view of every type. Data to be viewed are not part of the workspace.

The signal configurations defined in the *ROMES Configuration* menu (see section *Signal Configuration* in chapter 3) are stored in the Windows registry by default but can be alternatively included in the workspace.

During a ROMES session, exactly one workspace is active. The workspace opened when ROMES is started depends on the setting in the *General* tab of the *ROMES Configuration* menu (opened via the *Configuration – Preferences* command). ROMES uses either the last workspace used in the previous session or the following default workspace: a view window of each type is opened, all windows are tiled across the main window. The main application window size of the previous session is preserved.

User-defined workspaces can be stored to a workspace file <filename>.rms and recalled in later sessions. So, for each kind of measurement the matching control windows can be easily set, and each operator can save and reuse his favorite constellations.

Workspace-related menu commands (see chapter 3):

New Workspace
Create a new workspace

Open Workspace

Load an existing workspace file

Save Workspace
Save current workspace with its current name

Save Workspace As...
Save current workspace with a new name

Measurement Data

As explained in section *Performing a Measurement* on page 1.2, a measurement file (*.cmd) contains the complete measurement data acquired on a tour.

During a ROMES session, no measurement file needs to be open because many actions (such as view configurations etc.) are independent of the measurement data. A measurement file must be open if data is recorded, replayed, or exported. The corresponding commands (see below) take into account whether a measurement file is already open or not:

- If a measurement file is open already, the action is performed using the current measurement file *(Replay),* or the current measurement file is proposed as a default file for the action *(Recording, Export).*
- If no measurement file is open yet, a *File Open* dialog is opened first. In this dialog, a measurement file can be created or selected.

Measurement file-related menu commands (see chapter 3):

Open cmd file
Open a new measurement file

Close cmd file
Close the current measurement file

Export cmd file
Export the cmd file contents

Start Recording
Start a measurement and write the results to a measurement file.

Data Selection

In the configuration menus used to select data for viewing and exporting, the data of a measurement file is presented in hierarchical trees. The trees give a graphical representation of the correlation between the data that originates from different devices and technologies.

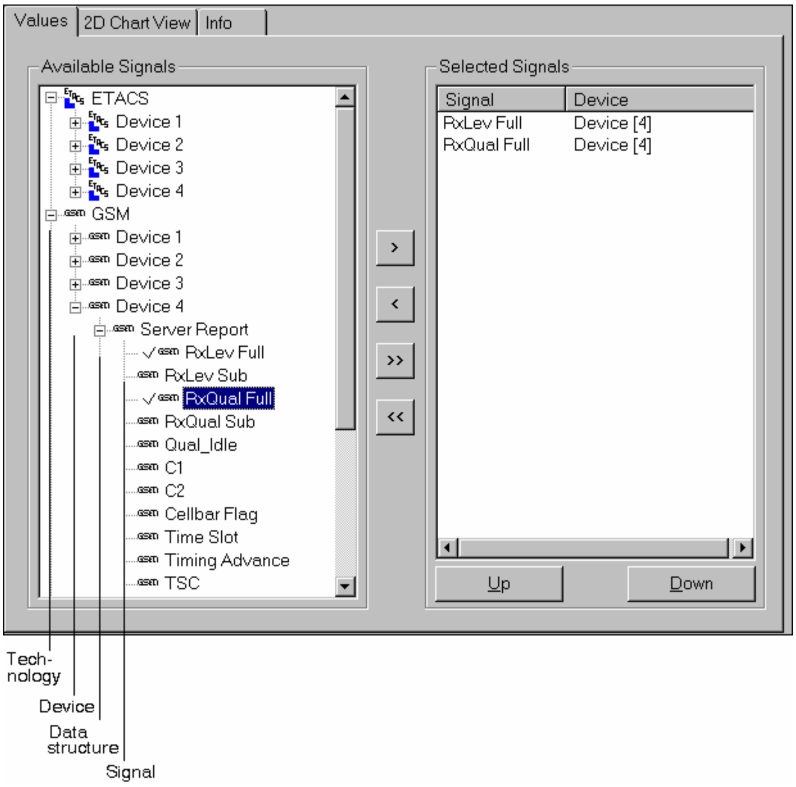


Fig. 1-4 Data tree and data selection

Use

The figure above shows the default data tree as is used in the view configuration menus as long as no measurement (cmd) file is open.

If a measurement file is open, the data tree is adapted to the file contents, the classifiers Device 1 to Device 4 being replaced by the actual device names (e.g. AEG[1], AEG[2] ...). Branches that are not occupied because the corresponding technologies, devices etc. are not available, are truncated. This is to make sure that any signal shown in the data is actually available in the current measurement data.

The data tree shown in the *ROMES configuration* menus (opened via the *Configuration – Preferences* command) don't show the device hierarchy level, because devices are selected elsewhere.

Available Signals

All signals (hierarchy level 4) of the data tree can be selected for display:

- ➢ To select a single signal for display, left-click this parameter (which will be highlighted in inverse video) and click the > button. Alternatively, double-click the parameter.
- ➢ To select all available signals at once, click the >> button.

Selected Signals

List of all signals selected for display.

- To remove a single signal from the list, left-click this parameter (which will be highlighted in inverse video) and click the < button. Alternatively, double-click the parameter.
- To remove all parameters at once, click the << button.

The order of the list can be changed using the two buttons below:

Up

Interchange the position of the selected signal with the signal located directly above. The first signal in the list can not be moved upwards.

Down

Interchange the position of the selected signal with the signal located directly below. The last signal in the list can not be moved downwards.

File Formats

Besides the measurement files and workspace files described in section *Workspace and Measurement Files* on page 1.3, ROMES uses the following file formats:

Export formats

Data stored in a measurement (*.cmd) file can be exported to files with special data formats in order to be used in other applications. Several ASCII and other export formats (*.txt, *.ASC, *.MES, *.NT3, *.COX, *.PRO, *.MIF, *NQA, *.NQ2, *.SRS, *.SER) are available, depending on the system configuration. Moreover, it is possible to export the layer 3 messages stored in a measurement file during replay.

A detailed description of file export and export formats can be found in Chapter 7 Data Processing.

View result export format (*.csv)

Several views support the export of the displayed data to a *.csv (comma-separated values) file that can be opened and processed by Excel. The contents of the Excel lists and the delimiters (commas, semicolons etc.) are view-dependent. To adjust Excel to the actual delimiters of the *.csv file use the MS Excel *Data – Text to Columns…* wizard.

Image files

In the *Route Track* window, arbitrary bitmap files (*.jpg, *.bmp, *.pcx, *.png, *.tif, *.gif) can be loaded and superimposed to a background world map. The bitmaps can be positioned onto the world map by means of a set of coordinates which are stored in a *.tab file, a short text file assigned to the bitmap.

A detailed description of bitmap positioning can be found in chapter 4 Display and Evaluation of Results.

Bitmap archive

Bitmap archive files (*.arc) created in earlier ROMES versions (TS51-K1 / TS55-K1 V2.x) can be imported and converted to *.tab files. In contrast to a *.tab file, the *.arc files generally contain the positioning information for several bitmaps. Consequently, when an archive consisting of several bitmaps and one *.arc file is imported, an equal number of *.tif bitmaps and *.tab files is created.

For further information refer to the description of the *Route Track* view in chapter 4.

Wave file

ROMES allows to use wave (*.wav) files to announce an event by an acoustic signal. The wave files can be selected in the *Available Events* tab of the *Event configuration* menu, see chapter 3.

BTS list files, Network data base

Base station data provided by the network operator can be imported from BTS list (*.txt) or ASCII table description (*.atd) files with definite file formats (see chapter 7 Data Processing), and information on the base stations can be indicated in the *Alphanumeric View, GSM Measurement Report,* or *Route Track* views (see chapter 4). The base station lists are selected via the *BTS Database* menu items of the *Database*

To be used internally the information on GSM base stations is imported to a Network Data Base (*.ndb) file. It is possible to edit the data within a network data base and export data to a new BTS list (*.txt).

Information on Node B BTSs for UMTS base stations is imported to Node B Data Base (*.nbdb) files.

Note:
The ROMES root program directory contains a program file named BTSListGenerator.exe. This software tool uses a GSM measurement (.cmd) file to generate a dummy BTS list (*.txt) file that can be imported into ROMES for demo purposes and to visualize measurement data.*
*The list generator can also generate Node B and CDMA database files from suitable *.cmd measurement files.*
The use of the tool is self-explanatory.

C0 scan export files

If a Carrier-to-Interference (C/I) analysis is performed and the C0 analysis is active (see description of C/I driver in chapter 6), then a C0 scan export file (*.cox) file is automatically generated at the end of the measurement. The *.cox file is an ASCII file and contains information about the scanned C0 signals; see description in chapter 7 Data Processing.

The *.cox file format is also available for an export of GSM network scan data (with option R&S ROMES-GS3, *GSM Network Scanner).*

SC color files

In some of the *UMTS PNS* views a color scale can be loaded from an SC color file (*.scc) and user-defined color scales can be stored to *.scc files to be reused in a later session.

ASCII Export Configuration File

When exporting measurement data to an ASCII file (see chapter 7), the export configurations can be stored to a *.rma file and reused later.

Profile files

To improve the system performance, it is possible to disable ROMES program components using the *ROMES Configurator* (see chapter 8). A particular configuration consisting of a list of all enabled and disabled components can be stored to a profile file (*.profile) and re-used later.

Other files are for internal use only.

Third Party Software for ROMES 3

ROMES 3 uses the following third-party utility:

MapX 5 *Map projection in the Route Track view*

ROMES 3 needs an installed Internet Explorer Version 6.0 or higher and is distributed and tested with the following shared files:

File	Directory	OS	Version	Manufacturer	Remark
TVICPORT.VXD	Windows\System32	Win95/98	-	-	Parallel Port Access
TVICPORT.SYS	Windows\System32\Drivers	WinNT/2000	-	-	Parallel Port Access
SHLWAPI.DLL	Windows\System32	All	4.70.0.1215	Microsoft	Shell Light-weight Utility Library
URLMON.DLL	Windows\System32	All	4.70.0.1300	Microsoft	OLE32 Extensions for Win32
WININET.DLL	Windows\System32	All	4.70.0.1300	Microsoft	Internet Extensions for Win32
MGMTAPI.DLL	Windows\System32	All	5.0.2195.5349	Microsoft	Microsoft SNMP Manager API
WSNMP32I.DLL	Windows\System32	All	5.0.2195.5349	Microsoft	Microsoft WinSNMP v2.0 Manager API
SNMPAPI.DLL	Windows\System32	All	5.0.2195.4874	Microsoft	SNMP Utility Library
MFC42.DLL	Windows\System32	All	6.0.8665.0	Microsoft	MFCDLL Shared Library - Retail Version
MFC70.DLL	Windows\System32	All	7.0.9466.0	Microsoft	MFCDLL Shared Library - Retail Version
MSVCIRT.DLL	Windows\System32	All	6.0.8637.0	Microsoft	Microsoft (R) C++ Runtime Library
MSVCP50.DLL	Windows\System32	All	5.0.0.7051	Microsoft	Microsoft (R) C++ Runtime Library
MSVCP60.DLL	Windows\System32	All	6.0.8972.0	Microsoft	Microsoft (R) C++ Runtime Library
MSVCP70.DLL	Windows\System32	All	7.0.9466.0	Microsoft	Microsoft (R) C++ Runtime Library
MSVCRT.DLL	Windows\System32	All	6.1.9359.0	Microsoft	Microsoft (R) C++ Runtime Library
MSVCI70.DLL	Windows\System32	All	7.0.9466.0	Microsoft	Microsoft (R) C++ Runtime Library
MSVCR70.DLL	Windows\System32	All	7.0.9466.0	Microsoft	Microsoft (R) C++ Runtime Library

Carrier-to-Interference Measurement

With option ROMES-GS, ROMES provides a Carrier-to-Interference (C/I) analysis. The measurement and evaluation of data follows the general principles explained in the previous sections, however, the C/I analysis relies upon some particular features that are not relevant for other ROMES applications.

Measurement Principle

The interference measurement involves three steps: Detection of the interference situation, analysis of the interference signal and assignment of the detected signals to their base stations.

1. Detection of the interference situation

In this step, calls are set up to the network from one or several test mobiles and the transmit power and quality (RxLev and RxQual) are measured. Increasing RxQual values for a specified period of time and at sufficiently high transmit power clearly indicate that interfering signals are present, and an interference analysis is started.

2. Interference analysis

In the interference analysis the system searches for two different types of GSM signals: C0 and Cx channels. These signals are measured in the co-channels and adjacent channels of the used channel.

C0 is a special base-station channel used by mobiles for power measurements and synchronization. The C0 signal is transmitted continuously at constant level, causing interference irrespective of the used cell. A sequence of time slots with a fixed signal content, the FCCHs, is sent on the C0 for synchronization of the mobiles. This sequence is also used by the interference measurement system, enabling to identify the interferer even if its power is considerably below that of the disturbed useful signal.

The strategy for this analysis is the following: In a first step, the received signal is collected for a time period of about two seconds. All FCCH structures inside this collected signal are filtered and graphically displayed. In this way the analysis of the interference situation of a C0 interferer is performed: if there is no C0 interferer, there must be a T_{51} frame structure on the C0 channel of the serving cell and none on its traffic channels. Any additional T_{51} frame structure indicates an interference at the measurement location. The remaining task therefore is to isolate the T_{51} frame structure of the serving cell and to identify the sectors causing the other T_{51} frame structures, i.e. the interferers.

The Cx interference analysis is performed in an analogous way, however, the TSCs (Training Sequence Codes) are used instead of the FCCH structures in order to analyze the interference situation.

3. Assignment of interference signals

In order to assign the detected interference signals to their base stations, we use the fact that the time difference between the starting time T_{51} of any two base stations, also called *time offset,* is not synchronized. So, it is randomly distributed and can be used to identify the base station belonging to the measured frame structure (in the case of traffic-channel interference, the TSC of the interfering signal is measured, too.) Additionally, the measured power of the individual signals and a propagation model helps in the preselection of the possible base stations. Because of fading effects and other propagation losses, the most reliable way of performing this assignment is the graphical analysis.

Measurement Process

ROMES-GS uses two different measurement modes, the Transmitter Scan (TS) and the interference measurement. Switchover between the two modes can be triggered either automatically by defining an appropriate trigger condition or manually at any time.

Transmitter Scan (TS)

To obtain the time offsets between the base stations, a *Transmitter Scan* is taken. During this measurement stage the system records, in addition to the timing of the signals, the *BCC*, *received power*, *NCC* and *TDMA frame number.* This additional information can be used to assign the signals with a specific time offset to a particular BTS.

Furthermore, the *Cell Identity, Location Area Identification* and *channel occupation* are measured if the *GSM Demodulator* driver included in ROMES-GS is loaded. The latter values allow to speed up the BTS assignment, to modify the BCC and channel occupation of a BTS automatically if the network planning has changed, and even to create a new BTS in the database.

Database

While the system receives undisturbed signals it measures their time offsets and assigns them to a base station in a BTS list containing all the information about the sectors in the network (position of the BTS, channel occupation etc.). The results of this analysis are stored in a *database*, which contains the BTS list itself, the TS values taken and the assignments of the latter to the base stations.

This assignment is based on an analysis of the signal, taking into account the measurement location, received power, BCC and the time offset obtained in former TSs, if available. A statistical analysis of the measurement data is performed, where only the base stations with a very high assignment probability are considered. This analysis makes the TS process highly efficient and reliable.

In combination with the *GSM Demodulator,* the system attempts to demodulate the received signals and directly obtains the Cell Identity and Location Area Identification. Using this information the signals can be directly assigned so that no statistical analysis is necessary.

Combining Measurements

Due to the database the system is capable of combining the information acquired in different independent measurements. The combination requires to match the relative time offsets obtained in different measurements and calculate a common reference time. This is possible if the starting point of a new measurement overlaps with the regions already measured so that the different measurements contain at least signals from one common BTS sector.

If such an overlap is not possible, a new database should be created. However, it is possible to merge different TSs by adding new TS files (see below) into an existing database as soon as an overlap occurs (see *Overview of Settings* in chapter 3). This can be done for several files, provided that all files are connected by overlap regions.

Age of the Transmitter Scan

To obtain maximum reliability of the assignment of a detected interferer to a base station it is recommended to perform the TS of the relevant base stations not too long before or after the interference measurement. The reason is twofold:

- The actual timing of a BTS can slightly differ from the nominal GSM timing. This time drift causes an error of the BTS time reference (and thus of the time offsets) which increases linearly in time. The uncorrelated time drifts of the different BTSs make older TS more and more unreliable.
- A reset of a base station causes an unpredictable change of its time offset.

Switchover between TS and interference measurement

To identify a base station during the TS, its C0 carrier must be received undistorted. Therefore the complete measurement is performed in the following way:

- The TS is always the first stage of every measurement. While the signal is received without any sign of interference, the C/I analysis remains in the TS mode.
- When an interference situation is detected by a test mobile phone, the system automatically switches to an interference measurement. The TS stops and ROMES-GS measures the interference on the distorted channel of the serving cell. This happens also in case of adjacent channel interference or if there is frequency hopping on all involved channels.
- As soon as the situation has changed again and the signal from the serving cell is received undistorted, or if a handover to a neighboring cell occurred, the measurement system switches back to the TS mode.

Manual trigger

In addition to this automatic recognition of an interference situation, an interference measurement can be triggered manually. This is a feature which enables to examine situations with very weak interference signals, or situations where the time period of interference is expected to be very short. For the latter case, the time period needed for switching can be circumvented.

Files Used for the Measurement

Several file types are used to evaluate and view the measurement data:

Database

The database is a file with the extension *.ndb* (Network Data Base) and contains all available information for the base stations. This includes the technical and measured data of its sectors.

Transmitter Scan files

TS files begin with the letter *D,* followed by the date of creation. For example the file D1020t14.50 was created on October 20, at 2:50 p.m.

These files contain all the information collected during a TS. They are used for evaluation during a measurement, but can also be loaded manually to update the database. This can be useful for merging results from different measurements, e.g. a TS acquired by another measurement system is available.

There is another file *AppendFile.tdd* stored in the same directory. However, this file is for internal use only.

Base station list

Base station list files have the extension *.txt* and contain the operator information of the base stations. They are ASCII files provided by the network operator with a format defined in chapter 7 Data Processing and are taken as the basis for every database.

If the *GSM Demodulator* driver of ROMES-GS is loaded, a BTS is created automatically by means of the TS data, if it is not itemized in the base station list. So it is even possible to start with an empty database and create the complete list automatically. However, it is recommended to use a BTS list for performance and accuracy reasons, because the BTS positions can only be determined within a confidence interval. Therefore, the inaccuracy of the time offset (inherent in every measurement) may be reduced if the BTS is specified in the list, because the delay caused by the finite speed of light can be calculated more accurately once the exact position of the BTS is known.

Workspace/ configuration files

Workspace or configuration files have the extension *.rms.* These files contain all the information about the device driver and screen settings of the measurement system; see section *Workspace and Measurement Files* on p. 1.3 ff.

A particular configuration file named *Master.rms* contains the configuration settings of all views; see section *General View Properties* in chapter 4.

Measurement files

Measurement files have the extension *.cmd* and contain the following information collected during a measurement process:

- Configuration data of the involved drivers
- All the measurement data collected by the loaded drivers. However, these values are only stored if the measurement has been taken with *Start Recording* activated.
- All the measurement data of the interferences which involve the following information: Information about the trigger state when the measurement has switched to an interference measurement, the measurement values of the interferences in the measured channels, data of the base stations which are potentially involved in an interference on the measurement location and the assignment information between the measured interferences and the base stations.

See also section *Workspace and Measurement Files* on p. 1.3 ff.

Stack files

These files have the extension *.stk. They contain the following information:

- Interference situations to be included in measurement files recorded later. Better assignments of TS values to BTS can so be incorporated into the interference measurements.
- Base stations to be measured (again) by a TS. If a BTS is included in the stack file, the user gets a notification on a new TS assignment.

In order to save memory on the hard disk, all files in the subdirectory *cipm* (TS files) can be deleted after finishing the program, if these files are not needed for a database update.

The following files are created or modified in the *TestFiles* subdirectory. Those files are overwritten at every new start of the measurement program and can be recreated by a replay of the same measurement file.

Ctol_Results.txt

Some message windows (see chapter 9 *Messages*) do not appear during a measurement, they are only shown during manual database manipulations (e.g. loading a Transmitter Scan file before the measurement is running), if the automatic response option has not been chosen. Those messages are written to the *Ctol_Results.txt* file.

Ctol_Message.txt

This file contains the messages shown in the *C/I Message View* accessed via the *View – C/I Analyzer Views* command.

Database Update

The database is regularly updated using the collected Transmitter Scan data. The measured time offsets T_{51} are assigned to the BTS and can hence be used to assign an interference signal to the emitting station. If the *R&S GSM Demodulator* driver included in ROMES-GS is loaded, the measured BCC, LAI and channel occupation are additionally taken into account in order to change the sector data for the case that the network planning has been modified. Depending on the network settings it is also possible to update every changed LAC automatically in the database.

Usually the database is updated every 2 minutes. There may be exceptions, especially if many interference measurements must be taken during this time period. The message *BTS time offset evaluation started* and *Database updated*, both in the *K6 Message View* window, indicate the start and stop of the update, respectively. During the update there is also a reassignment of the interferences taken: All sectors involved in the interference analysis are searched for time offsets T_{51} recorded closer to the interference time, which are then used to identify the interferer.

R&S GSM Demodulator

The *R&S GSM Demodulator* driver is part of option ROMES-GS. In addition to the transmitter scan and interference data described so far it records the following data:

- Cell Identity (CI)
- Location Area Identifier (LAI)
- Channel occupation from the System information type 1.

The purpose of recording this data is the following: First, knowing the CI and LAI the assignment of the Transmitter Scan data to the transmitting base stations is faster and more reliable. Second, it is possible to update the BTS data or to create a new one if it is not contained in the base station list. So it is not necessary to update the station list whenever the frequency planning has changed or some new base stations have been set up. This feature is also very useful for measurements in boarder regions, where another network operator across the boarder may operate in the same frequency range, so his base stations are potential interferers. The base station list of the other network is usually not available, therefore the automatic creation of measured base stations in the database is the only chance to identify these interferers.

Concerning the update the BTS data two scenarios must be distinguished:

- The CI identifies a BTS in the network uniquely.
- There may be several BTS in the network with the same CI, distinguished by their LAC.

In the first case, the CI, MNC and MCC are used to identify the base station. The channel occupation, BCC, NCC and LAC are then compared with the BTS data and the differences are updated. In the second case, the LAC must be used additionally for the BTS identification. So, if the LAC has changed, the BTS cannot be identified and instead of an update, a new BTS is added to the database. The BTS with the old values remains in the database and can only be deleted either manually or by creating a new database with the actual network data.

During the Transmitter Scan, the measurement system determines whether two or three sectors (at the same position) are synchronized. The synchronized sectors are assigned to one common BTS. (Knowing the synchronization properties of the sectors, this assignment can already be made during the creation of a new database, see chapter 7 Data Processing for details.) The advantage is evident in the update of the Transmitter Scan data: Once a sector for a BTS has been (re-)measured, all sectors receive the new time offset information, so the update of the TS data in a given region can be speeded up considerably.

A special situation occurs if a change in the BTS data (channel occupation etc.) has been observed for one sector, whereas the other sectors in the same BTS have not been measured within the last 12 hours. As the changed network planning often involves all sectors of a BTS the warning *Check Validity* is displayed for these sectors. This warning disappears when the sector data is confirmed or changed by a subsequent Transmitter Scan or when the sector data is updated by a new BTS list. An equivalent situation is given even within one sector: A change in the C0, BCC or NCC data without measurement of the system information type 1 causes the same warning in the field indicating the validity of the channel list, see chapter 5 *Carrier-to-Interference Analysis* (C/I) for details.

Contents

2 Getting Started 2.1

Preparations 2.1

Loading the Hardware Drivers 2.1

Configuration of the Drivers and Database Creation 2.4

Performing a Measurement 2.7

Performing a C/I Analysis 2.12

Configuring the background map 2.12

Replaying a Measurement File 2.14

Interference Analysis 2.15

Examples for the Graphical Analysis 2.17

C0 Interference Analysis 2.17

Cx Interference Analysis 2.19

Saving the Configuration and Closing the Session 2.21

Short Measurement Examples 2.22

Data Quality Tester 2.22

Setting up a Connection 2.22

UMTS PN Scanner 2.24

Performing a Spectrum Analysis 2.25

Performing a UMTS PN Scan 2.26

Using a Top N Pool 2.28

2 Getting Started

The following chapter presents a sample session with ROMES and of its GSM/GPRS Carrier to Interference (C/I) analysis module (option ROMES-GS). It is intended to provide a quick overview of the most important functions and configurations. In particular, it gives an introduction to the graphical determination of an interferer by interpreting some typical measurement results as shown in the *Interferer Situation Channel:* dialog.

Before starting any Carrier to Interference measurement, please check the cabling between the test receiver (in our example: ESVx from Rohde & Schwarz) and the controller, and make sure that a GSM mobile phone is properly connected.

The tests reported below include

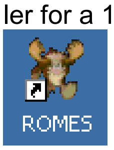
- Preparations (i.e. startup of the system, configuration of the hardware drivers, loading a database containing system and network data),
- Performing and monitoring a measurement, switchover between transmitter scan and interference measurement,
- Evaluating the measurement results and determining the interferers.

The steps to perform are explained with the menus required and the results obtained on the screen. We also point out alternative settings and related measurements which could not be reported in detail.

Section *Short Measurement Examples* on p. 2.22 ff. contains short operating sequences from various ROMES applications.

Preparations

ROMES is an application that runs under *MS Windows XP* with SP2. The recommended system controller for a 19'' rack is the R&S TSPC2.



➢ Double-click the icon on your desktop to start ROMES.

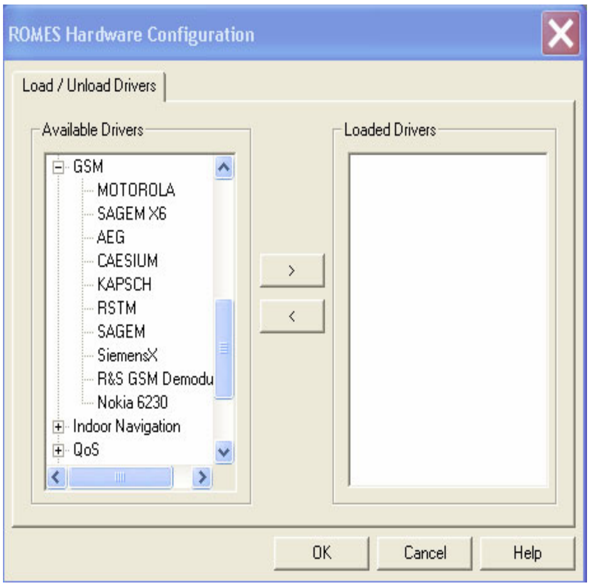
Loading the Hardware Drivers

The hardware device drivers for your mobile phone, for the positioning system, and for the C/I interference measurement must be loaded and installed before the measurement is started.

In our example we use an Sagem OT-35 mobile for the GSM900 network connected to COM port 1 and a Trimble Placer positioning system connected to COM port 2 of the controller. If you have a different equipment, the steps can be performed in an analogous way.
To load the hardware drivers, perform the following steps:

➢ Click the *Hardware...* command in the *Configuration* menu.

The *ROMES Hardware Configuration* window opens.

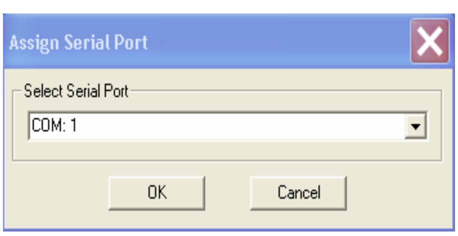


The *ROMES Hardware Configuration* window shows a list of all devices and hardware drivers available (the list varies according to the options of the coverage measurement system chosen).

➢ For the mobile driver select (click) the device class GSM.

➢ Select the manufacturer of your mobile phone.

➢ Click the  button to initiate the installation.



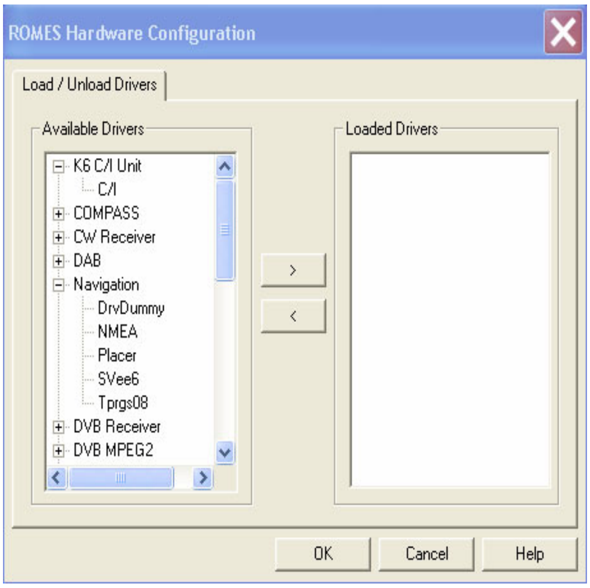
The *Assign Serial Port* window shows the COM Port assigned to the mobile driver. Port 1 must be set.

➢ If the COM port 1 is not set, select it from the Combo box.

➢ Press *OK*.

A progress bar *showing* the initialization of the mobile appears.

➢ Click *Navigation* and select *Placer* from the list of *Available drivers*.

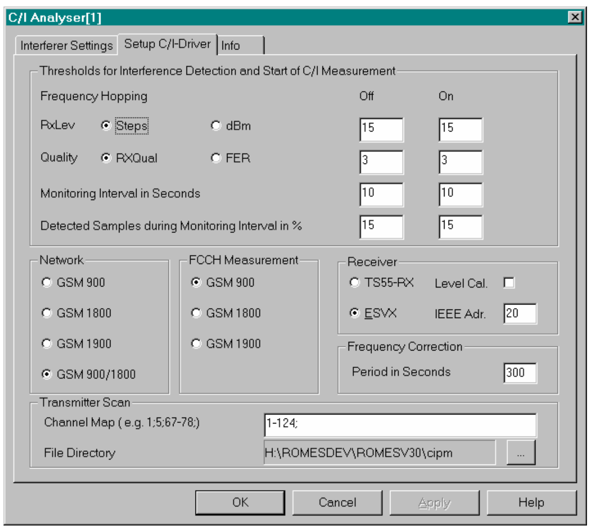


- Click the  button and proceed as described above to load the driver and assign it to COM Port 2.
- Click *K6 CI Unit* and select the *C/I* driver offered.
- Load the driver.
- Click *OK* to confirm your choice and close the *ROMES Hardware Configuration* dialog.

Configuration of the Drivers and Database Creation

Each driver installed extends the *Configuration* menu by a new command line. The command line opens a configuration menu for the driver. In the following example we perform the basic configuration of the *C/I* and the *Sagem Mobile* drivers, keeping the default settings for the *Trimble Placer* and the *R&S GSM Demodulator*.
To configure the drivers, perform the following steps:

➢ Click the *Configuration – Driver for CI Analyzer* command and open the *Setup C/I-Driver* tab.



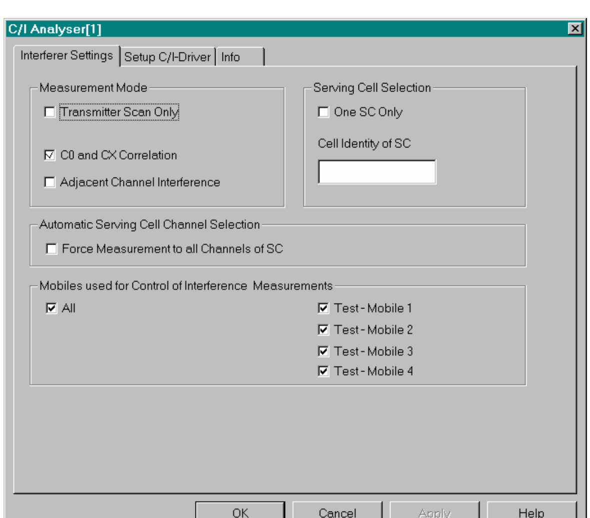
The interference measurement is started as soon as all the conditions listed in the *C/I Trigger* panel are fulfilled, i.e. a high value of RxQual (poor signal quality) must be measured during a specified minimum period and at sufficiently high signal level RxLev.

➢ In the *Thresholds for Interference Detection...* panel set the values shown in the figure.

➢ In the *Network* panel, specify the GSM band of your network.

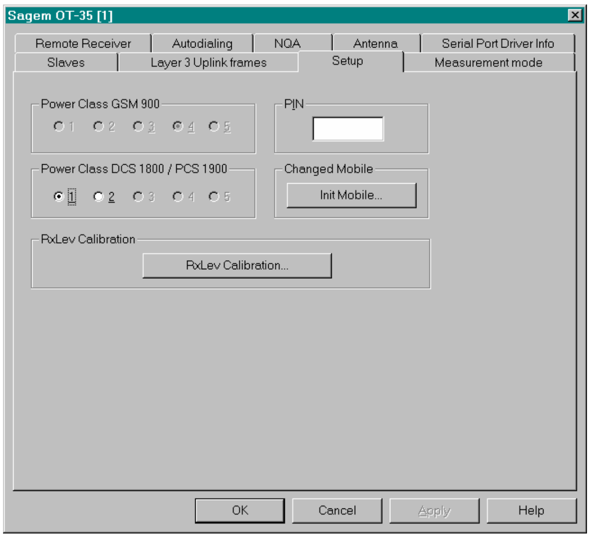
➢ In the *Transmitter Scan* panel specify the channels (depending on the GSM band) to be measured.

➢ Click the *Interferer Settings* tab and ensure that the settings are as shown in the figure.



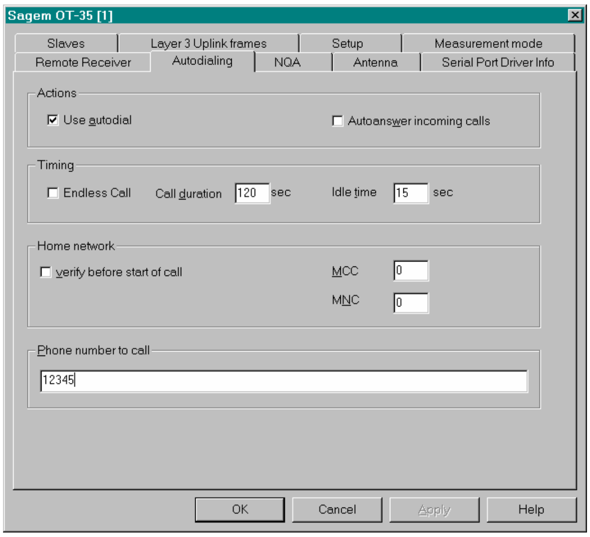
➢ Click *OK* to confirm the settings and close the C/I driver configuration menu.

➢ Click the *Configuration –Sagem OT-35/1 [1], Normal* command.



➢ If necessary, enter the PIN number in the *Setup* tab.

➢ Click the *Autodialing* tab.



The *Autodialing* menu defines a phone number which is called periodically. Autodialing is essential for the interference measurement because a call must be established to monitor the network quality applied in the trigger conditions for the interference measurement (see above, *Driver for CI Analyzer settings*).

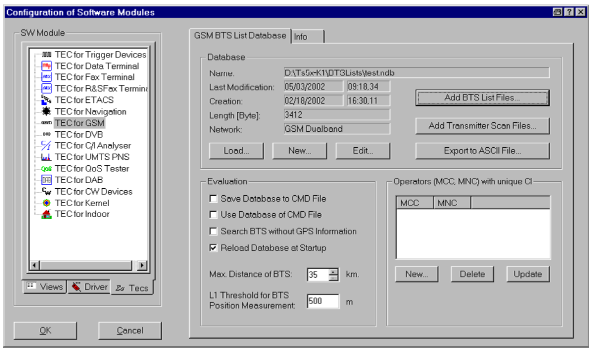
➢ Select the *Use autodial* option.

➢ In the *Timing* panel, enter a *Call duration* of 120 sec and an *Idle time* of 15 sec. You can also set an arbitrary value for the Call duration if your network supports longer talks for automatic calls. However, the Idle time must be at least 15 seconds.

➢ Enter an appropriate *Phone number to call*.

➢ Click *OK* to confirm the settings and close the mobile driver configuration menu.

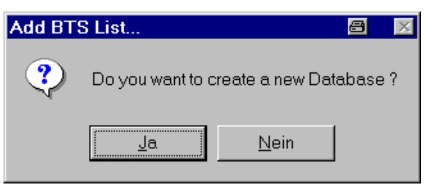
➢ Click the *Configuration – Settings* command.



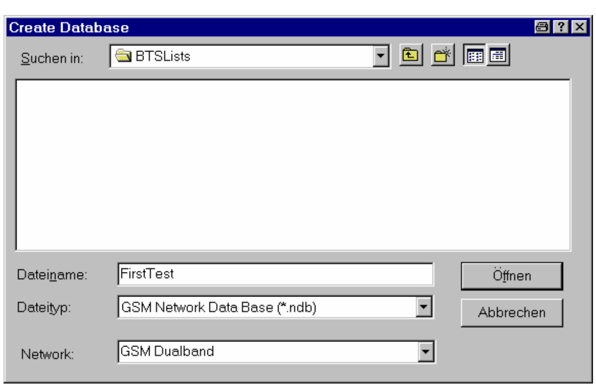
➢ Click the *Tecs* tab in the *SW Module* panel and click *TEC for GSM.*

➢ Click the *Add BTS List Files...* button in the *Database* panel to create a new database*.*

A database file contains all available information about the base stations. This includes the technical data of the base station sector provided by the operator and the measurement data of these sectors. A box pops up, asking whether a new data base should be created.



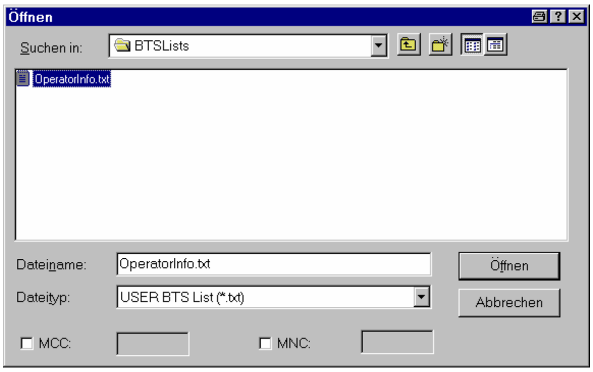
➢ Click *OK* to create a new database file.



➢ Enter the name of the new database in the *File Name* input field of the *Create Database* dialog (type a file name as shown in the figure; the default extension **.ndb* will be appended automatically).

➢ Select your GSM band from the *Network* pull-down list.

➢ Click *Open* to create the file and proceed to the *Open* file dialog.



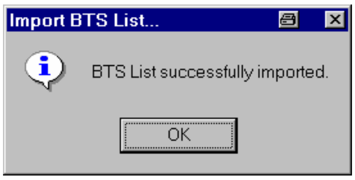
The *Open* file dialog is analogous to the previous dialog. It shows the base station lists available, i.e. text files containing the operator information about the base stations.

➢ Select the appropriate file type (preferably *USER BTS List (*.txt)),* directory and double-click the desired base station list.

The file selected is automatically entered in the *File name* input field.

➢ Click *Open* to confirm your selection and close the *Add ASCII File* dialog.

The system prompts with the message *BTS List successfully imported.*



➢ Click *OK* to close the info box and terminate the preparations by clicking *OK* in the *Configuration of Software Modules* dialog.

Note:
The file import into a network data base may fail if the operator list does not contain valid MCC and MNC information. In this case refer to chapter 3, section Importing a BTS List File into the Data Base.

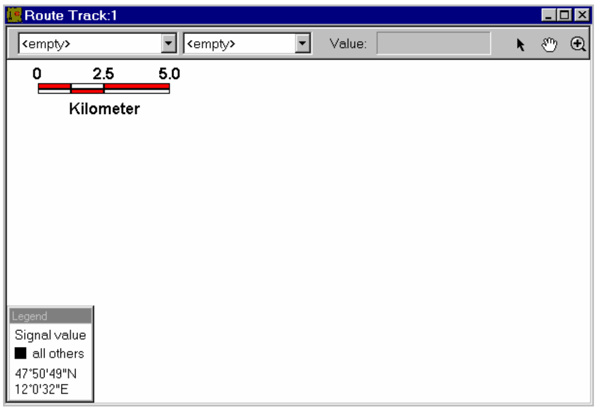
Performing a Measurement

In an ordinary measurement session, the C/I analysis module ROMES-GS is in the Transmitter Scan mode, records data and switches over to the interference measurement as soon as the defined trigger conditions are met. All measurement data is written to a specified measurement file.

As an alternative to automatic switchover between the two measurement modes, the interference measurement can be started explicitly any time.

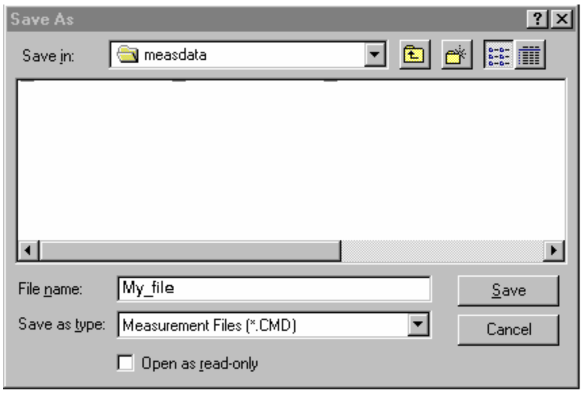
To perform a measurement, perform the following steps:

➢ Click the *View –Navigation Views – Route Track: 1* command.



The *Route Track* view window is opened. The view is either empty (except for a scale and the legend, if you're using the C/I analysis for the first time) or shows the map opened in the last session. It can be replaced or modified in many ways, see section *Configuring the Background* on page 2.12.

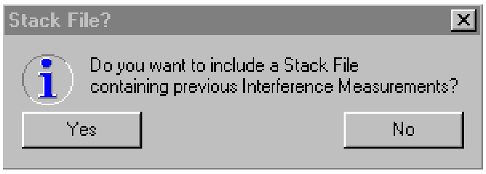
➤ Click the *Measurement – Start Recording...* command.



The *Save As dialog* proposing a list of existing measurement files is opened. Alternatively, a new file used to save the measurement data can be created.

➤ Enter a name of the measurement file to be created in the *File name* field. The extension *.cmd is appended automatically.

➤ Click *Save* to create the file and close the *Save As...* dialog.

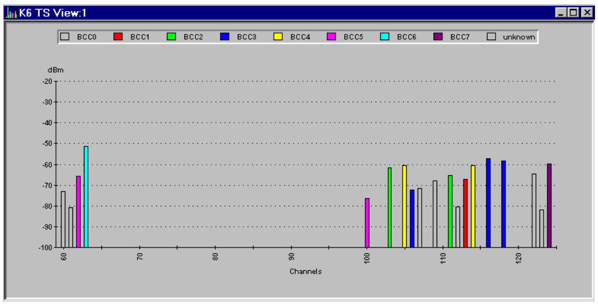


On *closing* the *Save As...* dialog, ROMES asks whether previous interference measurements are to be included in the current measurement file.

➤ Click *No* to refuse, to close the message box and to start the measurement.

While measuring, your test receiver (ESVx) scans all channels selected in the *C/I* driver menu. The corresponding frequencies are indicated in the display of the test receiver. The signal power can be monitored with the C/I analyzer.

➤ Click the View –C/I Analyser Views – K6 TS View: 1 command.

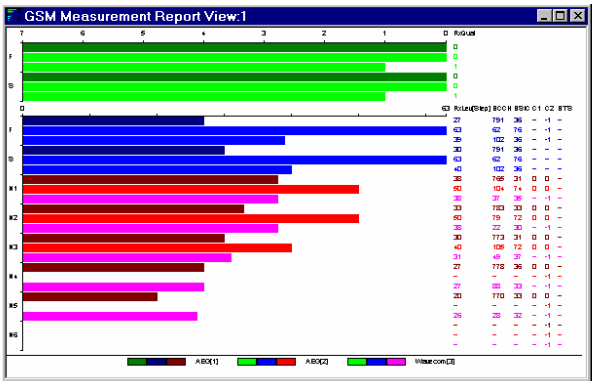


The *K6 TS View* window shows the level of the signals recorded in all channels and the color codes (BCC) of the corresponding base stations.

The channel number forms the abscissa, the length and color of the bars corresponds to the signal level and BCC.

The test receiver performs a cyclic scan of the selected channel range so that the bars are continuously updated.

➢ Click *View – UMTS/GSM View – GSM – GSM Measurement Report View:1*.



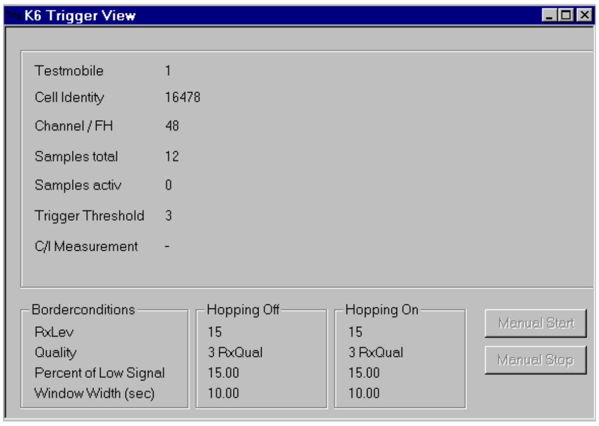
The *GSM Measurement Report* window gives an overview of the receiver reports of the mobile phone. The number of the BCCH, the BSIC, and the name of the base station (if a ROMES database is loaded) are displayed additionally.

The values are indicated for the serving cell and (except for RxQual) 6 neighboring cells.

For the interference measurement the minimum (concerning the full band *F* and the sub band *S)* of the RxQual and RxLev values are relevant, respectively.

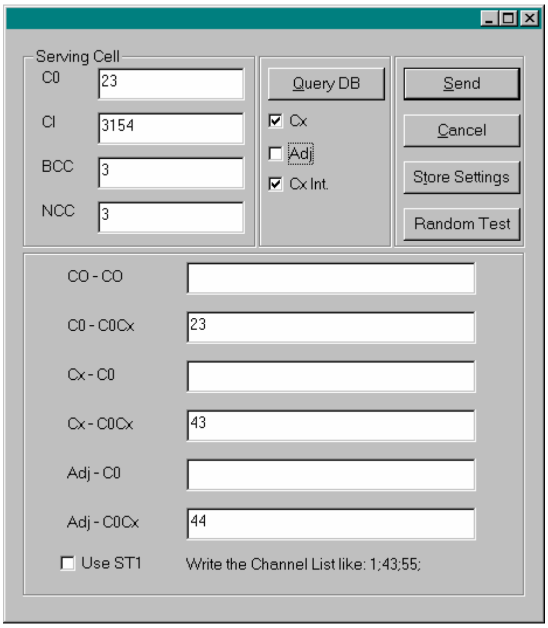
➢ Click the View –C/I Analyser Views – K6 Trigger View Command

At present, the system toggles between Transmitter Scan and interference measurement according to the trigger criteria defined in the *Driver for K6 CI* dialog (see page 2.4). Every time the system performs an interference measurement, a yellow asterisk appears in the *Route Track* view. The trigger criteria and the trigger situation can be monitored as well:



The *K6 Trigger View* window shows the trigger criteria defined in the *CI Analyser* driver dialog and the current statistics for the *K6 Trigger View* measurement (including the channel number of the serving cell when there is no frequency hopping, the number of RxQual/RxLev values taken, the number of values fulfilling the trigger criteria etc.).
Instead of applying fixed trigger criteria, an interference measurement can be triggered manually:

➢ Click the *Manual Start* button.



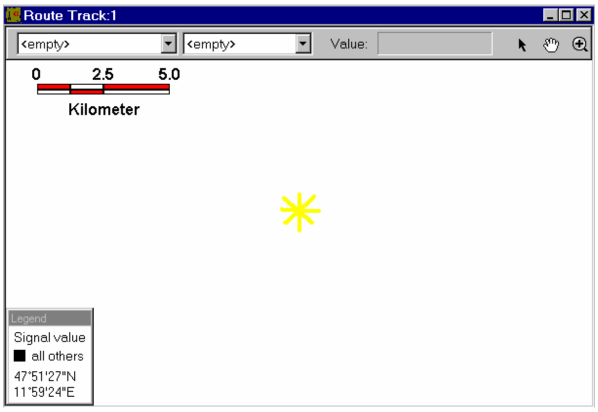
The *Trigger Simulation* window is opened. Here, the characteristics of the serving cell and of its channels to be searched for interference must be specified. If these characteristics are not known, you can also specify some entries in the *Serving Cell* and push the *Query DB* button to get the corresponding information. If the information specified in the *Serving Cell* group field is not unique in your database, the SC next to the current position fulfilling the entries is taken.

➢ Enter the C0 channel, cell identity and base station color code of the serving cell to be measured (any serving cell can be selected).

➢ Select all checkboxes under the *Query DB* button and press this button to get the channel occupation.

Cx searches for the traffic channels of the SC and *Adj* the adjacent channels. If *Cx Int* is selected, the interference measurement is taken for both the C0 and the Cx interferences.

➢ Confirm and Click *Send* to trigger the interference measurement.



A yellow asterisk in the *Route Track* view indicates the interference position. The system is ready to perform the interference analysis described in "*Performing a C/I Analysis*", page 2.12.

➢ Click the *Manual Stop* button on the Trigger window to switch back to the Transmitter Scan mode.

➢ Stop the measurement via the *Stop measurement* command and answer the message box with *OK*.

➢ Close the *K6 TS View* window and the *GSM Measurement Report* window.

Performing a C/I Analysis

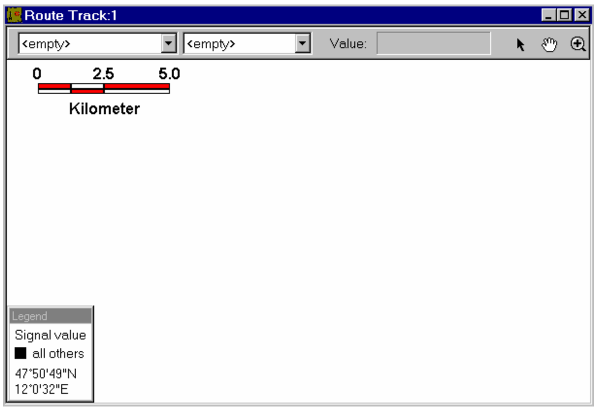
ROMES offers the possibility of evaluating the measurement results either during the measurement or afterwards, from a measurement file recorded previously and loaded before the evaluation (in the so-called *replay* mode or by searching an interferer). The actual data evaluation is mostly done graphically; it is identical in both cases.

In the following we describe a *replay* session, including the step where the measurement file is loaded.

Configuring the Background Map

To configure the background map, perform the following steps:

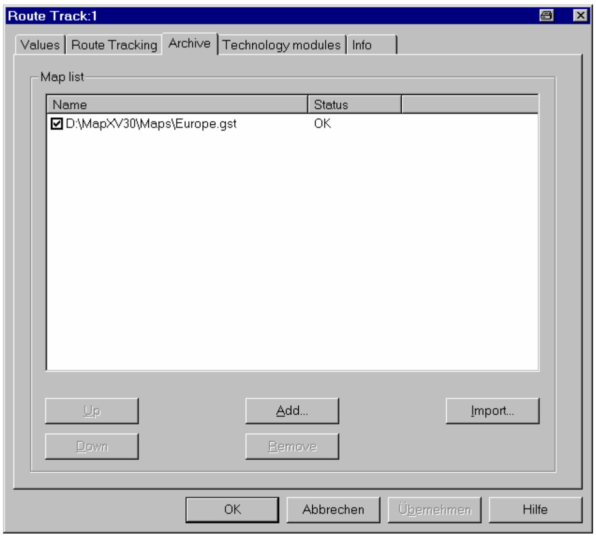
➢ Return to the *Route Track* view (to be opened as shown at the beginning of section *Performing a Measurement* on p. 2.7).



➢ Right-click on an arbitrary point within the view.

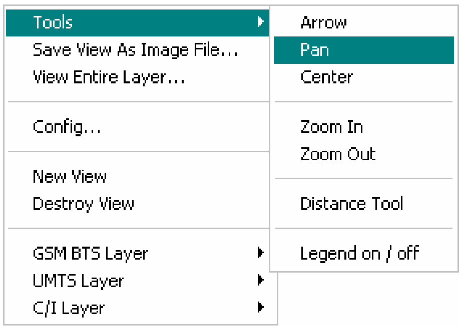
The context configuration menu pops up. From this menu all configuration and evaluation tools for the C/I analysis can be accessed.

➢ Click *Config...* to open the *Route Track* configuration menu and select the *Archive* tab.



- Click *Add...* to open a *File* open dialog and to select one of the *MapX GeoSet Files (*.gst)* available on your system.
- Back in the configuration menu, click *OK.*

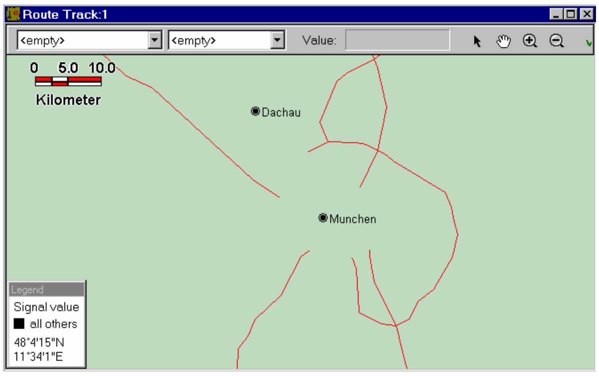
  The configuration menu is closed and the added map is displayed as a background map in the *Route Track view.*
- Right-click again on an arbitrary point on the map.
- Click *Tools → Pan.*



  The configuration menu is closed. The cursor takes the shape of a hand. The whole map can be shifted without changing the scale by a drag-and-drop mechanism.
- Right-click on the map again to reopen the context menu.
- Click *Tools → Zoom In*.

  The configuration menu is closed again. The cursor takes the shape of a zoom-in icon (a magnifying glass with a '+' inside). The map can be magnified by clicking on a point of the map or by selecting a rectangular area (use the left mouse button).
- Click *Tools → Pan.*

  The configuration menu is closed. The cursor takes the shape of a hand. The whole map can be shifted without changing the scale by a drag-and-drop mechanism.



- Right-click on the map again to reopen the context menu.

- Click *Tools → Zoom In*.

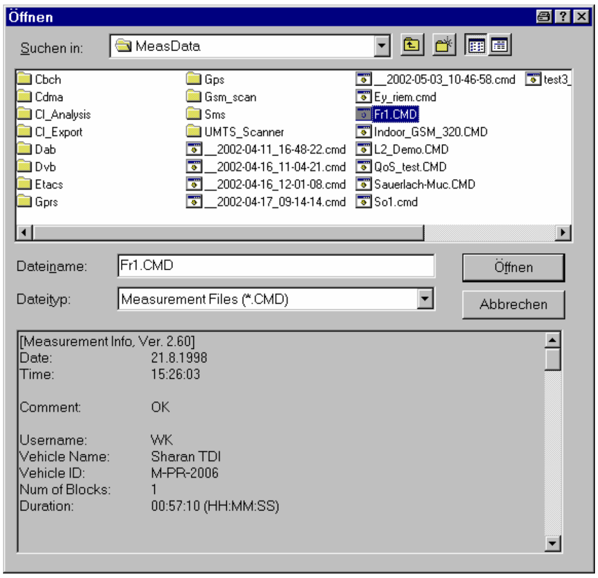
  The configuration menu is closed again. The cursor takes the shape of a zoom-in icon (a magnifying glass with a '+' inside). The map can be magnified by clicking on a point of the map or by selecting a rectangular area (use the left mouse button).

Replaying a Measurement File

To replay a measurement file, perform the following steps:

- Click the *Measurement – Start Replay...* command.

  The dialog window opened offers a list of all measurement files (*.cmd) available.



- To start the replay session, select a measurement file from the list, e.g. the measurement file created in the previous session.

  The selected file is entered in the *File name* field, the file information is displayed below.

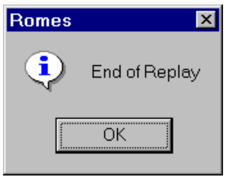
- Press *Open* to confirm your selection and close the *Open* dialog window.

  The measurement file is now replayed. A bar graph in the left-hand part of the status bar at the bottom of the main window indicates the progress, i.e. the percentage of measurement data already loaded.

The *replay speed*, currently set to minimum *(Min.),* can be increased by dragging the arrow across the *Min/Max* scale in the toolbar.

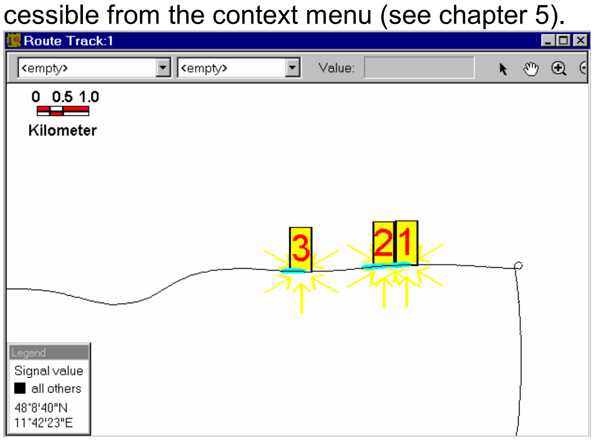
As soon as the entire data is loaded the message *End of Replay* pops up.

➢ Click *OK* to close the box and start the graphical analysis of the measurement data.



Interference Analysis

In the *Route Track* view (from which we removed all background maps, for the sake of clarity), interference points contained in the replayed measurement file are indicated with a yellow asterisk and a current number for the interference framed by a rectangle. The length of each interference is indicated by a colored line. The color and shape of the display symbols can be changed in the configuration menu accessible from the context menu (see chapter 5).

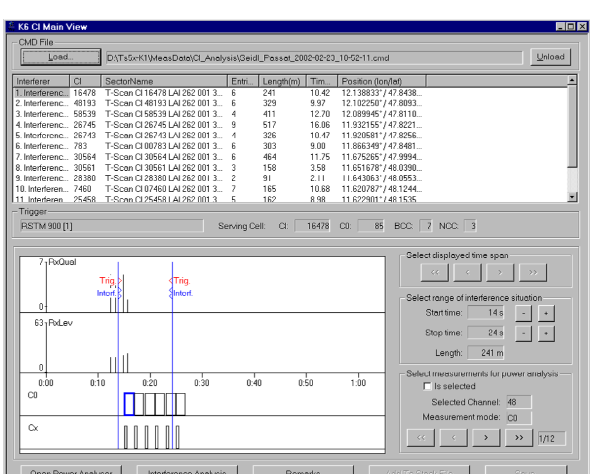


To analyse the interference points, perform the following steps:

➢ Click the View –C/I Analyser Views – K6 CI Main View Command.

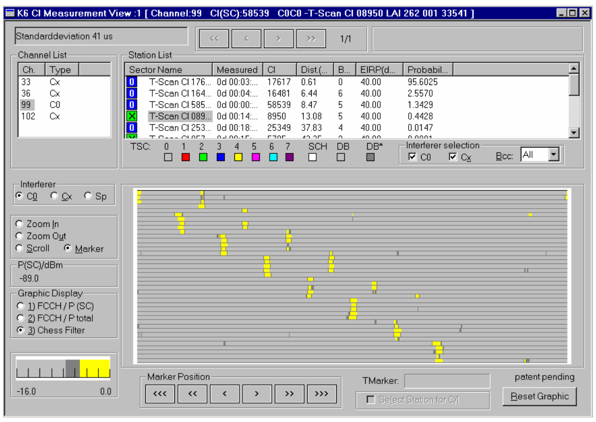
➢ In the *K6 CI Main View* opened, click the *Load* button and open the file replayed in the last section.

The *Interferer* list shows all interferences stored in the measurement file.



➢ Select a particular interference in the list and click *Interference Analysis*.

The *K6 CI Measurement View* is the basic tool to perform the graphical analysis of the interference.
The *Channel List* shows the disturbed channels of the serving cell of the current interference situation.
The *Station List* shows all known BTS sectors in the vicinity of the interference position transmitting a signal in the selected channel.
The diagram below the *Station List* shows all FCCH signals detected during the interference measurement at the current interference point.



Examples for the Graphical Analysis

The purpose of the interference analysis is to assign the measured interfering signals to known BTS sectors. The general method and the structure of the interference diagram is explained in chapter 5 Carrier to Interference Analysis (C/I). In the following, we give a few examples for interpreting a measurement result for the interference analysis.

C0 Interference Analysis

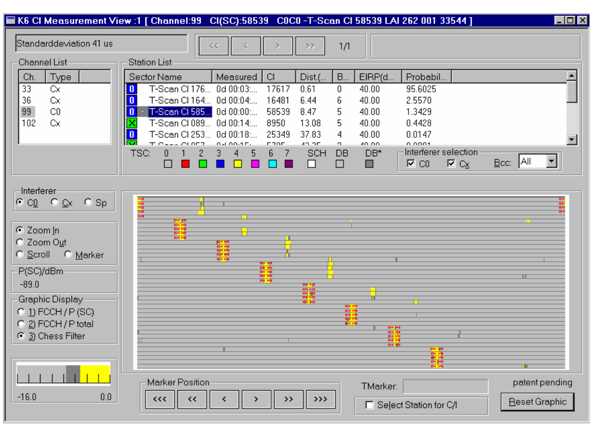
To understand the diagrams for C0 interference analysis it is enough to keep in mind the following items:

- The diagram shows the relative position of the T_{51} frames of all signals measured on the time axis. The beginning of the diagram (upper left corner) corresponds to the beginning of a T_{51} frame of the serving cell signal (if the serving cell was measured before, which is quite often the case).
- A single signal from the BCCH of a BTS sector yields a staircase pattern, formed by a series of vertical bars shifted by 1/10 of the diagram width with respect to each other. The individual bars extend over 5 diagram lines.
- If there is no C0 interference we must have a T_{51} frame structure in the BCCH and none on the traffic channels. So, any additional T_{51} frame indicates a C0 interference on this measurement location.
- The time offset of a signal, i.e. the starting time of its T_{51} frames relative to a reference time, is a characteristic quantity allowing to identify the signal at a high confidence level.

To analyse the C0 channel, perform the following steps:

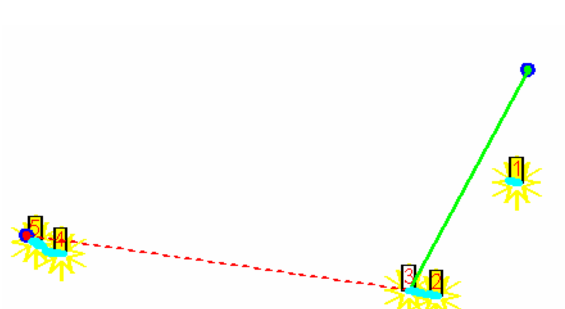
➢ Select (click) the C0 channel of the *Channel List*. In the *Interferer* panel, select *C0*.

The *Station List* shows the individual sectors sorted by their probability of having the largest signal strength at the measurement position (last column).



➢ Select (click) one of the sectors of the *Sector List* marked with a blue *0* symbol (C0 interferers).

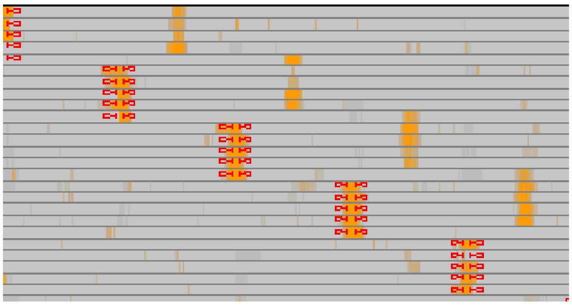
The data of the selected sector is processed.
With the default color settings the sector is shown in the *K6 Map View*, connected to the interference point with a green line (serving cell), or red line (all other cells).



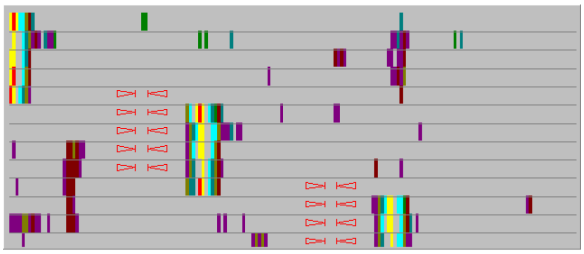
The result of the Transmitter Scan, i.e. a confidence interval for the time offset of the current sector, is indicated in the interference diagram (the signal is framed by red triangle symbols).

In the current example, the Transmitter Scan result (red symbols) and the interference measurement result match closely: The serving cell signal (starting at the upper left corner of the diagram) is unambiguously determined.

➢ Select another BTS sector or another channel and repeat the analysis.

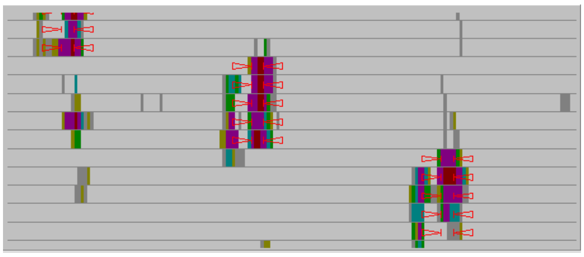


The picture obtained varies according to the BTS signal, the signal level, and the Transmitter Scan results. In the following we will interpret some typical examples.



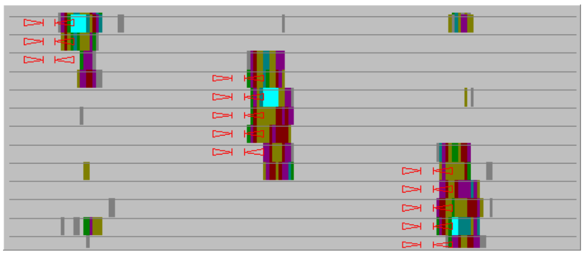
Here the Transmitter Scan result doesn't match with any of the signals measured. There are several possible causes for that:

- The signal of the measured BTS sector is too weak at the interference point, i.e. there is no interference at the measurement location caused by this sector.
- The base station was reset between the Transmitter Scan and the interference measurement. The probability for a reset of the BTS increases with the age of the Transmitter Scan.

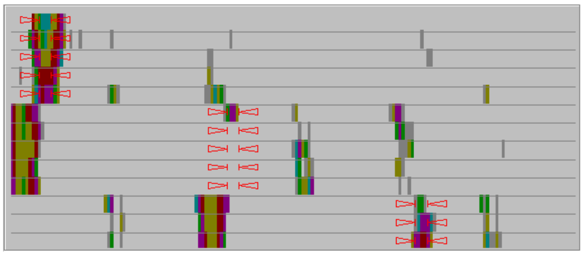


At first glance the two signals seem to have a similar time offset. However, one of them is delayed with respect to the other by approx. 1 diagram width corresponding to 10 TDMA frames. The apparent vicinity of the signals is an artifact and due to the diagram structure.

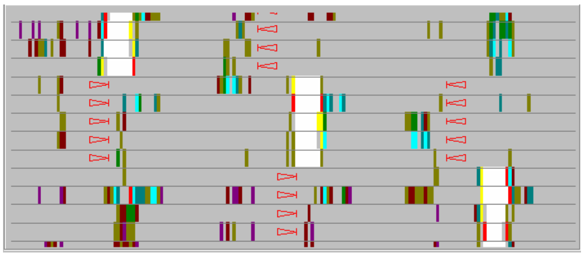
The signals can be clearly separated in the C/I analysis.



The two signals have a time-offset difference of roughly 2 diagram lines. The BTS sector of the confidence interval is in-between and corresponds to none of them.
No signal matching with the Transmitter Scan result could be found.



A signal can be clearly identified but the signal pattern is irregular, and one T_{51} frame is almost completely missing in the diagram.
Such a gap in the signal can occur if the receiver conditions vary in time, e.g. because of a vehicle crossing the signal path or due to fading effects.



The width of the confidence interval for the time offsets depends on the age of the Transmitter Scan and various other factors concerning the signal propagation.
If the Transmitter Scan was performed a long time ago it is recommended to repeat it and improve the time-offset accuracy.

In some cases, no interfering signal is visible although an interference was triggered. This can be due to the following reasons:

- The interference was limited to a very small area. The test vehicle left the interference area before the interference measurement was triggered. Usually this leads to a very short measurement time so that only one interference diagram per channel is generated.
- The interference was caused by a Cx channel, see the analysis below.
- The bad signal quality which triggered the interference measurement was caused by an intermodulation effect.

Cx Interference Analysis

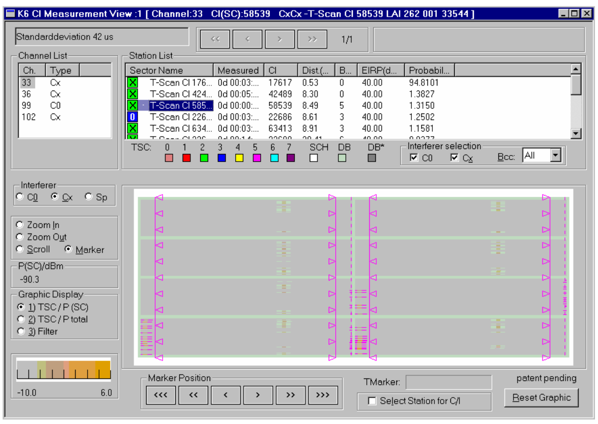
In order to understand the diagrams for Cx interference analysis it is enough to keep in mind the following items:

- The diagram shows the relative position of the correlated TCH signals on the time axis (which is divided into 8 time slots), including the information of the underlying time slot. The representation of the time axis shows signals spread in different TDMA frames vertically arranged.

- Both signals, the C0 and the Cx signal, are visible in this diagram. They can be distinguished in the following way: First, there are no dummy bursts and SCHs in the Cx-signal and second, the Cx signal may cover only some of the time slots.
- If there is no interference, we must have one C0 signal in the C0 channel, and maximally one Cx signal in each traffic channel, respectively. Both signals must be horizontally aligned on the same position. Each additional signal indicates an interference on this measurement location.
- The time offset of the signal and its TSC are used to identify the SC and the interferer at a high confidence level.

To analyse the C0 channel, perform the following steps:

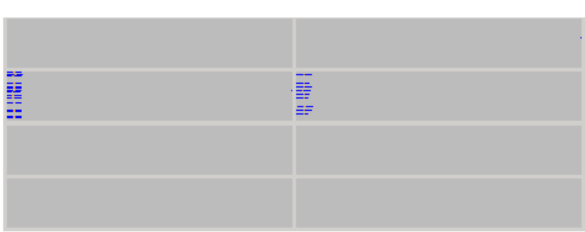
➢ Select (click) a Cx channel of the *Channel List*. In the *Interferer* group field, select *Cx*.



The *Station List* shows the individual sectors sorted in the same way as in the C0 analysis. In the column *Sector Name* there is also an icon showing whether this sector has a C0 channel in the selected channel (blue icon with a 0) or a traffic channel (green icon with an X). In the *Interferer selection* panel you can restrict the stations in this list.

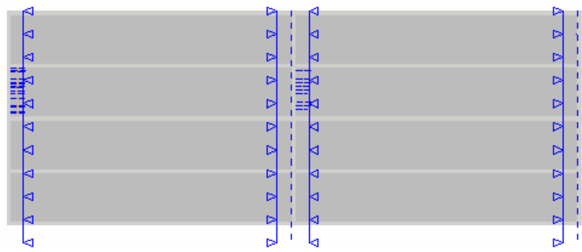
The diagram on the left side shows a situation with a Cx and a C0 signal. The color in the center of the signal bar gives a power information, the narrow lines on both sides show the TSC.

➢ In the *Graphic Display* group field, toggle between *TSC/P total* and *Filter*. You may see variations in the signal shown. This is due to the following reason: In the *Filter* display, the sensitivity is enhanced, however, statistical evaluation is done in order to exclude accidental correlations leading to a noisy representation.



In some channels you might get a bitmap like the one shown on the left side. You see a traffic channel signal in the time slots 2 and 3.

➢ Select a measured sector in the *Station List* in order to determine the confidence interval for the time offset. In the *Interferer selection* panel set the values of the BCC corresponding to the TSC value shown in the diagram.

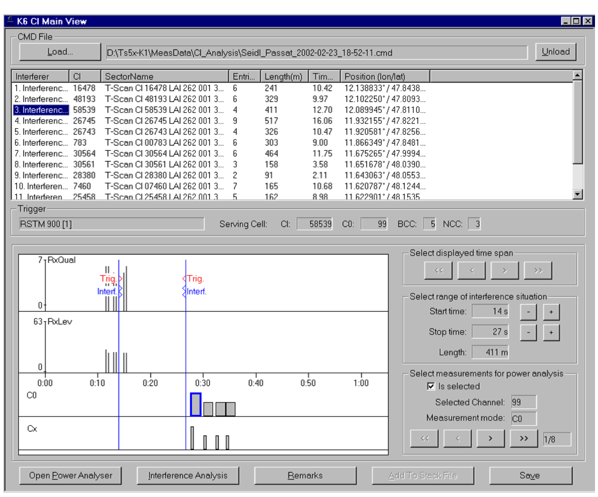


Again, there is a confidence interval for the time offset shown. Instead of the triangles, 3 lines are displayed: One for the left and the right side of the confidence interval, and a dashed one for the enter. These lines are shown in the same color as the TSC in the diagram. If you do not see all of these lines, check the standard deviation entry shown in the upper left corner of the *Interferer Situation* dialog. Only for a standard deviation of 200 µs or less all 3 lines are shown. Up to 1000 µs, the middle line is still shown and for a standard deviation of more than 1000 µs there is no line shown anymore.

Saving the Configuration and Closing the Session

Before closing ROMES, the loaded device drivers, the display settings, and the loaded database can be saved to a configuration file (*.rms). In addition the results of the interference analysis and the changes made to the interference data can be stored to the current measurement file. This saves time when a similar measurement or evaluation is to be repeated later.
To save the configuration and close the session, perform the following steps:

- Return to the *K6 CI Main View* and click *Save* to store the results of the interference analysis to the current measurement file.



- Click the *Save Workspace As...* command in the *File* menu. In the *Open* dialog window enter a configuration file name (the extension *.rms is automatically appended). Click *Save*.

  The current configuration including the device drivers, the display settings, and the loaded database is saved. The *Open* dialog is closed. When you start ROMES for the next time the configuration file will be listed in the *File* menu.

- Click the *Exit* command in the *File* menu to close the application.

Short Measurement Examples

The following sections are intended as a quick introduction to typical measurement tasks, listing the steps necessary to set up the drivers, obtain, display and interpret the basic results. The examples are taken from different ROMES options and technologies.

Data Quality Tester

The purpose of the Data Quality Tester (DQA, option ROMES-Z6) measurement is to evaluate the Quality of Service (QoS) of any kind of data transfer connection. Configuration of the driver is described in detail in chapter 6, section *UMTS PN Scanner Driver.* The *QoS Views* are described in chapter 4 Display and Evaluation of Results.

Setting up a Connection

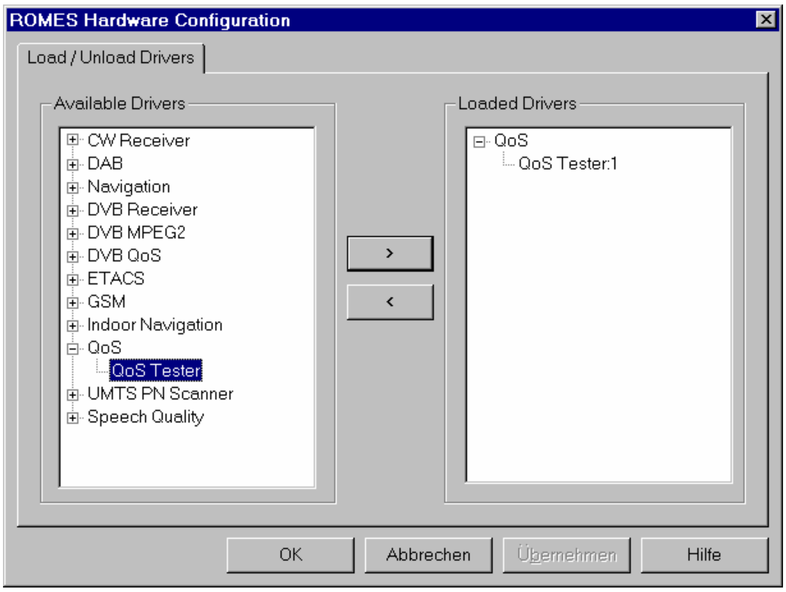
The DAQ driver provides various jobs to define and establish a connection to a network provider or remote server. The procedure of setting up the connection is analogous for all jobs. In the following example an *FTP Download* connection to a remote server is set up.

Suppose that your local computer contains a ROMES installation including the Data Quality Tester, that it is configured for ftp file transfer with a remote server (in case of doubt refer to your Windows help), and that a remote server can be accessed. To set up and test the *FTP Download* connection with ROMES, perform the following steps:

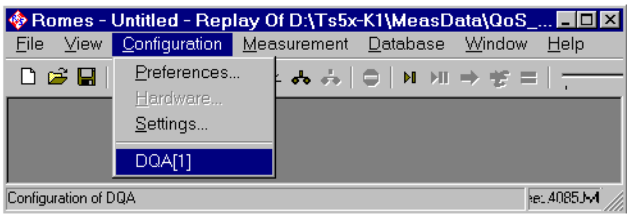
➢ Click the Hardware command in the Configuration menu to open the ROMES Hardware Configuration dialog.

➢ Expand the QoS driver section (click the + node) and double-click QoS Tester to load the driver.

➢ Click OK to close the ROMES Hardware Configuration dialog.

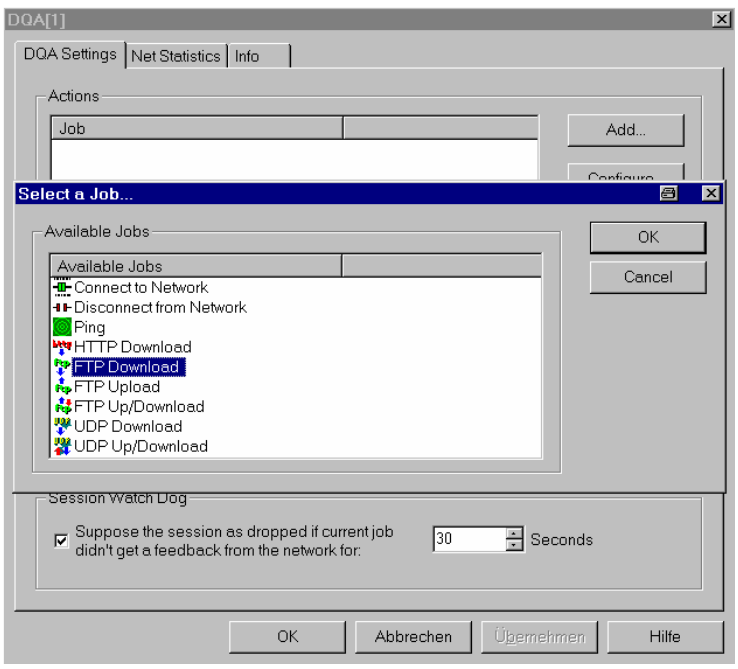


➢ In the *Configuration* menu, select the *DQA[1]* command to open the DQA driver configuration menu.

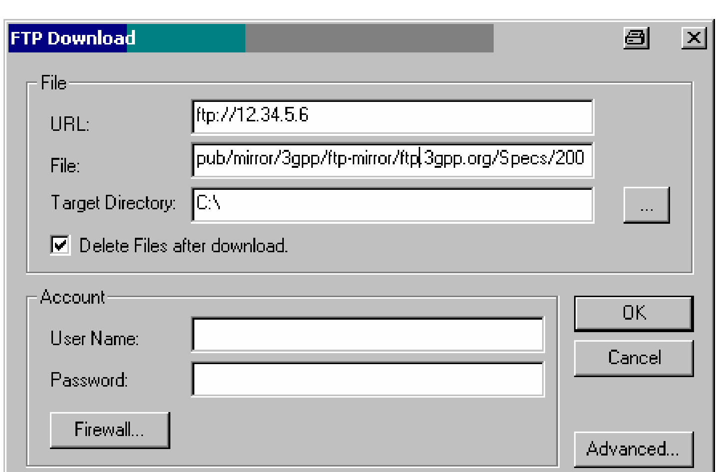


- ➢ Select the DQA Settings tab and click Add to open the list of available jobs. Select an FTP Download job.

- ➢ Double-click the selected FTP Download job or confirm with OK to open the FTP Download configuration menu.

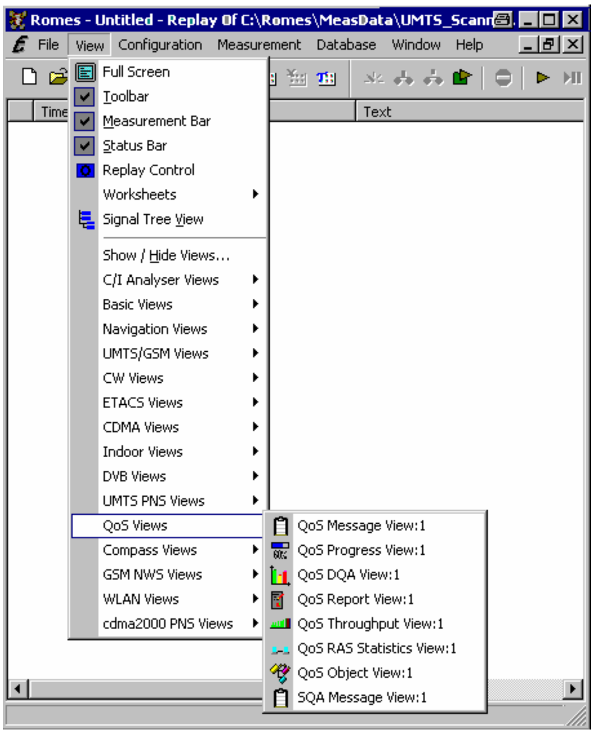


- ➢ In the configuration menu, enter the URL of the remote server (IP address as shown in the example or host name) and the name and directory of a file located on the remote server. Complete the settings as shown in the example. If the access is password-protected, specify the user name and password for your account. Open the *Firewall* settings dialog if needed.



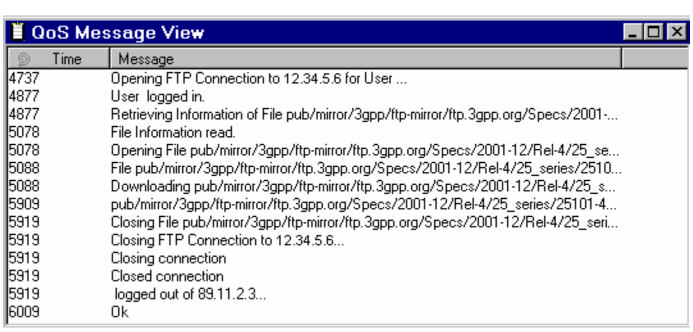
- Press *OK* to confirm your settings, close the *FTP Download* menu and return to the *DQA Settings* tab of the DQA configuration menu. Press *OK* again to close this menu.

- In the *View* menu, select the *QoS Views – QoS Message View*.



- Click the icon to start the DQA measurement.

  The *QoS Message View* indicates the progress of the measurement.



  The DQA measurement consists of opening the FTP connection to the remote server, downloading the file specified in the *FTP Configuration* menu, and closing the connection without keeping a copy of the downloaded file. As the session continues the job will be executed repeatedly until the DQA measurement is stopped, e.g. by clicking the icon.

UMTS PN Scanner

An UMTS PNS (Pseudo Noise Scanner) measurement consists of performing alternate PN scans and spectrum measurements using the R&S UMTS PN Scanner driver. The driver controls R&S FSP spectrum analyzer, a R&S ESPI test receiver, or a R&S TSMU radio network analyzer. Configuration of the driver is described in detail in chapter 6, section *UMTS PN Scanner Driver.* The *UMTS PNS Views* are described in chapter 4 Display and Evaluation of Results.

In the following examples we suppose that an R&S FSP or R&S ESPI test device is available and properly connected to the trigger device and your PC as described in chapter 6 Hardware Components. The first step for any PN Scan measurement is then to load the driver and set the address of your test device.

To load the driver...

- Click the *Hardware* command in the *Configuration* menu to open the *ROMES Hardware Configuration* dialog.
- In the list of *Available Drivers,* expand the *UMTS PN Scanner* section (click the + node) and double-click *R&S PNS* to load the driver.
- Click *OK* to close the ROMES Hardware Configuration dialog.

To set the device address…

- In the *Configuration* menu, select the *R&S UMTS PNS[1]* command to open the *R&S UMTS PNS* driver configuration menu.
- Click the *Receiver* tab and set the IEC/IEEE bus address (for a connection via IEC/IEEE-bus interface) or IP address (for a connection via Ethernet/LAN interface) of your test device.

Performing a Spectrum Analysis

The spectrum analysis consists of a frequency sweep over a specified range to detect arbitrary UMTS downlink and uplink signals. Like any other ROMES measurement, the spectrum analysis requires to load the hardware driver and set the driver parameters before you can start the measurement and evaluate the results. In the following example we suppose that these steps have been taken as described in section *UMTS PN Scan above* and that the driver configuration menu is still open.

Measurement task:

Measure the power in the nominal UMTS uplink and downlink bands. Set the test device to provide the maximum amount of data possible and view the downlink and uplink spectrum.

To set the test device parameters...

- In the *R&S UMTS PNS* driver configuration menu click the *Measurements* tab and check the settings in the *Uplink* and *Downlink* section of the *Spectrum* panel:
  - To repeat the spectrum measurements as quickly as possible, set the *Measurement Rate* to its maximum (20).
  - To speed up the individual spectrum measurements, ensure that a *Bandwidth* of 100 kHz is selected.
  - In the *Downlink* section, set the *Start* and *Stop* frequencies to 2110 MHz and 2170 MHz, respectively. In the *Uplink* section, set the *Start* and *Stop* frequencies to 1920 MHz and 1980 MHz, respectively.
- Click the *Receiver* tab and select one UMTS PN scan frequency in the *Frequency Table.*

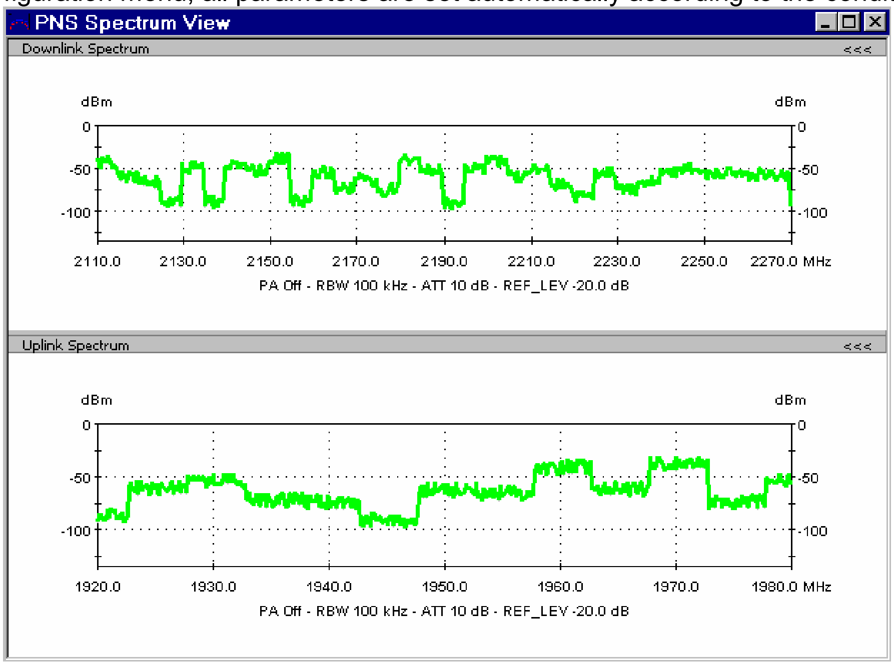
  The UMTS PN scan frequency is irrelevant for the current measurement task. However, ROMES always performs a combination of spectrum measurements and UMTS PN scans and requires at least one scan frequency to be defined.
- Click *OK* to apply the settings and close the driver configuration menu.

To open the views and perform the measurement...

- In the View menu, click UMTS PNS Views – PNS Spectrum View:1 to open the PNS Spectrum View.

- ➢ In the Measurement menu, click *Start Recording* to initiate the measurement.

As ROMES starts measuring, the downlink and uplink spectrum is displayed in the two subdiagrams of the *PNS Spectrum View.* Below each diagram, the settings at the test device are displayed. With the exception of the resolution bandwidth (RBW) which is identical with the *Bandwidth* set in the driver configuration menu, all parameters are set automatically according to the conditions of the measurement.



To terminate the measurement...

- ➢ In the Measurement menu, click Stop Recording.

- ➢ In the Comment dialog opened, briefly describe your measurement for later evaluations and confirm with OK.

ROMES terminates the measurement. The measurement data including the comment is stored in a measurement file named <current date>-<time>.cmd, e.g. __2006-07-15_12-36-44.cmd.

Performing a UMTS PN Scan

In an UMTS PN scan, the test device measures and identifies all UMTS downlink (Node B) signals in the air. The main purpose of this measurement is to test the receiving conditions of a mobile in an UMTS network and to analyze possible interferences. Like any other ROMES measurement, the UMTS PN scan requires to load the hardware driver and set the driver parameters before you can start the measurement and evaluate the results. In the following example we suppose that these steps have been taken as described in section *UMTS PN Scan* on p. 2.24 and that the driver configuration menu is still open.

Measurement task:

Perform a comprehensive analysis of all Node B signals on UTRA ARFCN 10561 that can be received along a measurement tour, including multiple signals caused by reflections (and possible sources of interference). Set the test device to provide the maximum amount of PN scan data possible and operate at maximum speed. View the signals with their power and relative timing.

To set the test device parameters...

- ➢ In the *R&S UMTS PNS* driver configuration menu click the *Receiver* tab and select the *Frequency* of 2112.2 MHz (click the checkbox), corresponding to ARFCN 10561. Deselect all other frequencies, if necessary.

- Click the *Measurements* tab and check the settings in the *Uplink* and *Downlink* section of the *Spectrum* panel. To repeat the spectrum measurements as rarely as possible, reserving the system resources for the PN scan, set the *Measurement Rate* to its minimum (0.1).
- Select *High Speed* in the *Measurement Mode* panel.
- To ensure that the system scans all signals, even those that are only received for a short time, set the *Synchronization Rate* to its maximum (20).
- To limit the size of the measurement file, reduce the *Update Rate for P-SCH View.*
- Click *OK* to apply the settings and close the driver configuration menu.

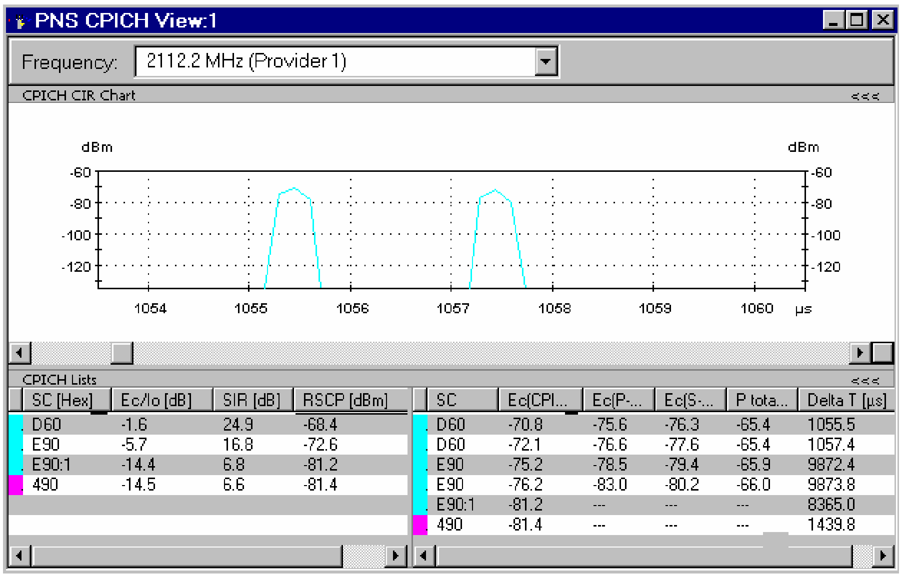
To open the views and perform the measurement...

- In the *View* menu, click UMTS PNS Views – PNS CPICH View:1 to open the PNS Spectrum View.
- In the *Measurement* menu, click *Start Recording* to initiate the measurement.

As ROMES starts measuring, the average power of the P-CPICHs of all received signals with their relative timing is displayed in the *CPICH CIR Chart.* The table below contains a comprehensive list of properties for each measured signal.

To analyze the results...

- Mark a time delay range in the *CPICH CIR Chart* while the left mouse button is pressed to magnify the diagram in x-direction and separate the different peaks with a common scrambling code.
- Right-click on a point inside the view to open the context menu; click *Config...* to call up the view configuration menu.
- Click the *CPICH View* tab to adjust the *Dynamic Range* to the signals in the *CPICH CIR Chart.*
- In the *Node B List Columns* and *Peak List Columns* selection tables, deselect the quantities to be omitted in the *CPICH Lists.*
- Click *OK* to confirm your settings and close the configuration menu.



To interpret the results...

The figure above shows a typical result of an UMTS PN scan analyzed in the *CPICH View:*

- The *CPICH CIR Chart* shows two reflections with the same scrambling code (SC = D60), i.e. originating from the same Node B, and almost the same signal power, separated by a relative time delay of approx. 2 µs.
- The *CPICH List* shows that the system is currently able to identify signals from 4 different Node Bs. Of these 4 Node Bs, two use the same scrambling codes (namely E90; the signals are labeled E90 and E90:1) but the signals are received at different time delays.
- The signals from the Node Bs using SC = D60 and SC = E90 are each split into 2 reflections.

Some of the signal contributions of SC = E90:1 and SC = 490 are too weak to be accurately received: The left table shows invalid results.

To terminate the measurement...

➢ In the *Measurement* menu, click Stop Recording.

➢ In the *Comment* dialog opened, briefly describe your measurement for later evaluations and confirm with *OK*.

ROMES terminates the measurement. The measurement data including the comment is stored in a measurement file named <current date>-<time>.cmd, e.g. __2006-07-15_12-36-44.cmd.

Using a Top N Pool

A top N pool contains up to N Node Bs with specific characteristics providing the strongest P-CPICH level at a given position and time. A top N pool can be used in the framework of a UMTS PN scan. It requires to load the hardware driver and set the driver parameters before you can start the measurement and evaluate the results. In the following example we suppose that these steps have been taken as described in section *UMTS PN Scan* on p. 2.24 and that the driver configuration menu is still open.

Measurement task:

Monitor and compare the properties of the three strongest signals on UTRA ARFCN 10561 along a measurement tour as accurately as possible, discarding the information about all other signals.

To set the test device parameters...

➢ In the *R&S UMTS PNS* driver configuration menu click the *Receiver* tab and select a valid UMTS provider frequency (in this example: 2112.2 MHz, corresponding to ARFCN 10561). Deselect all other frequencies, if any of them are checked.

➢ Click the *Measurements* tab and check the settings in the *Uplink* and *Downlink* section of the *Spectrum* panel. To repeat the spectrum measurements as rarely as possible, reserving the system resources for the PN scan, set the *Measurement Rate* to its minimum (0.1).

➢ Select *High Dynamic* in the *Measurement Mode* panel.

➢ To improve the system performance, set the *Synchronization Rate* to a rather small value, e.g. 0.1.

➢ To limit the size of the measurement file, reduce the *Update Rate for P-SCH View.*

➢ Select the *Top N* tab and click the *Add* button to generate a customized top N pool:

- In the *Count* select field, limit the number of Node Bs that are member of the pool to 3.
- Uncheck the *Sort* box to ensure that the pool members keep their rank within the pool until they are replaced by a new pool member.

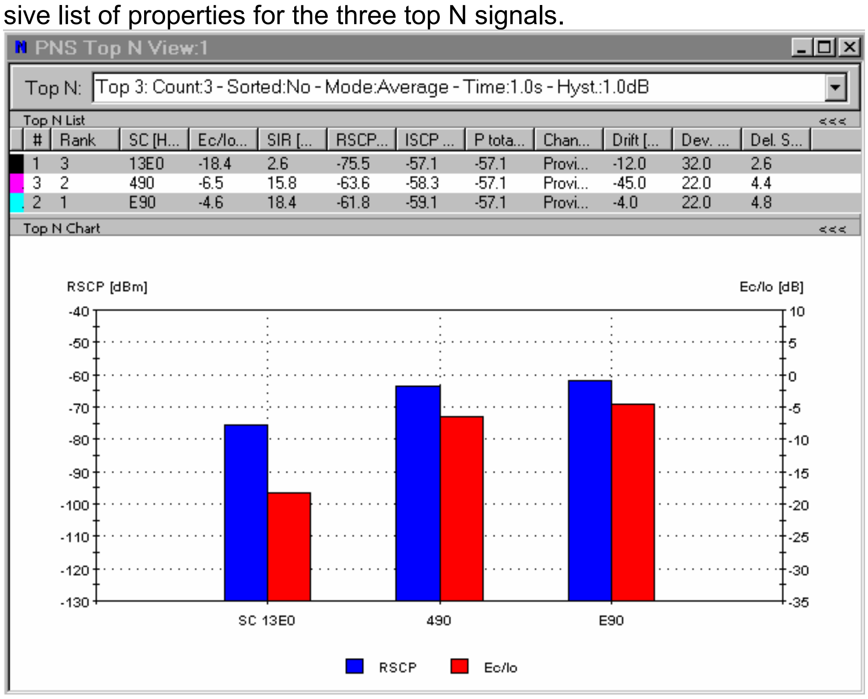
➢ Click *OK* twice to confirm the settings and close the driver configuration menu.

To open the views and perform the measurement...

➢ In the *View* menu, click UMTS PNS Views – PNS Top N View:1 to open the PNS Top N View.

➢ In the *Measurement* menu, click *Start Recording* to initiate the measurement.

As ROMES starts measuring, the *Top N Chart* displays the Received Signal Code Power (RSCP) and the average Ec/Io of the P-CPICHs of the three top N signals. The table above contains a comprehensive list of properties for the three top N signals.



To analyze the results further ...

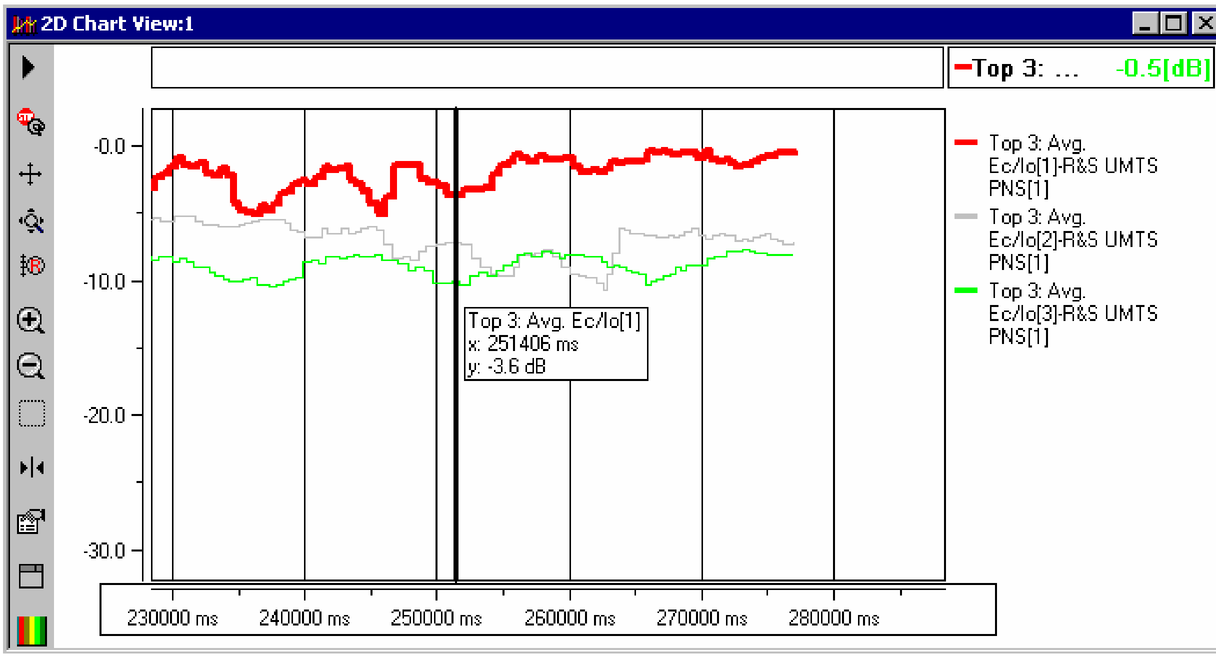
Besides the UMTS PNS views you can also use other ROMES views to analyze the results of an UMTS PN scan. We pick just one example, plotting the average Ec/Io of the three top N signals as a function of the time.

➢ In the *View* menu, click Basic Views – 2D Chart View:1 to open a 2D Chart View.

➢ Right-click inside the view and select *Config...* to open the configuration menu. In the *Values* tab expand the data tree and select the signals *Top 3: Avg. Ec/Io[1], Top 3: Avg. Ec/Io[2],* and *Top 3: Avg. Ec/Io[3]* to be displayed.

➢ Click *OK* to confirm the selection and close the configuration menu.

The 2D Chart view displays the three top N signals as a function of time. In the figure below the broad line, corresponding to *Top 3: Avg. Ec/Io[1]* is not always the strongest signal, which is due to the fact that the considered pool is unsorted.



To terminate the measurement...

➢ In the *Measurement* menu, click *Stop Recording*.

➢ In the *Comment* dialog opened, briefly describe your measurement for later evaluations and confirm with *OK*.

ROMES terminates the measurement. The measurement data including the comment is stored in a measurement file named <current date>-<time>.cmd, e.g. __2006-07-15_12-36-44.cmd.

Contents

3 User Interface 3.1

Menus and Commands 3.1

Menu Bar 3.1
Toolbar / Measurement bar 3.1
Work Area 3.2
Coupled Focus 3.4
Menus and Commands 3.5

File Menu 3.5

New Workspace 3.6
Open Workspace 3.7
Save Workspace 3.9
Save Workspace As... .... 3.9
Open CMD File... .... 3.10
Search CMD File... .... 3.11
Close CMD File... .... 3.12
CMD File Info 3.12
Merge CMD Files... .... 3.13
Export CMD File 3.15
Export CMD File Info(s) 3.15
Print... .... 3.16
Print Preview 3.16
Print Setup... .... 3.16
1 C:\...*.rms 3.16
1 C:\...*.cmd 3.17
Exit 3.17

View Menu 3.18

Full Screen 3.18
Toolbar 3.19
Measurement Bar 3.20
Status Bar 3.21
Replay Control 3.22
Worksheets 3.24
Signal Tree View 3.25
Show/Hide Views... .... 3.26
C/I Analyser Views 3.27
Basic Views 3.29
Navigation Views 3.30
2G/3G Views 3.31
HSDPA 3.32
UMTS 3.34
1xEV-DO 3.36
CDMA 3.37
GPRS 3.39
GSM 3.40
CW Views 3.42

ETACS Views....3.43
Indoor Views 3.44
DVB Views 3.45
UMTS PNS Views....3.47
QoS Views 3.49
Spectrum Views 3.50
Compass Views 3.51
GSM NWS Views....3.52
WLAN Views....3.53
CDMA2000 PNS Views 3.54

Configuration Menu 3.56

System Configuration (Preferences) 3.56
General Settings 3.57
Signal Configuration....3.60
Event Configuration....3.63
Positive Slope / Negative Slope 3.66
User Events....3.66
Comment Event 3.66
Voice Marker Event....3.67
Technology-Specific Settings....3.67
File Scanning Settings 3.68
Assignment of Shortcuts....3.70
Advanced Settings 3.71
Max. Number of Devices....3.72
Change 3.72
GSS Configuration 3.72
Registry 3.73
Replay Mode 3.74

Driver Installation (Hardware)....3.75

Overview of Settings (Settings)....3.75
TEC for GSM/UMTS/CDMA Test Mobiles 3.76
TEC for GSM NWS....3.76
GSM NWS Top N Settings....3.77
GSM NWS Scan Signal Settings 3.79
Info tab 3.81
GSM Technology 3.81
Creating a Database File....3.82
Importing a BTS List File into the Data Base 3.82
Database Management....3.83
Add BTS List Files....3.84
Evaluation 3.85
Operators (MCC, MNC) with unique CI....3.86
BTS List Editor 3.87

UMTS Technology 3.88
Creating a Data Base File 3.89
Importing a Node B List File into the Data Base 3.89
Tx Database Editor 3.90
UMTS Technology Settings....................3.91
CDMA Technology 3.91
TEC for UMTS PNS 3.92
TEC for CW Devices....................3.94

Measurement Menu 3.95
Start Measurement... ....3.95
Continue Measurement....................3.96
Start Recording 3.96
Stop Recording 3.97
Restart Measurement 3.97
Stop....................3.97
Status of the measurement....................3.97
Start Replay 3.98
Pause Replay....................3.99
Step One Data Set Forward....................3.99
Restart Replay 3.99
Use Fast Replay....................3.99
Configure Fast Replay… 3.100
Replay Device Filter 3.101
Replay Jump 3.102
R. Jump To Next Event....................3.103
Replay Jump To Block 3.104
Blocks 3.104
Events 3.105
Set Marker 3.105
Set Voice Marker 3.105
Release Coupled Focus....................3.105

Database Menu 3.106
CDMA BTS Database 3.106
GSM BTS Database 3.106
UMTS Node B Database 3.106

Window Menu 3.106
New Window 3.107
Close All Windows 3.107
Close All Windows on <S>....................3.107
Cascade 3.107
Tile 3.107
Arrange Icons....................3.107
1 <ViewName> View....................3.107

Help Menu 3.108
Index 3.108
Using Help....................3.108

Tip of the Day..3.108
Loaded Modules..3.108
TSMx Installation..3.109
About ROMES..3.110

3 User Interface

This chapter describes ROMES interface elements and their use. When the program is started, it opens the main window with all its working components. These components will activate depending on the loaded workspace.

Menus and Commands

The ROMES main application window consists of the main elements listed below.

Tools to configure the different active elements of the main window and the views are provided in the View Menu.

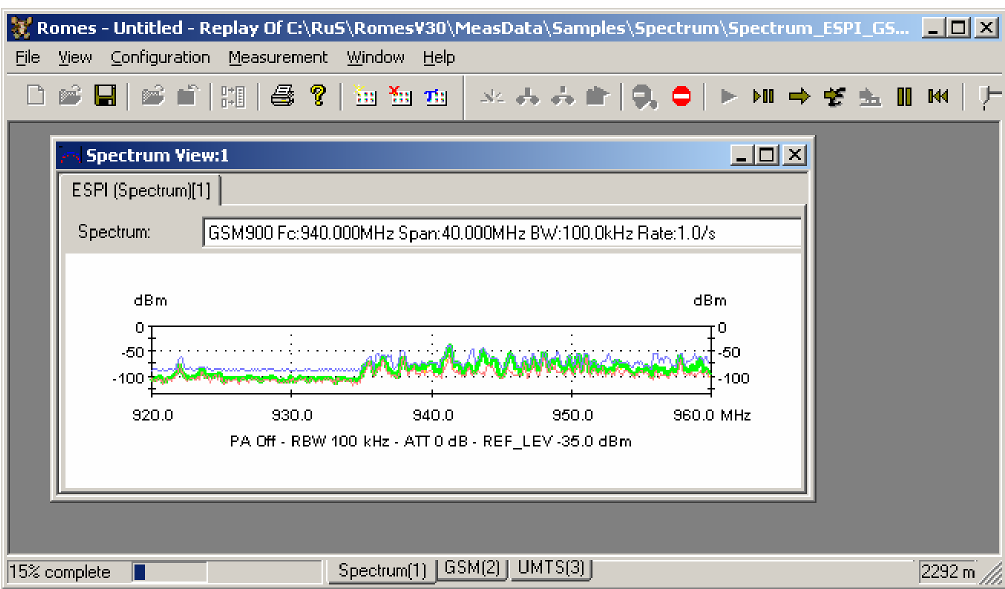


Fig. 3–1 ROMES main window

Menu Bar

Below the title bar along the top of the screen, the program displays a menu bar with a variety of menu titles. Selecting a command from one of these menus either performs an action or displays a submenu or dialog. The menus – including dialogs that call for an explanation – are described in the following sections in this chapter.

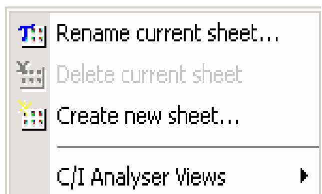
Toolbar / Measurement bar

Directly below the menu bar is a bar with an array of buttons that provide access to the most commonly-used commands. The left part of the bar is to access the functions in the *File* and *Help* menu *(Toolbar);* the right part controls a *Measurement*. Toolbar and Measurement bar can be hidden or displayed separately; see *View Menu* on p. 3.18 ff.

Work Area

When the program is started with default settings, the main work area within the program window is empty (except for the *Sheet* name displayed in the center) and may be filled with one or several views (see *View Menu* on p. 3.18 ff.). One of the views is always active and displayed with a blue title bar so it is possible to customize the view and work with it.

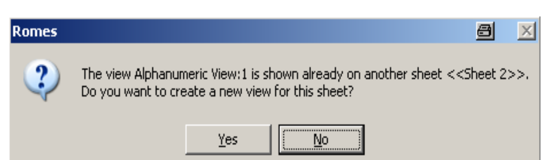
The work area can be divided into different superimposed worksheets in order to gain more space and arrange the views in different groups. Each sheet has a name and is accessible by clicking the associated tab in the status bar below the work area. A right-click on one of the tabs opens a context menu with self-explanatory entries:



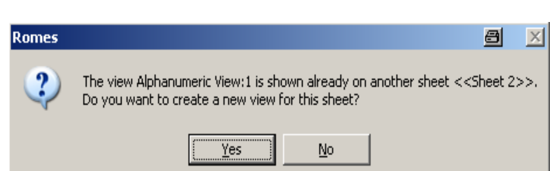
(complete list of views, see section *View Menu* on p. 3.18 ff.)…

Moving views between different worksheets
Suppose that a sheet contains a view of a view type that can be opened several times (e.g. the Spectrum View:1 in Spectrum Views below).

- To move the view from the current sheet to a target sheet, use one of the following methods:
  - Right-click the view and click *Move to – <Target Sheet>* in the context menu.
  - Open the target sheet and select the view type (e.g. *Alphanumeric View:1)* in the *View* menu. In the message box opened, click *No*.



- To create a new view of the same type (e.g. *Alphanumeric View:2)* in another sheet, use one of the following methods:
  - Right-click the existing view to open the context menu, click *New View*, then move the new view to the target sheet.
  - Open the target sheet and select the view type (e.g. *Alphanumeric View:1)* in the *View* menu. In the message box opened, click *Yes*.



Saving and loading worksheets
You can save your worksheet with all views and their settings to a file and re-use it in a later session. You can also save one or more default sheets that will be loaded automatically when ROMES is started; see Worksheets on p. 3.24.

Tools for configuring the different working elements of the main window and the views are provided in the *Window Menu* (see p. 3.106 ff.).

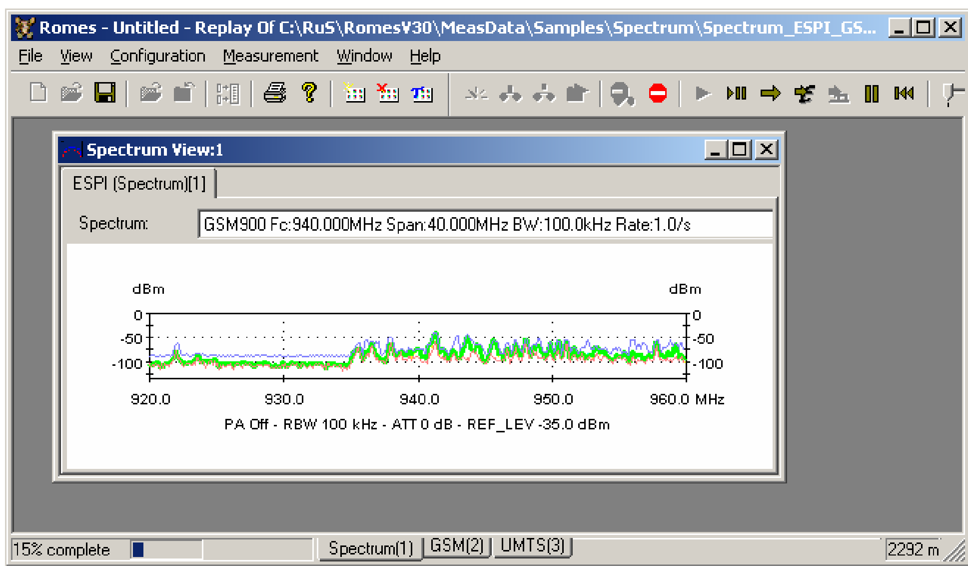
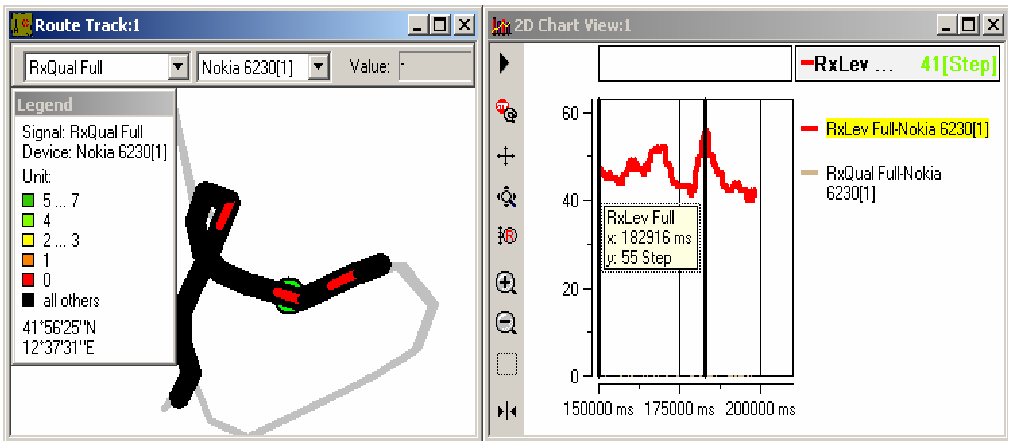


Fig. 3–2 ROMES main window

Coupled Focus

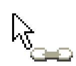
Many views provide graphical tools to highlight special areas and read a particular result. Examples are the marker line and the info field for the *2D Chart View* and the circular focus in the *Route Track* view shown below. The focus in several views can be coupled, which makes it easier to analyze different aspects of a coverage measurement at a particular position using a set of appropriate views.

In the example below, a local maximum of the *RxLevFull* reported by the test mobile is located in the *2D Chart View,* and the value (41) is read. The *Route Track* view shows the corresponding geographical position.



The following tools control the coupled focus:

- *Alt* plus a double-click inside a view activates the coupled focus.

  The cursor changes to . Views without focus indicate *not synchronized.*

- The mouse cursor or the arrow keys move the focus within the view. To obtain different step widths you can combine the arrow keys with the <*SHIFT*> and the <*CTRL*> keys.

- The *Coupled Focus* settings in the *ROMES Configuration* dialog (see p. 3.59 ff.) specify which views are synchronized if the coupled focus is active and define the effect of the arrow keys.

- The *Release Coupled Focus* button  in the measurement bar or (equivalently) the menu command *Measurement – Release Coupled Focus* releases the coupled focus.

If no coupled focus is available for a view, the message <<*not synchronized*>> is displayed in the title bar, e.g.:

Menus and Commands

ROMES provides seven menus opened by clicking one of the items in the menu bar on top of the main application window. The menus are used to access the functions and windows configuring and controlling the measurement and evaluation of results:

File Menu
: Opens and saves workspace and measurement files, exports and prints data and closes the application.

View Menu
: Customizes the main application window and offers the view windows used to visualize and evaluate measured data.

Configuration Menu
: Installs the hardware drivers necessary for a measurement, configures the display and defines directories for the different types of files.

Measurement Menu
: Starts and stops a measurement, starts and stops the replay of a measurement file and displays the list of event settings.

Database Menu
: Customizes the internal database for GSM/UMTS data and Carrier to Interference (C/I) analysis.

Window Menu
: Arranges and handles the different view windows.

Help Menu
: Provides online help and general information on the coverage measurement system.

File Menu

The *File* menu opens and saves workspace and measurement files, exports and prints data and closes the application.

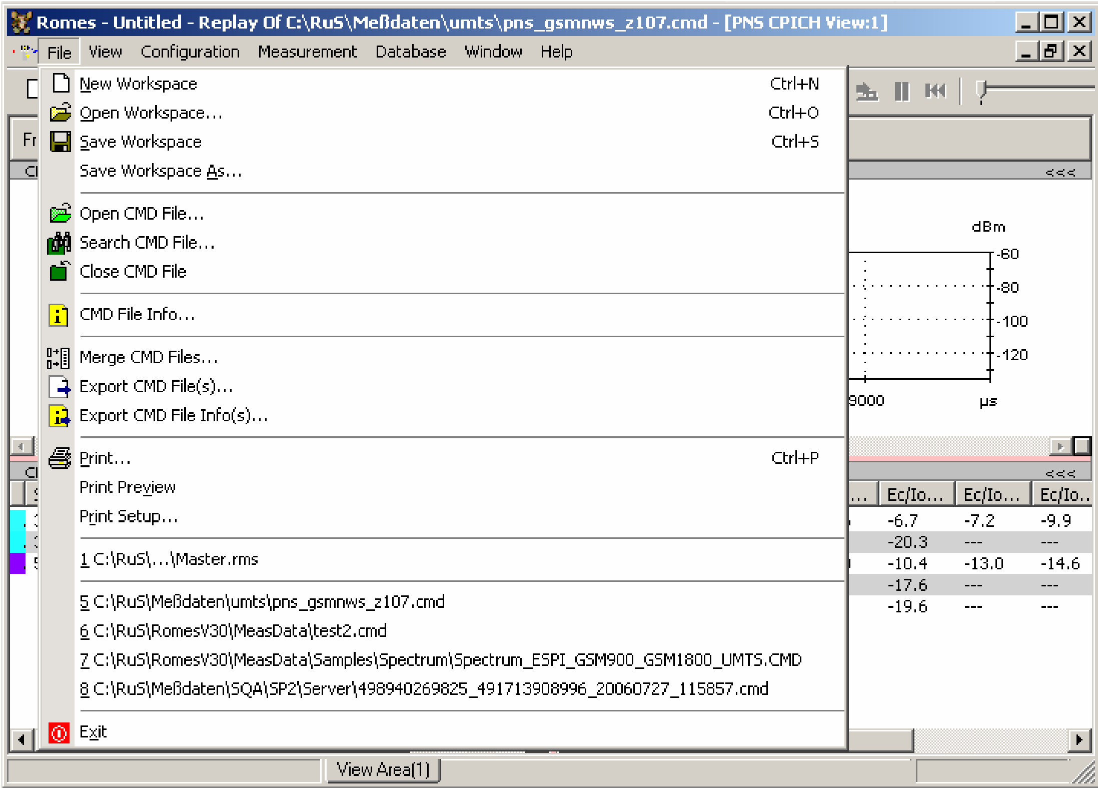
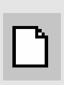


Fig. 3–3 File menu

New Workspace



Ctrl+N

Creates a new workspace.

A workspace contains the device driver and screen settings for a ROMES session, including the type, size, and position of all opened view windows, parameter types to be viewed in each view type (if applicable), and a bitmap archive for *Route Track Views*, if defined. A workspace must contain at least one view of every type. Data to be viewed are not part of the workspace.

The workspace opened when ROMES is started depends on the setting in the *General* tab of the *ROMES Configuration* menu. ROMES uses either the last workspace used in the previous session or the following default workspace: a view window of each type is opened, all windows are tiled across the main window. The main application window size of the previous session is preserved.

User-defined workspaces can be stored to a workspace file <filename>.RMS and recalled in later sessions. So, for each kind of measurement the matching control windows can be easily set, and each operator can save and reuse his favorite constellations.

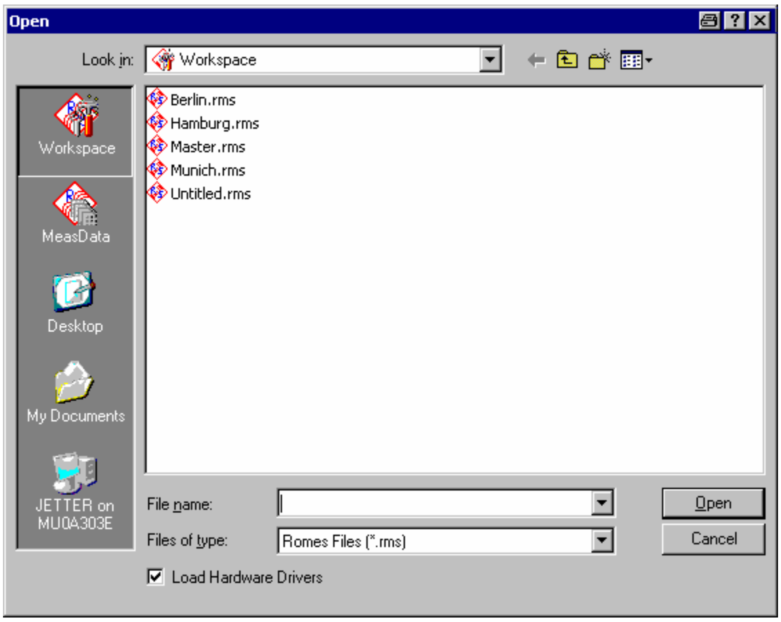
For a definition of the workspace see chapter 1.

Open Workspace

Ctrl+O

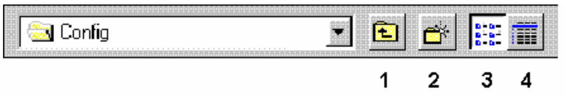
Loads an existing workspace from an *.rms or a *cmd file.

The *Open* command calls up the *Open* dialog box.



Look in:

The *Look in:* pull-down directory window is used to search the directories accessible from your computer for workspace files.



The icons at the right side of the pull-down window form a simple file manager:

1 Move up one level in the directory tree

2 Create a new directory

3 Display the list of subdirectories and files

4 Show directory and file properties like size, type or time stamp

Files and directories may be selected and deleted using the *Delete* key of your keyboard.

File list

The file list shows all files within the current directory with the extension (*.rms or *.cmd) selected under *Files of type* .

➢ Click one of the of the files in the list to enter it in the *File name* window.

File name:

A file selected from the file list is entered in this field. Alternatively, a file name may be entered manually.

The *Open* button opens and loads a workspace. Equivalently, a workspace file may be double-clicked in the file list.

The *Cancel* button discards the file selection.

Open button:

The *Open* button opens and loads a workspace. Equivalently, a workspace file may be double-clicked in the file list.

Cancel button:

The *Cancel* button discards the file selection.

Files of type:

Only files of the type selected in this field will be shown in the file list. The following file types may be selected:

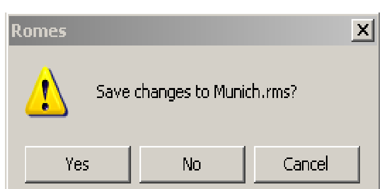
Workspace files (*.rms)
Standard workspace file type, contains the workspace but no measurement data.

Measurement files (*cmd)
Measurement file created with a ROMES version ≥ V3.50 containing the workspace at the time when the file was recorded *(Start Recording)*.

Load Hardware Drivers

A workspace can be loaded with or without the hardware drivers required for the measurement. Loading without hardware drivers is faster and sufficient, e.g. for replay sessions.

As only one workspace configuration can be active at one time, the current workspace is closed before a new one is opened. Before closing the workspace, ROMES displays a message:

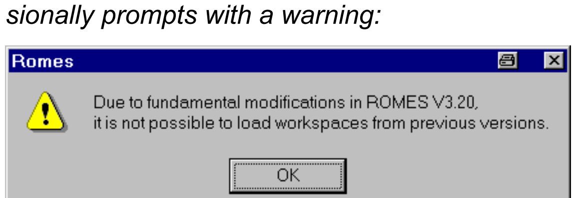


- The *Yes* button saves changes and closes the current configuration.
- The *No* button closes the current configuration without saving.
- The *Cancel* buttons returns to the current configuration.

Notes on older workspace files:

*The *.cms workspace configuration files of measurement software versions older than 3.0 can't be used in newer ROMES versions as their format is completely different.*

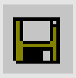
*If an older *rms file is loaded into a ROMES version ≥ 3.21, the system occasionally prompts with a warning:*



This warning can usually be ignored. If ROMES keeps generating error mes-

sages after the first warning is confirmed, it is recommended to reset the registry entries in the Advanced Settings tab of the ROMES Configuration menu; see section Advanced Settings on p. 3.71 ff.

Save Workspace



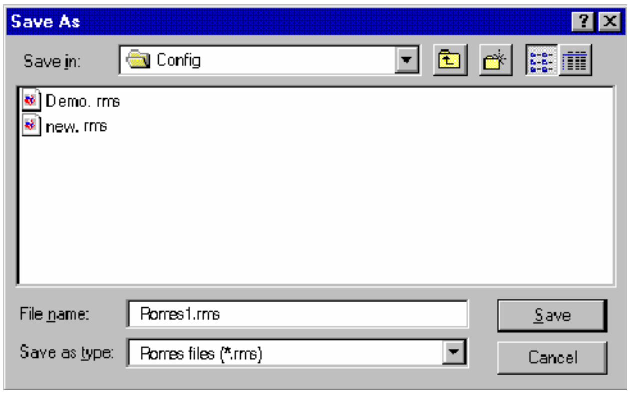
Ctrl+S

Save a workspace file with its current name.

Save Workspace As...

Save a workspace file with a new name and directory.

The *Save As...* command calls up the *Save As...* dialog.



This dialog is analogous to the *Open* dialog, see above.

➢ Choose a file name with the extension *.rms and a directory of your choice to save the current workspace for later use. If a file name is entered manually without extension, *.rms is appended automatically.

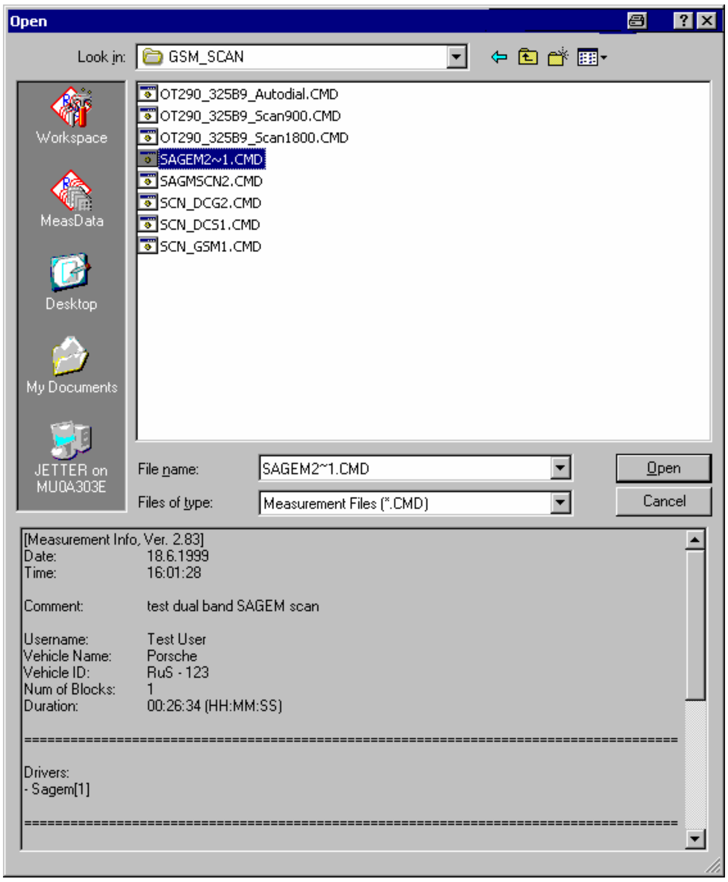
Open CMD File...

Ctrl+S

Open a new measurement file.

The currently open CMD file is replayed when the *Start Replay* command in the *Measurement* menu (p. 3.95 ff.) is executed. It is also used as a default file to be exported (see *Export CMD File* command below).

The *Open CMD File...* command calls up an extended *Open* dialog.



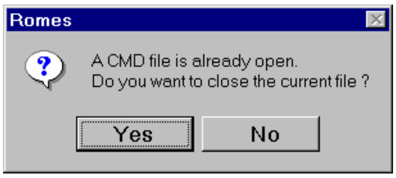
The upper part of the menu is analogous to the dialog used to open a workspace file (see above, *Open* command *Open Workspace*).

Files of type

Only files of the type selected in this field will be shown in the file list. The following file types may be selected:

- Measurement files (*.cmd):
- Standard measurement file type

Only one measurement file can be open at one time. If the *Open CMD File* command is used while a measurement file is open, ROMES prompts with a message:



➢ Click Yes to close the current workspace and open the selected one.

➢ Click No to return to the current measurement menu.

Open as read-only

If the *Open as read-only* switch is checked, the measurement file opened is protected so that the file contents can not be overwritten.

File Info

In the lower half of the *File Open* dialog, information stored with the measurement data of the selected file is displayed. See description of *CMD File Info* command below.

File scan

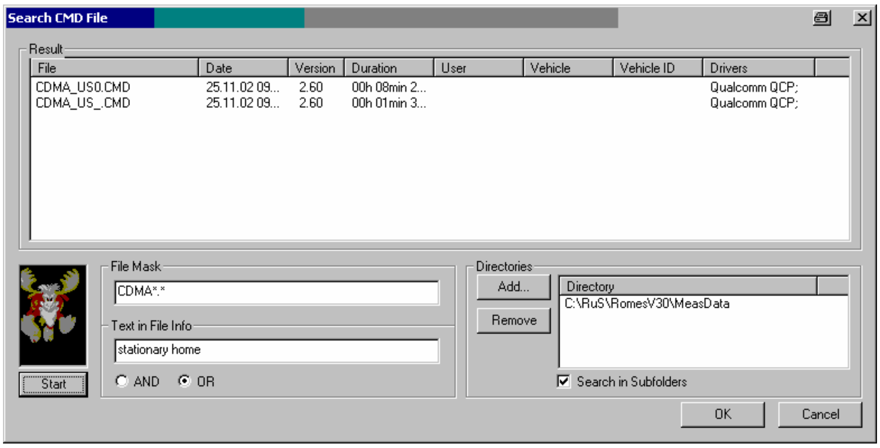
When opening a measurement file, ROMES automatically scans the data, sorting the timestamps and extracting geographical information. After the scan, the entire measurement route can be displayed in the *Route Track* view.

To disable the file scan, you can either press the *Ctrl* key while opening the file or disable CMD file scanning in the *General* tab of the *ROMES Configuration* menu (see section General Settings on p. 3.57 ff.). This can be necessary for older measurement files recorded with a ROMES 2.x version.

Search CMD File...

Search for a particular measurement file stored on your file system.

Search CMD File... calls up a dialog:



The dialog is subdivided into three different panels:

Result

Contains a list of all measurement files in the selected *Directories,* meeting the search criteria defined in *Search in File Header.*

File Mask

Defines search criteria to find a particular file from an extensive list. The following criteria are provided:

A condition for the file name *(File Mask)*

A condition for *Text* stored in the *File Info,* complemented by a logical condition for the text elements/words *(AND* for a file info containing all words, *OR* for a file info containing at least one of the words).

Directories

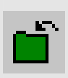
Contains a list of all search directories, adds and removes directories. The checkbox provides a decision whether or not to include all subfolders of the selected directory in the search.

Searching a file

To search a measurement file proceed as follows:

- In the *Directories* panel, click *Add* to open a *Browse for Folder* dialog and select the directory for your measurement files.
- Specify whether ROMES should also search the subfolders of the selected directory.
- Click Start.
- If the result list is too long, specify a file mask or a search text in the file info and repeat the search.
- Right click a measurement file in the list to display the *File Info,* double click to open it; see *Open CMD File...* on p. 3.10.

Close CMD File...



Close the current measurement file.

CMD File Info

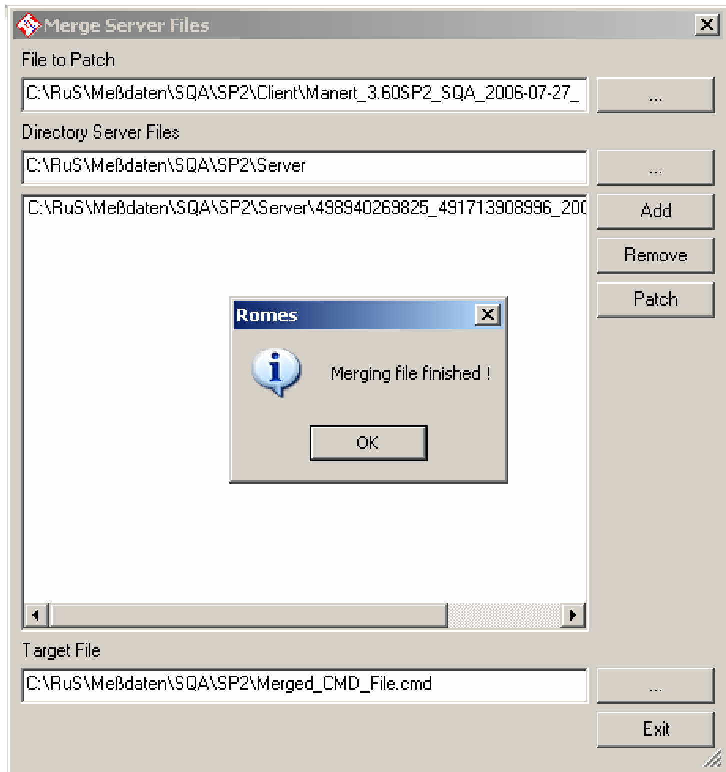
Display the file information of the current measurement file.

The file information is identical with the information displayed when a measurement file is opened (see above, *Open CMD File* command). It includes:

- Date and time of the measurement.
- A user-defined comment.
- User name, vehicle type and ID, the file length in blocks, and the duration of the measurement.
- The drivers used and the most important driver settings made before the measurement was started (see chapter 6). Driver settings such as the Meas. Mode of a mobile or the frequency and trigger settings of a test receiver are essential for the type of data recorded and the available views.

Merge CMD Files...

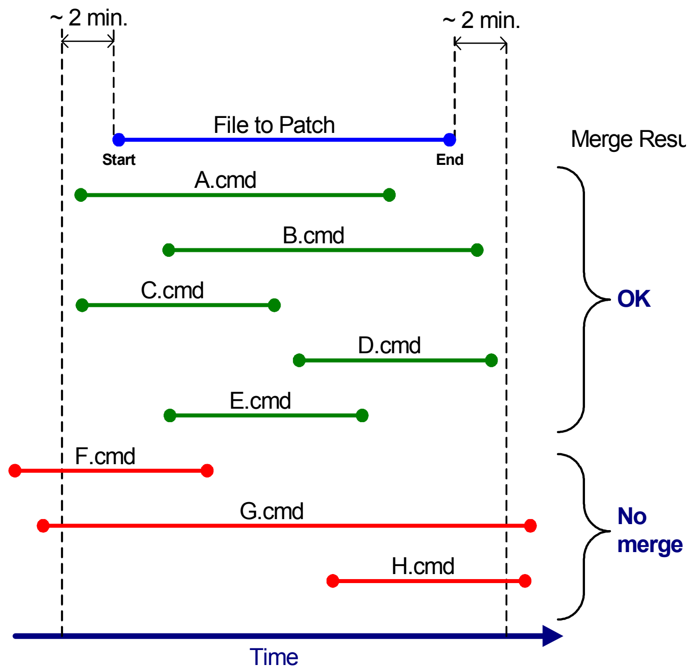
The *Merge CMD Files...* function is available for speech quality measurements, where uplink and downlink data is measured simultaneously on separate hosts (stationary server for test data generation, and receiving mobile). The resulting client and server-side CMD files can be merged using the *Merge Server Files* dialog.



The buttons on the right side of the dialog control the file merger:

Command	**Description**
...	Browse for File to Patch: Open a selection dialog window for the first CMD file to be merged. This file contains the GPS and time-related data, which defines the location(s) and the master time frame for all associated files to be merged.
...	Browse for Directory Server Files: Open a selection dialog window for the directory of the next CMD file.
Add	Show the available CMD files in the specified directory of the *Directory Server Files*. Note that the file to be merged with the *File to Patch* must be within a similar time frame, otherwise the merger is refused with the following error message:

The allowed time frames of the *.cmd files for merges are shown in the following diagram:



Remove	Remove the previously selected CMD file from the list box.
Patch	Perform the file merge of the selected CMD files (the button becomes active when all required merge file information is provided, otherwise it is grayed).
...	Browse for Target File: Open a dialog window for the target file name and storage directory.
Exit	Close the *Merge Server Files* dialog. If the *Patch* button is not used, nothing is merged or modified.

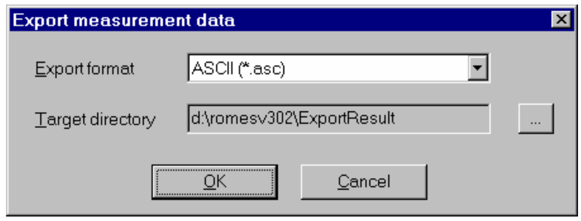
Please note that only the time frame of the files to be merged is checked for plausibility and that this funtion is only intended for SQA measurements. All kinds of other measurement data combinations within the merged files are possible, but not necessarily useful.

An example: It is not possible to activate more than one UMTS PNS TSMU driver at a time, which is the basis for multiple UMTS views. Now if two measurements are performed simultaneously with two different TSMU drivers and the resulting CMD files are merged, then the ROMES system replaying the merged file has a very high probability to hang or terminate.

Export CMD File ...

Export and save measurement data for later evaluation, e.g. with an other application.

The *Export* command calls up the *Export measurement data* dialog.



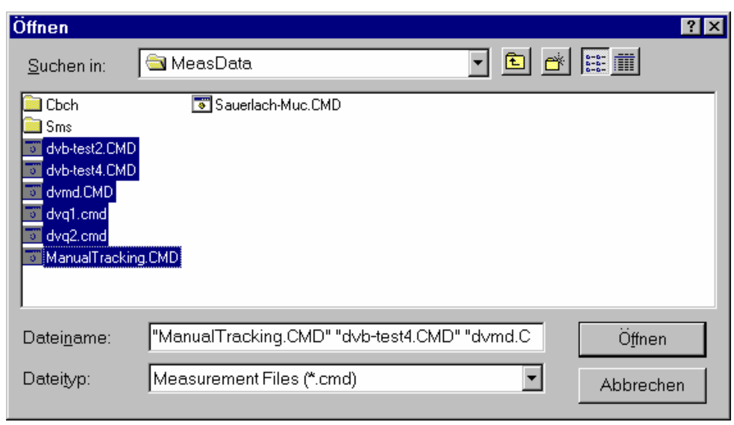
Data may be stored to a file in a *target directory* and with one of the *export formats* offered. For more information on data export and the corresponding file formats exporting refer to chapter *Data Processing*.

Export CMD File Info(s)

Write the file information of several measurement files to a single text file.

The file information is identical with the information displayed when a measurement file is opened (see above, *CMD File Info* command). It is exported in two steps:

➢ The *Export CMD File Info(s)* command opens a file *Open* dialog to select the measurement files:



➢ After file selection, the *Open* button calls up a *Save As...* dialog to select a file name (*.txt) and a directory for the file information.

In the *.txt file, the file information of the individual files form separate consecutive sections. Each section starts with the name and path of the measurement file, e.g.:

`************D:\RuS\RomesV30\MeasData\dvb-test4.CMD**********`

The text file can be regarded as a catalog providing an overview of a whole archive of measurement files. If it is viewed with an suitable text editor using functionality such as the text search function.

Print...

Ctrl + P

Print the contents of the active view.

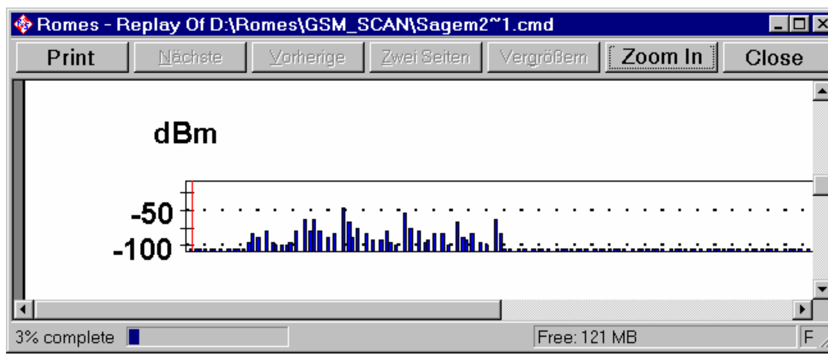
The *Print* option is an alternative to taking screenshots via the clipboard (see chapter 7). ROMES uses the standard *Print* menu familiar from other MS Windows applications. Printing to a file or a configurable printer with selectable page numbers is possible. For details use the context-sensitive help.

To control the appearance of the hardcopy, a preview option is provided, see *Print Preview* below.

Print Preview

Show a preview of the hardcopy to be created.

The *Print preview* command opens a window showing one page (our example shows a section of such a page):



The buttons below the title bar of the window control the preview and printout:

Command	Description
Print	Print the previewed file with the current printer settings
Next	Show next page (if applicable, otherwise grayed)
Previous	Show previous page (if applicable, otherwise grayed)
Two pages	Show two pages (if applicable, otherwise grayed)
Zoom In	Magnify current page by a factor of 2 (2 steps possible)
Zoom Out	Reduce scale of current page by a factor of 2 (2 steps possible)
Close	Close the window without printing

Print Setup...

Modify the printer settings.

ROMES uses the standard *Print Setup* menu familiar from other WINDOWS applications. For details use the context-sensitive help.

1 C:\...*.rms

Open one of the workspace files saved before.

A maximum of four workspace files numbered 1 to 4 are listed in this field.

1 C:\...*.cmd

Open one of the measurement files used before.

A maximum of four measurement files numbered 1 to 4 are listed in this field.

The currently open CMD file is replayed when the *Start Replay* command in the *Measurement* menu (p. 3.95 ff) is executed. It is also used as a default file to be exported (see *Export CMD File* command above).

Exit

Close the application.

Before closing, ROMES issues a warning if there are unsaved changes to the currently active workspace.

View Menu

The *View* menu customizes the main application window and offers the view windows used to visualize and evaluate measured data.

Note:

The selection of view windows is determined while ROMES is installed, depending on the system configuration and the available options. Fig. 3–4 below shows the maximum number of views possible.

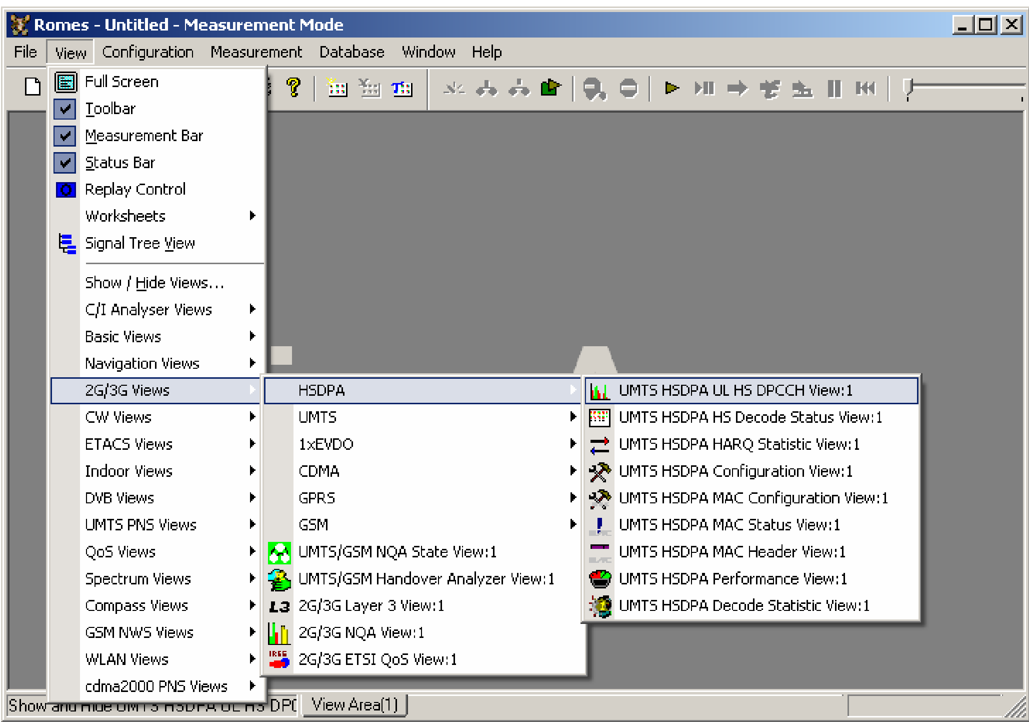


Fig. 3–4 View menu

Full Screen

Maximize the main application window to full screen size.

The toolbar, the measurement bar and the status bar are hidden in full screen mode.

Toolbar

Display and hide the toolbar of the main application window.

The toolbar forms the left part of the upper margin of the main window and offers controls for the most common program tasks, otherwise offered in the *File* and *Help* menu and in the context menu of the main application window (see section *User Interface* on p. 3.1 ff.).

1 2 3 4 5 6 7 8 9 10 11

Control	Menu command	Shortcut
1	New workspace	Ctrl N
2	Open workspace	Ctrl O
3	Save workspace	Ctrl S
4	Open CMD File	
5	Close CMD File	
6	Merge CMD Files	
7	Print...	Ctrl P
8	About ROMES...	
9	Create new sheet (context menu)	
10	Delete current sheet (context menu)	
11	Rename current sheet (context menu)	

The toolbar may be hidden together with the measurement bar in order to enlarge the main window. A checkmark next to the menu item shows that the toolbar is displayed (see Fig. 3–4).

Measurement Bar

Display and hide the measurement bar of the main application window.

The measurement bar forms the right part of the upper margin of the main window and offers controls for the most common program tasks, otherwise offered in the *Measurement* menu (see p. 3.95 ff.). Many of the icons are also available in the *Replay Control* dialog described on p. 3.22.

Control	Menu command
1	Start Measurement
2	Start Recording
3	Stop Recording
4	Continue Measurement
5	Restart Measurement
6	Stop
7	Start Replay
8	Step One Data Set Forward
9	Replay Jump
10	Replay Jump to the Next Event
11	Replay Jump to Block
12	Pause Replay
13	Restart Replay
14	Replay Speed
15	Enable and disable fast replay
16	Event Window
17	Set Voice Marker
18	Show/Hide Signal Tree View (see below)
19	Release Coupled Focus (see p. 3.4)

The measurement bar may be hidden together with the toolbar bar in order to enlarge the main window. A checkmark next to the menu item shows that the measurement bar is displayed (see Fig. 3–4).

Status Bar

Display and hide the status bar of the main application window.

The status bar forms the lower margin of the main window and is divided into three different areas (see Fig. 3–4):

1. In the left-hand part of the status bar, a short explanation of the function of control elements appearing in the main window is given. This includes

- Menu items selected by the pointer or the cursor keys or click
- Toolbar buttons, either selected by the pointer (arrow points to the button) or clicked with the left mouse button

2. The next field of the status bar indicates the free disc space available for storing measurement data. During a measurement or during recording, the time elapsed since the start of the measurement and the data rate which is being written to the measurement file (during recording) is indicated in addition.

3. The next field of the status bar gives the status of data processing, i.e. it indicates the status of the current *temporary working data* set. Possible messages are:

Message	Description
Ready	Ready for measuring or data processing
Replay	Data measured before and stored to a measurement file are being processed and loaded
Replay – Pause	Replay process paused
CMD file open	A measurement (*.cmd) file is open and ready to be replayed or exported
Load Drivers	Drivers being loaded
Measuring	Measurement running (without data recording)
Recording	Measurement and data recording running

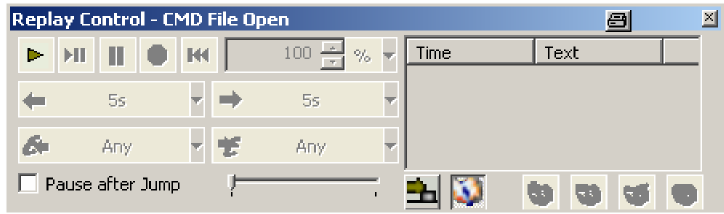
4. The fields in the right-hand part of the status bar indicate which of the following keys are latched:

Indicator	Description
CAP	The Caps Lock key is latched
NUM	The Num Lock key is latched
SCRL	The Scroll Lock key is latched

The status bar may be hidden in order to enlarge the main application window. A check mark left of the menu item indicates that the status bar is currently displayed.

Replay Control

Open or close a dialog to control the replay of a measurement file.



The *Replay Control* dialog is opened automatically each time a measurement file is replayed if *Show Replay Control Dialog Automatically...* is selected in the ROMES configuration dialog; see section *General Settings* on p. 3.57 ff.

Basic Functionality

The *Replay Control* menu contains the replay control icons of the *Measurement Bar,* corresponding to the following *Measurement Menu* commands (see p. 3.95 ff.):

 Start Replay

 Step One Data Set Forward

 Pause Replay

 Stop

 Restart Replay; rewind the measurement file; the replay can be restarted via *Pause Replay.*

Replay Jump

The control element to the right of the measurement bar icons defines by which amount ROMES can jump forward and back within the measurement file. Together with the *Pause after Jump* checkbox, it corresponds to the *Replay Jump* dialog described on p. 3.102.

The two buttons below the measurement bar icons initiate a replay jump by a selectable amount of time.

The two buttons below initiate a replay jump to the previous or next event. The pull-down lists select the relevant events; they give access to the list of available events in the *ROMES Configuration* menu; see section *Event Configuration* on p. 3.63 ff.

Block Mode

The *Replay Jump to Block* icon in the right half of the dialog displays the blocks in the measurement file and initiates a replay jump to the next block; if the file contains several blocks. The blocks are listed in the table above the icon; see *Replay Jump to Block* on p. 3.104. A double click on the block initiates a jump to the selected block.

Bookmark Mode

The *Bookmark* icon in the right half of the dialog displays the bookmarks in the measurement file and initiates a replay jump to the next bookmark; if the file contains several bookmarks. The bookmarks are listed in the table above the icon. A double click on the bookmark initiates a jump to the selected bookmark.

Bookmarks can be added or manipulated in the *replay pause* state. The following buttons are related to bookmarks in measurement files:

	Add a bookmark		Remove the selected bookmark
	Edit the sel. bookmark		Save bookmark list to meas. file.

Worksheets

Open a submenu to rename, create and delete worksheets.

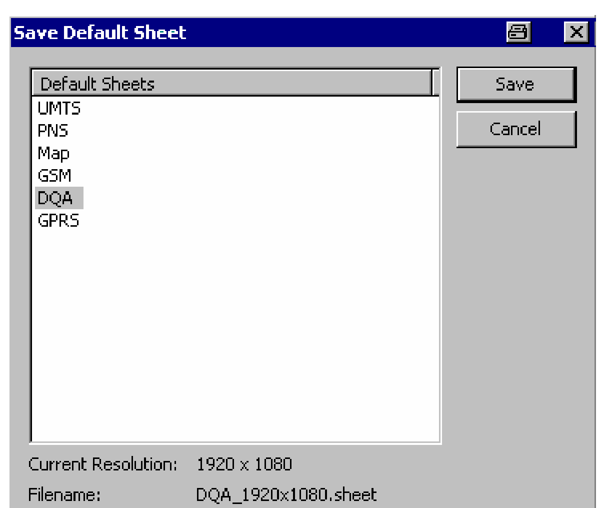
The submenu contains the entries in the context menu in the work area; see description on p. 3.2. In addition, it provides commands for saving and reusing worksheets:

To reuse a default sheet after a change of the screen resolution, load it (Load Sheet…) and save it again under a file name containing the new resolution.

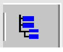
Load Sheet… Calls up an Open dialog box to select and load a worksheet file saved before. Worksheet files are ASCII files with the extension *.sheet containing the sheet name, the current screen resolution, and information on all views in the sheet together with their size, position, and special configuration settings. A selection of standard worksheet files for typical measurement tasks and screen resolutions is available in the *Sheets* subdirectory of the ROMES program directory.

Save Sheet… Calls up a *Save As…* dialog to save the current sheet with its views in a worksheet file (*.sheet).

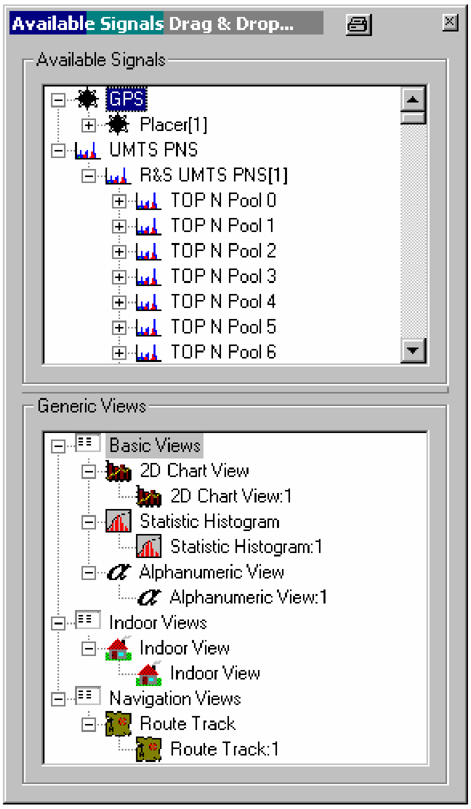
Save Sheet as Default… Save the current worksheet as default sheet, to be opened automatically when ROMES is started, provided that this is selected as an option in the ROMES Configuration dialog (see section General Settings on p. 3.57 ff.) and that the screen resolution is left unchanged. The file name of the default worksheet is assigned automatically according to the main technology and the current screen resolution. A separate default sheet can be created for each technology.



Signal Tree View



Call up the *Available Signals Drag & Drop...* menu.



The menu displays the branches of the data tree that are actually available in the current measurement file. The complete data tree (see chapter Data Selection) is displayed in the view configuration menus (e.g. *Route Track View, Alphanumeric View, 2D Chart View, Statistic Histogram View,* see chapter 4). The signal tree view is a fast alternative for selecting a signal or a group of signals to be viewed without opening the view configuration menu:

- A click on a single signal selects the signal to be viewed.
- A click on several signals with pressed shift or control key selects a group of signals.
- A click on a technology, device, or data structure node selects all signals below the node.

After dragging and dropping the selected signal(s) into the view area, they appear in the *Selected Parameter* list and in the list of *Selected Signals* in the *Values* tab of the view configuration menu. They can be removed by means of the context menu or the view configuration menu.

Generic Views

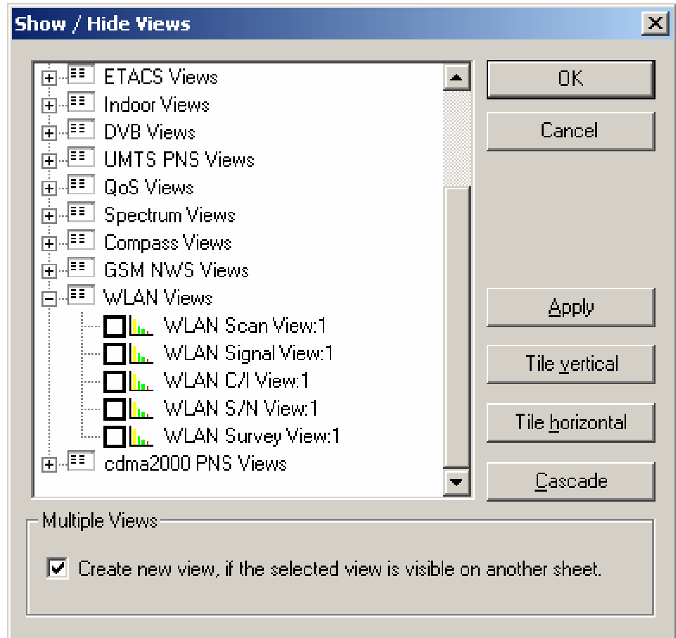
The lower part of the dialog shows a selection of views that are not specifically designed for a particular technology. In general, these generic, general purpose views can be used for arbitrary signals, irrespective of the selected measurement file.

➢ To display one or several signals in a generic view, select the signal(s) in the upper part of the dialog, drag and drop them to a generic view type icon.

Show/Hide Views...

Show (open) and arrange or hide the individual ROMES view windows.

The *Show/Hide Views* command opens a dialog with the same name:



Note:

A view hidden by means of the Show/Hide Views window is temporarily removed from the main window and can be recalled any time. The ROMES workspace contains at least one view of every type. All views can be hidden but only multiple views of the same type (if available) can be destroyed, i.e. permanently removed.

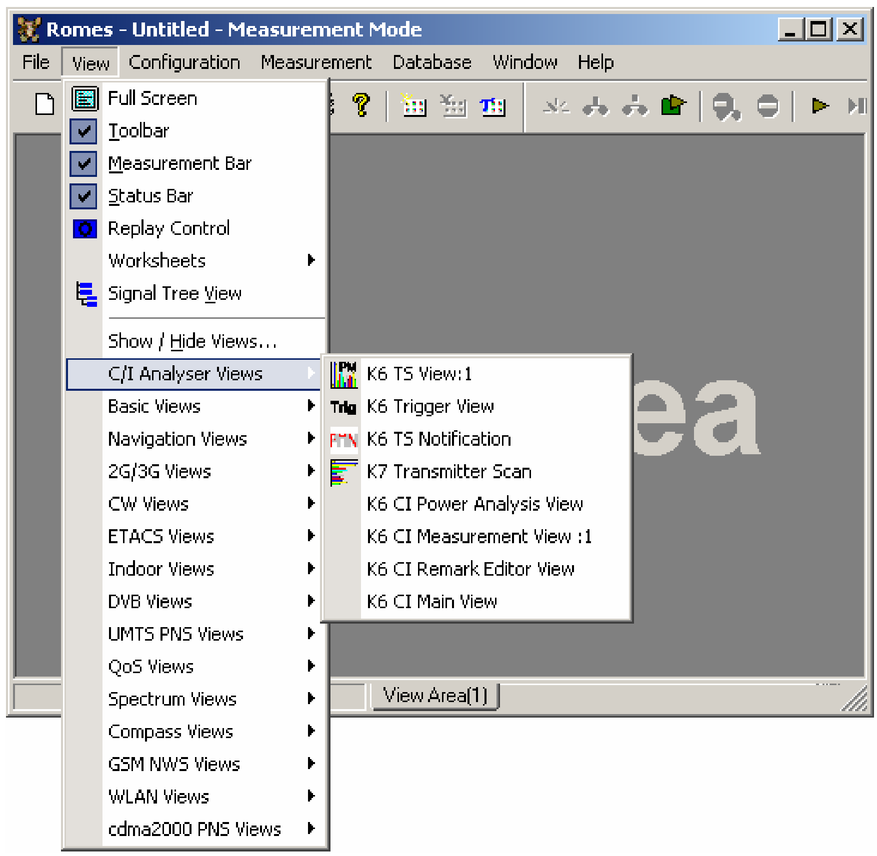
Tree view	List of all view windows provided. A view is shown/opened if it is selected in the corresponding checkbox.
Apply	Apply (preview) the current settings without closing the *Show/Hide Views* dialog.
Tile	The selected views are tiled, i.e. placed side by side so they do not overlap (see also *Window Menu* on page 3.105 ff.)
Cascade	The selected views are superimposed such that all title bars are visible
OK	Apply the current settings and close the *Show/Hide Views* dialog.

Cancel Discard the current settings and close the *Show/Hide Views* dialog.

Multiple Views If *"Create new view…"* is selected, then ROMES always creates new views on the current sheet and does not affect the views on the other sheets. Otherwise views from other sheets will be moved to the current sheet.

C/I Analyser Views

Offers a selection of control windows for the GSM/GPRS Carrier-to-Interference (C/I) measurement.



K6 TS View: 1 Bar graph showing the channels where Transmitter Scan values are recorded. The entries include the signal levels and the BCC.

K6 Trigger View Display of the configuration and status of the trigger used to start and stop interference measurements.

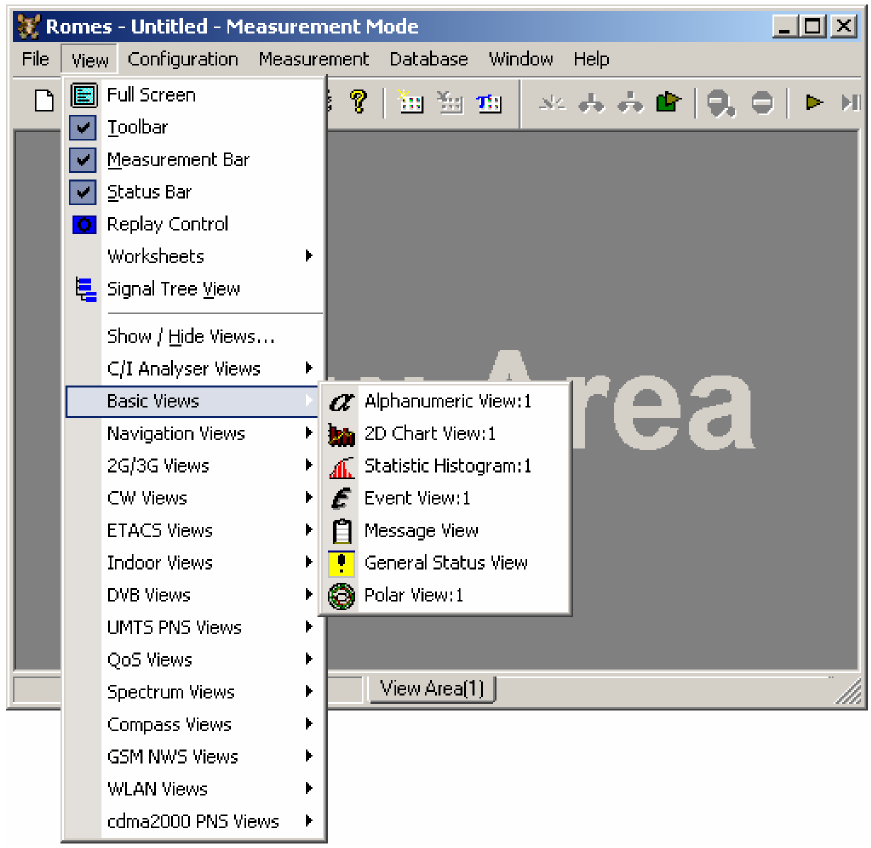
K6 TS Notification Graphical tool to determine the kind of interference at a particular point and locate the interferers.

K7 Transmitter Scan	Displays the data measured by the test receiver during the Transmitter Scan .
K6 CI Power Analysis View	Bar graph showing the distribution of the measured power from the serving cell and up to 4 interferers and the Carrier-to-Interference ratio.
K6 CI Measurement View: 1	List of system messages recorded during the measurement.
K6 CI Remark Editor View	Overview of the characteristics of a BTS sector plus entry of user comments.
K6 CI Main View	Overview of the measured interferences and central view giving access to the evaluation tools for a particular interference situation.

The GSM/GPRS Carrier-to-Interference analysis can be performed with option ROMES-GS. Chapter 5, section *Carrier-to-Interference Analysis* explains the views and the C/I analysis from a general point of view. Chapter 2 of the printed manual (*.pdf) contains a comprehensive application example.

Basic Views

Offers a selection of views to show information from any technology.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information about the basic views refer to chapter 4, section *Basic Views.*

Alphanumeric View:1 List offering information about the selected parameters. Several *Alphanumeric Views* corresponding to different connected mobile stations can be opened simultaneously.

2D Chart View: 1 2D-chart showing the current measurement data as a function of time. In practice, an unlimited number of 2D-charts can be defined simultaneously.

Statistic Histogram: 1 Collection of several diagrams to show a statistical evaluation of a signal.

Event View: 1 List of all events that occurred during the measurement

Message View Detailed, chronological list of the system messages generated during the measurement

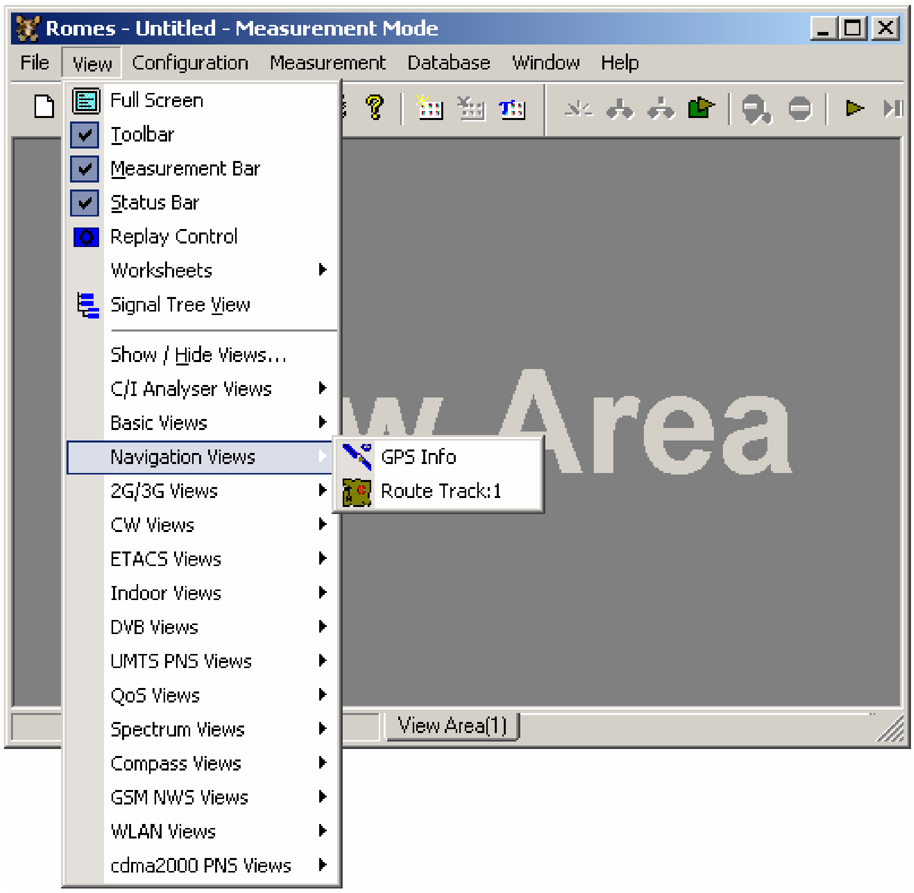
General Status View List of device messages of general interest

Polar View: 1 Display of a signal as a function of the geographic orientation of the receiving directional antenna using a circular diagram.

Navigation Views

Offers a selection of views to display data in a map.

The Geographic PositioningSystem (GPS) is used to visualize data with valid geographical information (longitude/latitude parameters) in a map or to retrieve geographic information assigned to the data points.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information about the GPS views refer to chapter 4, Section *Navigation Views.*

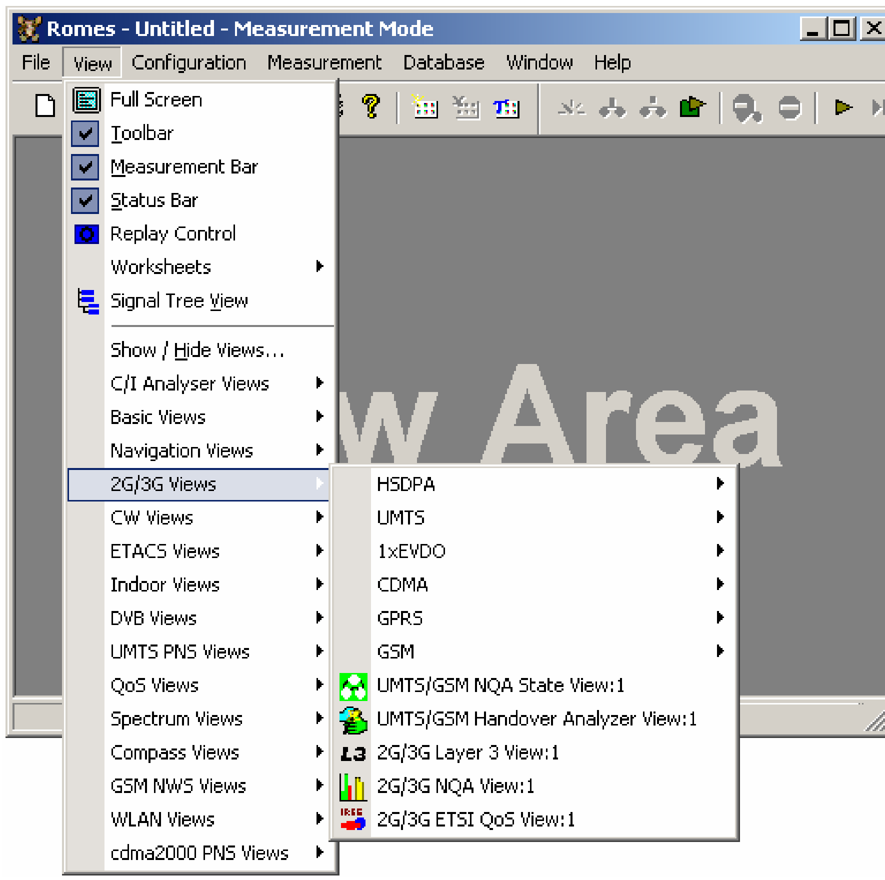
GPS Info List of the geographical coordinates and other information about a particular test point.

Route Track:1 Map view showing measured data and various other information, in particular the results of a Carrier-to-Interference analysis (with option ROMES-GS)

2G/3G Views

Offers a selection of views to show GSM and UMTS data.

The *2G/3G Views* are divided into seven groups. The first group of views is for HSDPA data (see p. 3.32), the second for UMTS data (see p. 3.34), the third for 1xEV-DO data (see p. 3.36), the fourth for CDMA data (see p. 3.37),, the fifth for GPRS data (see p. 3.39), and the sixth for GSM data (see p. 3.40). The views in the seventh group are labeled *UMTS/GSM* or *2G/3G* to indicate that they can be used for both technologies:



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously.

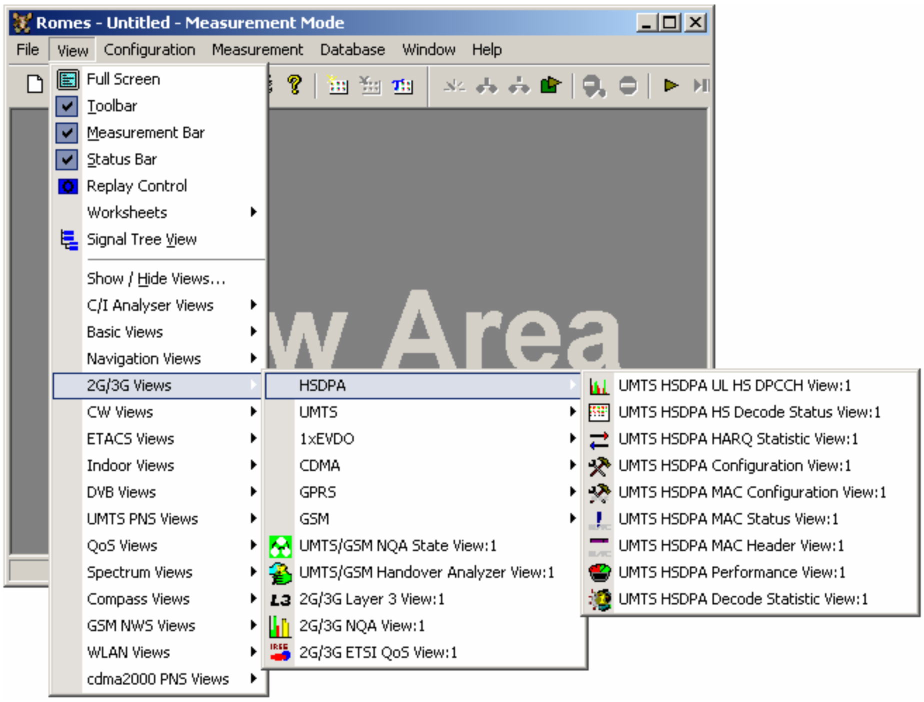
UMTS/GSM NQA State View: 1	Detailed analysis of the NQA states and state transitions of each call
UMTS/GSM Handover Analyzer View: 1	Complete list of the handover procedures attempted by UMTS or GSM mobile phones and statistical evaluation
2G/3G Layer 3 View: 1	GSM Layer 3 messages, GPRS RLC/MAC control messages and UMTS RRC messages recorded
2G/3G NQA View: 1	Call statistics (percentage of Good, Blocked, Dropped and No Service calls) of each GSM or UMTS mobile

2G/3G ETSI QoS View: 1	NQA classification for each UMTS or GSM call and Quality of Service parameters defined in the IREG specifications

HSDPA

Offers a selection of views for UMTS HSDPA data.

HSDPA views may be opened any time, however, they are empty unless HSDPA data are available.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information about the UMTS HSDPA views refer to chapter 4, Section UMTS HSDPA view.

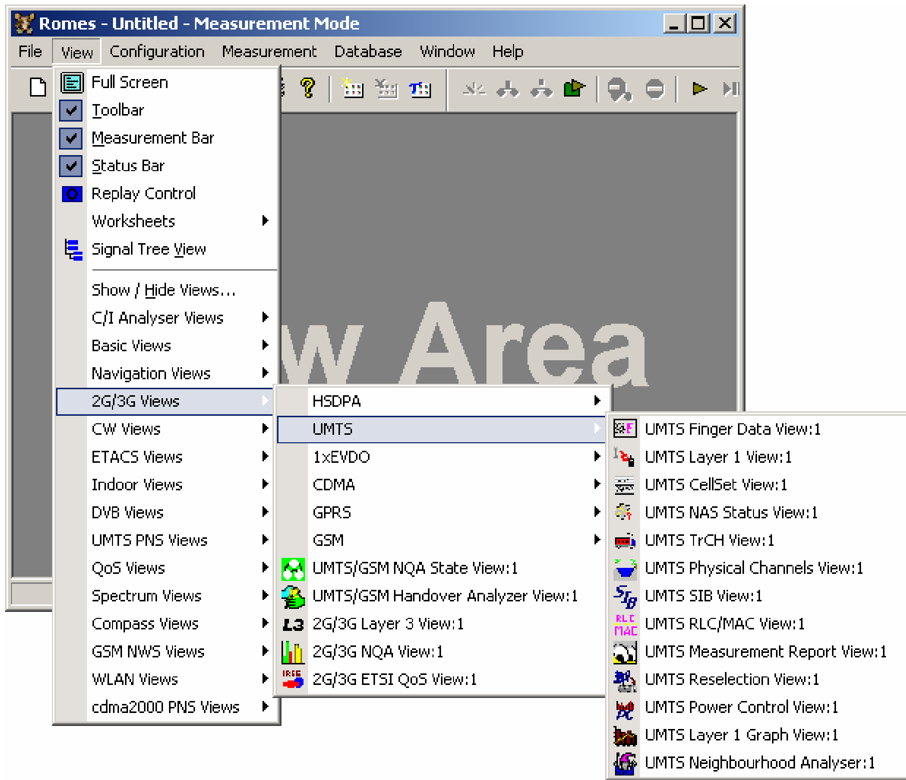
UMTS HSDPA UL HS DPCCH View: 1	CQI values reported by the test mobile in the last 100 HSDPA subframes.
UMTS HSDPA HS Decode Status View: 1	Status of the HS-SCCH demodulation and the decoded HS-SCCH information.
UMTS HSDPA HARQ Statistic View: 1	Characteristics of all HARQ processes of the test mobile.

UMTS HSDPA Configuration View: 1	Configuration of the DL HSDPA channels received by the test mobile, the UL HS-DPCCH, and information related to the finger configuration command, the DL HS-SCCHs, and the active HARQ processes.
UMTS HSDPA MAC Configuration View: 1	Configuration of the MAC-hs that the test mobile receives from the network.
UMTS HSDPA MAC Status View: 1	Overview of the status of the reordering entity in the mobile receiver.
UMTS HSDPA MAC Header View: 1	Mobile-specific subframe number and the corresponding (HS-DSCH) MAC-hs headers as defined in standard 2GPP TS 25.321.
UMTS HSDPA Performance View: 1	Transmission performance parameters, given in terms of the requested or achieved data throughput.
UMTS HSDPA Decode Statistic View: 1	Statistical evaluation of the received DL HS-DSCH transport blocks, together with the block error rate and the number of retransmissions needed to successfully decode the blocks of each size.

UMTS

Offers a selection of views for UMTS data.

UMTS views may be opened any time, however, they are empty unless UMTS data are available.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information about the UMTS views refer to chapter 4, Section UMTS views.

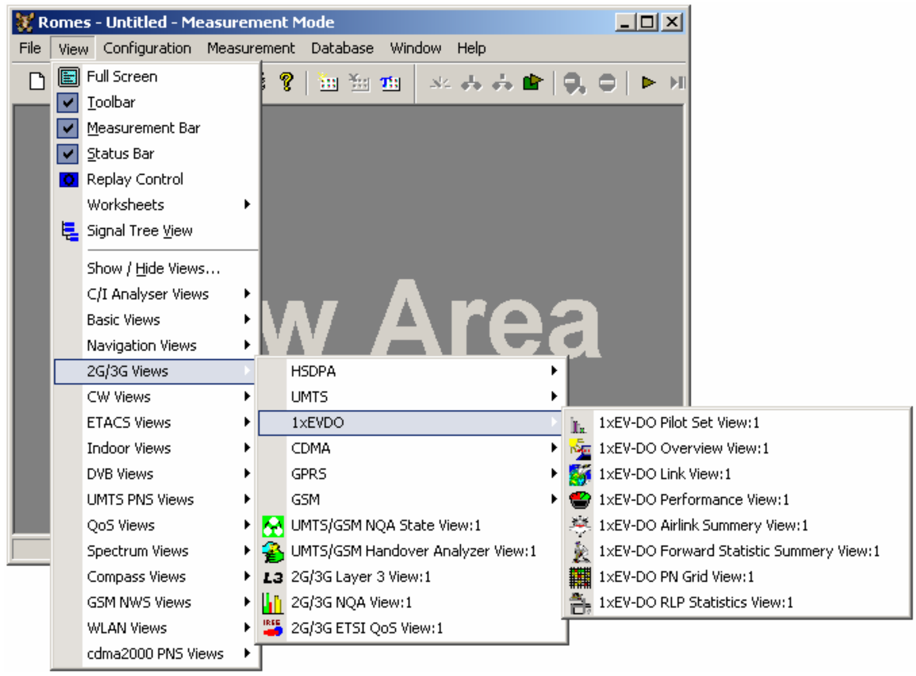
UMTS Finger Data View: 1	Layer 1 parameters characterizing the different downlink WCDMA signals received by the mobile, captured with the different branches (fingers) of the test mobile UMTS RAKE receiver.
UMTS Layer 1 View: 1	Layer 1 (physical layer) parameters that are constantly measured and transferred to the base station while the UMTS mobile operates in the network.
UMTS CellSet View: 1	Layer 1 parameters of the serving cell and the neighbor cells.
UMTS NAS Status View: 1	Higher-layer (Non-Access Stratum, NAS) parameters of the serving cell and the connection.
UMTS TrCH View: 1	Channel coding parameters in the downlink and uplink Transport Channels (TrCHs).

UMTS Physical Channels View: 1	Physical channel parameters in the downlink and uplink WCDMA signals.
UMTS SIB View: 1	Tree view of the exchanged System Information Blocks.
UMTS RLC/MAC View: 1	Display of important Radio Link Control/Medium Access Control parameters of UMTS mobile phones.
UMTS Measurement Report View: 1	Intra-frequency measurement results that the test mobile sends to the network in a Measurement Report RRC message.
UMTS Reselection View: 1	Display of parameters that are used for cell reselection of UMTS mobile phones.
UMTS Power Control View: 1	Transmitter output power and closed loop power control parameters of a Nokia UMTS mobile.
UMTS Layer 1 Graph View: 1	Display of UMTS or GSM layer 1 parameters in a 2D chart.
UMTS Neighborhood Analyzer View: 1	Results of the neighborhood analysis of option ROMES-U1.

1xEV-DO

Offers a selection of views for 1xEV-DO data.

1xEV-DO views may be opened any time, however, they are empty unless 1xEV-DO data are available.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information about the 1xEV-DO views refer to chapter 4, Section 1xEV/DO view.

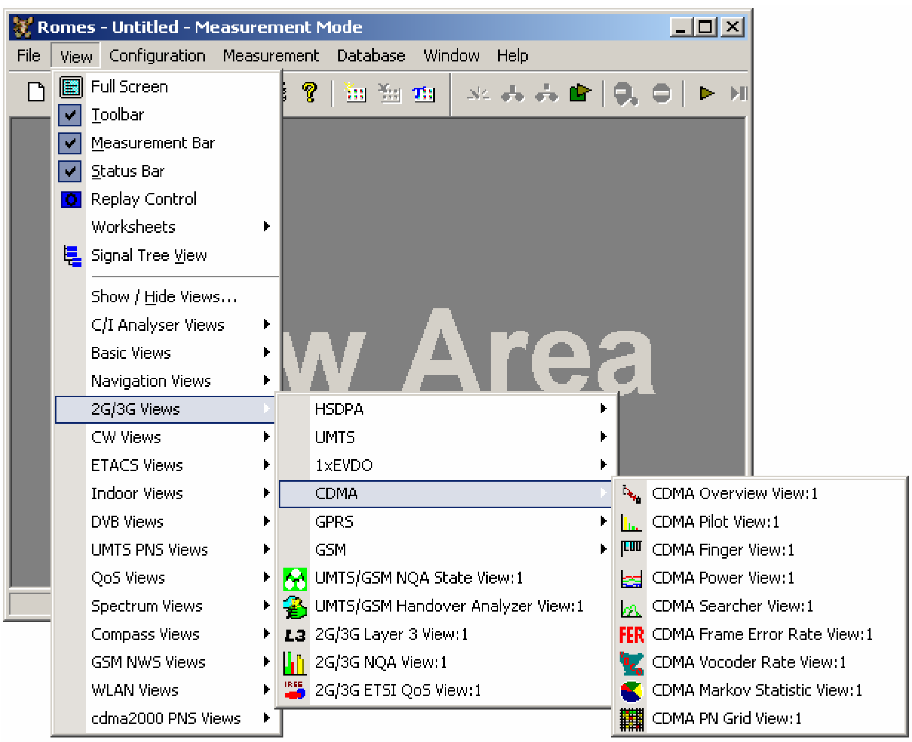
1xEV-DO Pilot Set View: 1	List and bar graph showing the pilot channel signal strength from the active and several neighbor base stations.
1xEV-DO Overview View: 1	A summary of the test mobile state, power/quality, sector, airlink quality results, and, if applicable, results from a connected 1xEV-DO PN scanner.
1xEV-DO Link View: 1	Information about access, connection and session attempts.
1xEV-DO Performance View: 1	Transmission performance parameters, given in terms of the requested or achieved data through-put.
1xEVDO Airlink Summary View: 1	The signals shown in these three preconfigured 2D charts are the pilot energy, the requested through-put, and the PER over the measurement time.

1xEV-DO Forward Statistic Summary. View: 1	Shows the CRC success rates on the measured forward traffic and forward control channel slots.
1xEV-DO PN Grid View: 1	Shows the forward channel PN offsets 0 to 511 as a matrix with 16 offsets in a row. Within this grid, the PN offsets in the currently active set, in the candidate set, and in the neighbor set are marked in different color shades
1xEV-DO RLP Statistics View: 1	Displays the parameters describing the reverse link performance during the measurement.

CDMA

Offers a selection of views for CDMAone (IS-95) measurements.

CDMA views may be opened any time, however, they are empty unless a CDMA measurement is performed.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section *CDMA Views*.

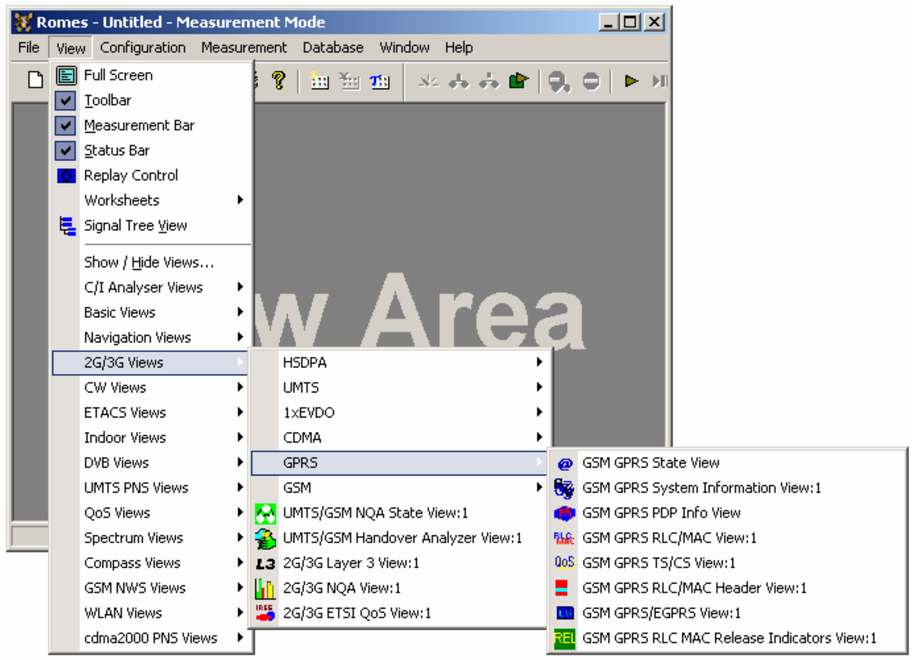
CDMA Overview-View: 1	Displays a summary of the test mobile state, power/quality, active set and system parameters, and, if applicable, results from a connected CDMA PN scanner
CDMA Pilot View: 1	List and bar graph showing the pilot channel signal strength from the active and several neighbor base stations.

CDMA Finger View: 1	Relative strength of the different multipath signals of the pilot signal detected by the RAKE receiver of the CDMA mobile.
CDMA Power View: 1	Relative TX and RX power at the CDMA mobile and related power levels as a function of time.
CDMA Searcher View: 1	Relative strength of the different multipath signals of the pilot as a function of their time offset.
CDMA Frame Error Rate View: 1	Percentage of erroneous CDMA frames detected and reported by the CDMA mobile station.
CDMA Vocoder Rate View: 1	Date rate generated and received by the voice coders of the CDMA mobile station vs. time.
CDMA Markov Statistic View: 1	Statistical evaluation of the call provided by the mobile.
CDMA PN Grid View: 1	Forward channel PN offsets 0 to 511 as a matrix with 16 offsets in a row. Within this grid, the PN offsets in the currently active set, in the candidate set, and in the neighbor set are marked in different colors.

GPRS

Offers a selection of views for GPRS data.

GPRS views may be opened any time, however, they are empty unless GPRS data are available.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section GPRS views.

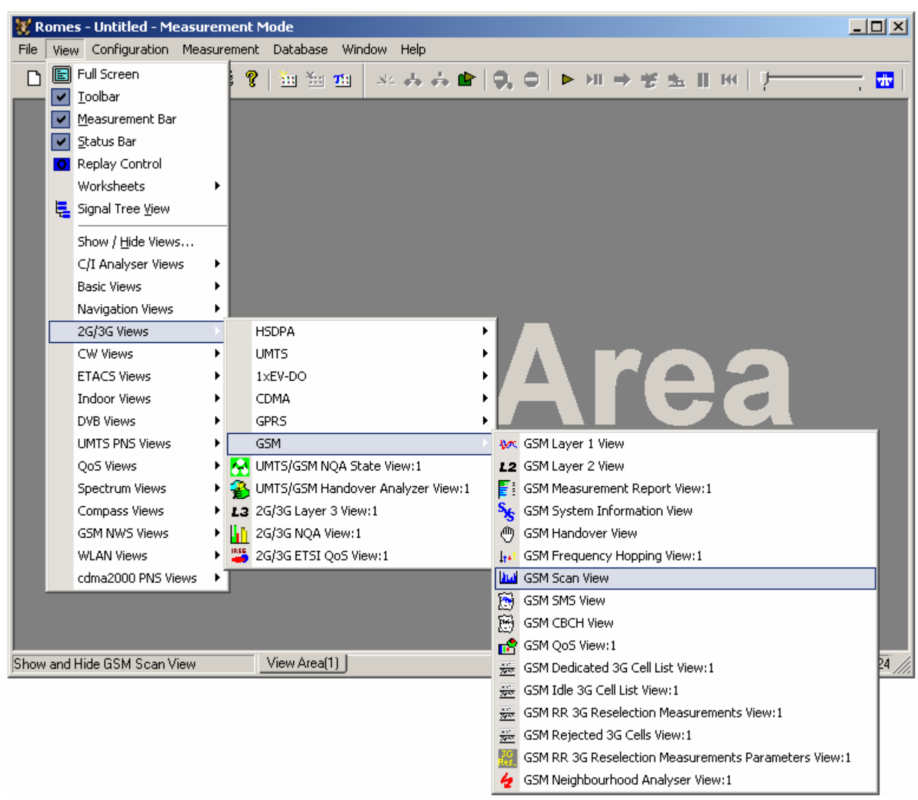
GSM GPRS State View	List of parameters characterizing the operating state of mobile phones supporting GPRS.
GSM GPRS S. Info. View.:1	List of GPRS-related parameters contained in the layer 3 messages *System Information Type 1* to *System Information Type 13*.
GSM GPRS PDP Info V.	List of important Packet Data Protocol (PDP) parameters of mobile phones supporting GPRS.
GSM GPRS RLC/MAC V.:1	Overview of important Radio Link Protocol/Medium Access Control parameters of mobile phones supporting GPRS.
GSM GPRS TS/CS View:1	Statistical evaluation of the number of timeslots *(TS)* that are active in the connection and the Coding Scheme *(CS)* that is used for the transmission of radio blocks.

GSM GPRS RLC/MAC Header View:1	List of the exchanged RLC/MAC block header information.
GSM GPRS/EGPRS View:1	Control and physical parameters of a GPRS and EGPRS connection.
GSM GPRS RLC MAC Release Indicators View:1	Control and physical parameters of the connection release information, such as the cause of the release, statistical parameters and the release indicator description, if supplied.

GSM

Offers a selection of views for GSM data.

GSM views may be opened any time, however, they are empty unless GSM data are available.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section *GSM Views*.

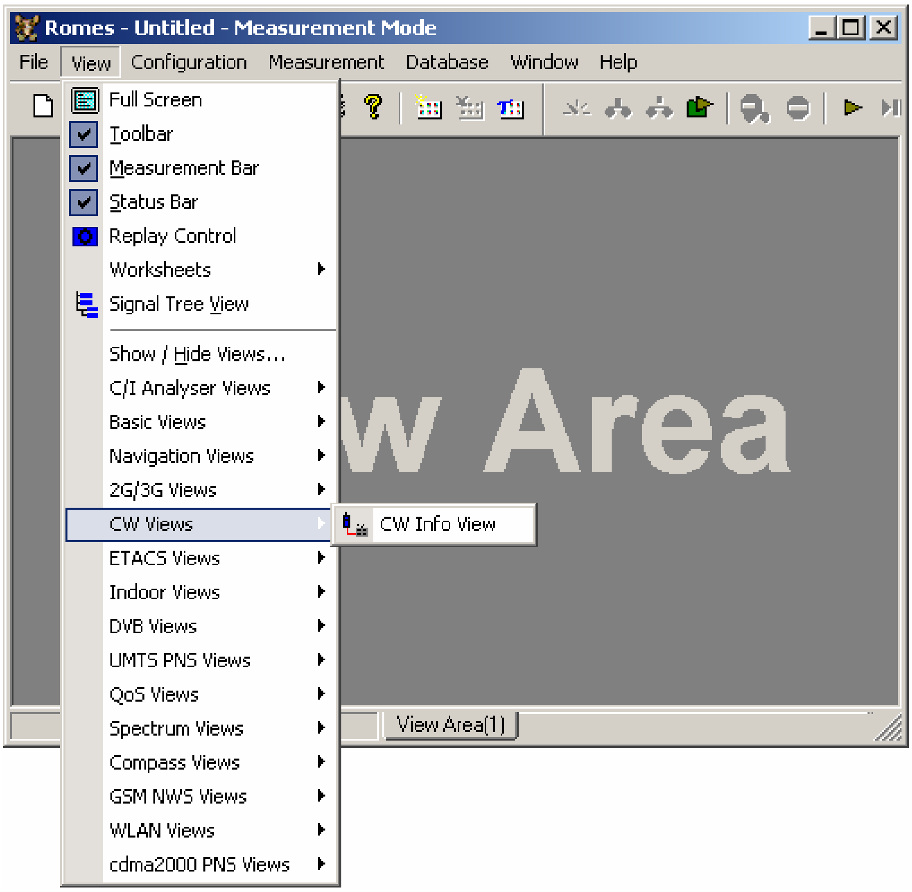
GSM Layer 1 View	List of layer 1 (physical layer) parameters measured by the GSM mobile station and transferred to the BTS.
GSM Layer 2 View	List of all layer 2 messages, scrolled during measurement or replay

GSM M. Rep. View: 1	Bar graphs and tabular overview of the MS measurement reports. Several *Measurement Report Views* corresponding to different connected mobile stations can be opened simultaneously.
System Information View	List of the GSM parameters in the Layer 3 messages *System Information Type 1 to 6* sent by the BTS.
GSM Handover View	List of the handover events performed by GSM mobile phones.
GSM Freq. Hopp. View: 1	List of the frequency hopping parameters of GSM mobile phones.
GSM Scan View	2D-chart displaying the signal strength of GSM channels.
GSM SMS View	List of the short messages sent or received during the measurement.
GSM CBCH View	List of all cell broadcast messages, scrolled during measurement or replay.
GSM QoS View: 1	Statistical evaluation of important layer 3 (*Location Update, GSM Handover),* mobility management *(GPRS Attach/Detach, Routing Area Update)* and packet routing *(Activate/Deactivate PDP Context)* procedures performed by mobile phones supporting GPRS
GSM Dedicated 3G Cell List View: 1	Overview of the measured dedicated 3G cell parameters.
GSM Idle 3G Cell List View: 1	Overview of the measured idle 3G cell parameters.
GSM RR 3G Reselection Measurements View: 1	An overview of the Radio Resource 3G reselection measurement results.
GSM Rejected 3G Cells View: 1	Overview of the determined 3G cell parameters for rejected cells.
GSM RR 3G Reselection Meas. Param. View: 1	An overview of the Radio Resource 3G reselection measurement parameters.
GSM Neighbourhood Analyser View:1	This view shows the results of the neighborhood analysis of option ROMES-U1. The aim of this analysis is to reveal possible conflicts between the current

best server and the transmitters in the neighborhood in order to assess the general condition of a UMTS / GSM network. To this end the neighborhood analyzer post-processes PN scanner, UMTS test mobile, and/or GSM scanner data and compares them with the information stored in a Node B and BTS data base (see description of ATD files in chapter 7, in particular the neighbor cell columns 2GNC and 3GNC). In case of a mismatch between the detected Node Bs and the Node Bs in the data base, an alarm is generated. The same holds if a missing neighbor of the best server or a potential interferer is found.

CW Views

Offers a view to monitor a CW measurement using a test receiver.



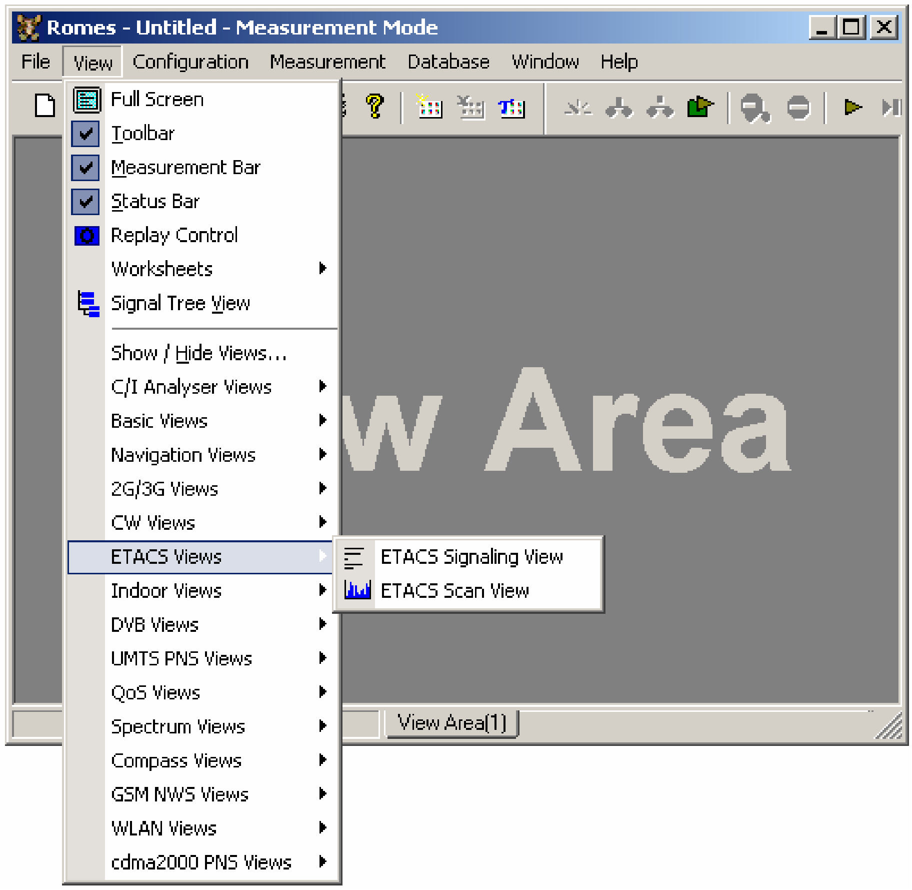
For detailed information about the *CW Info View* refer to chapter 4, section *CW Info View*.

CW Info View — Measurement frequency of an ESVx or SBR receiver that operates in *Manual Tracking* mode.

ETACS Views

Offers a selection of views for ETACS measurements.

ETACS views may be opened any time, however, they are empty unless an ETACS measurement is performed.



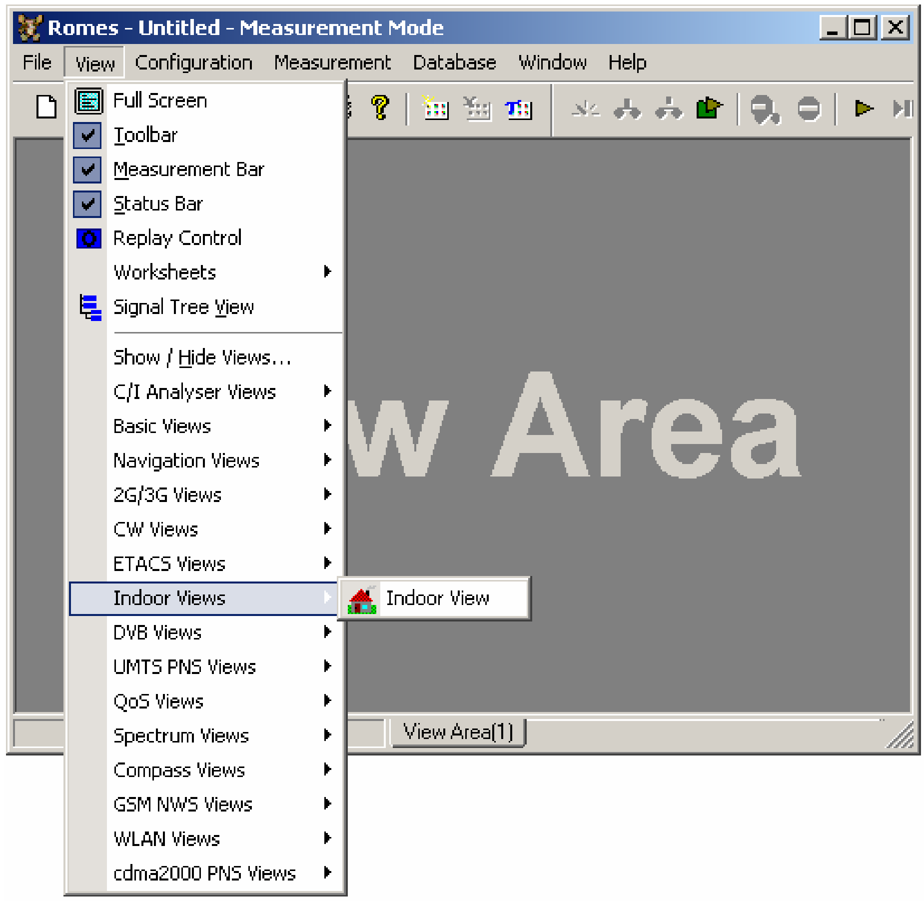
For detailed information about the *ETACS views* refer to chapter 4, section ETACS Views.

ETACS Signaling View	List of all signaling messages, scrolled during measurement or replay
ETACS Scan View	2D-chart displaying the signal strength of ETACS channels

Indoor Views

Offers a view to show data recorded with the Indoor navigation driver.

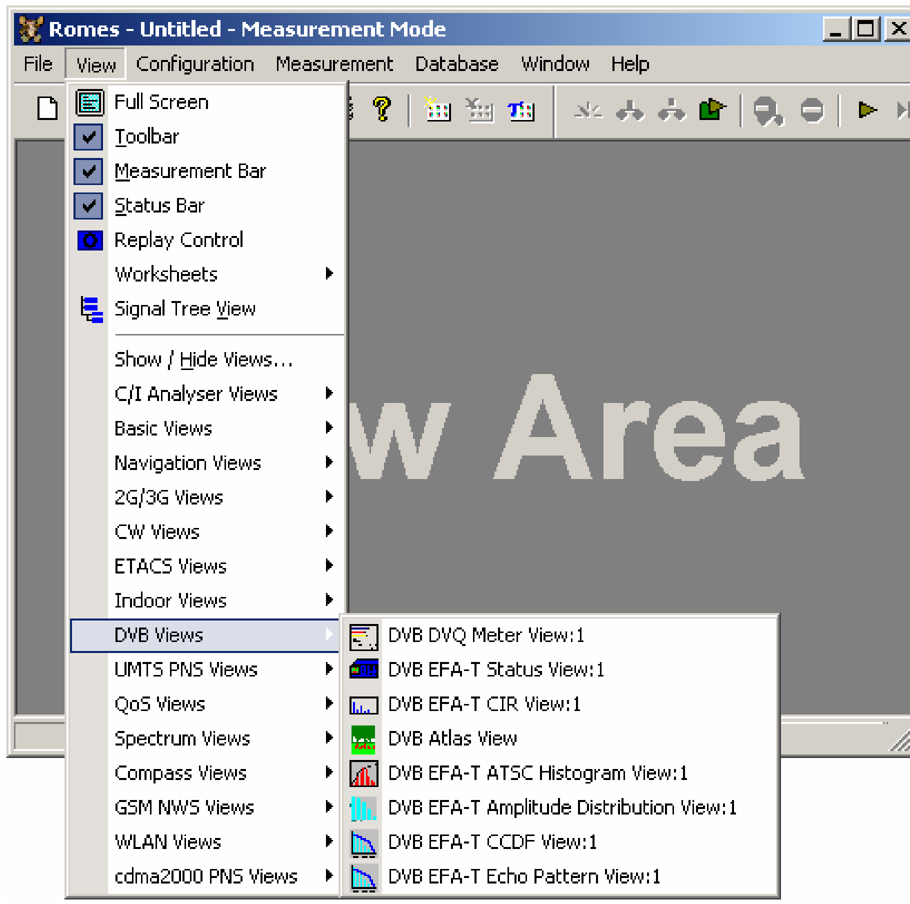
For detailed information refer to chapter 4, section *Indoor Views*.



DVB Views

Offers a selection of views for DVB (Digital Video Broadcasting) measurements.

DVB views are empty if no DVB measurement is performed, or if the measurement file replayed contains no DVB data.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section *DVB Views*.

DVB DVQ Meter View:1 — Diagram showing the Digital Video Quality Level (DVQL, weighted or unweighted) of the DVQ analyzer.

DVB EFA-T Status V.:1 — Overview of important status and transmission parameters of the EFA-T DVB receiver.

DVB EFA-T CIR View:1 — Diagram showing the Channel Impulse Response (CIR) of the EFA-T DVB receiver as a function of time or distance.

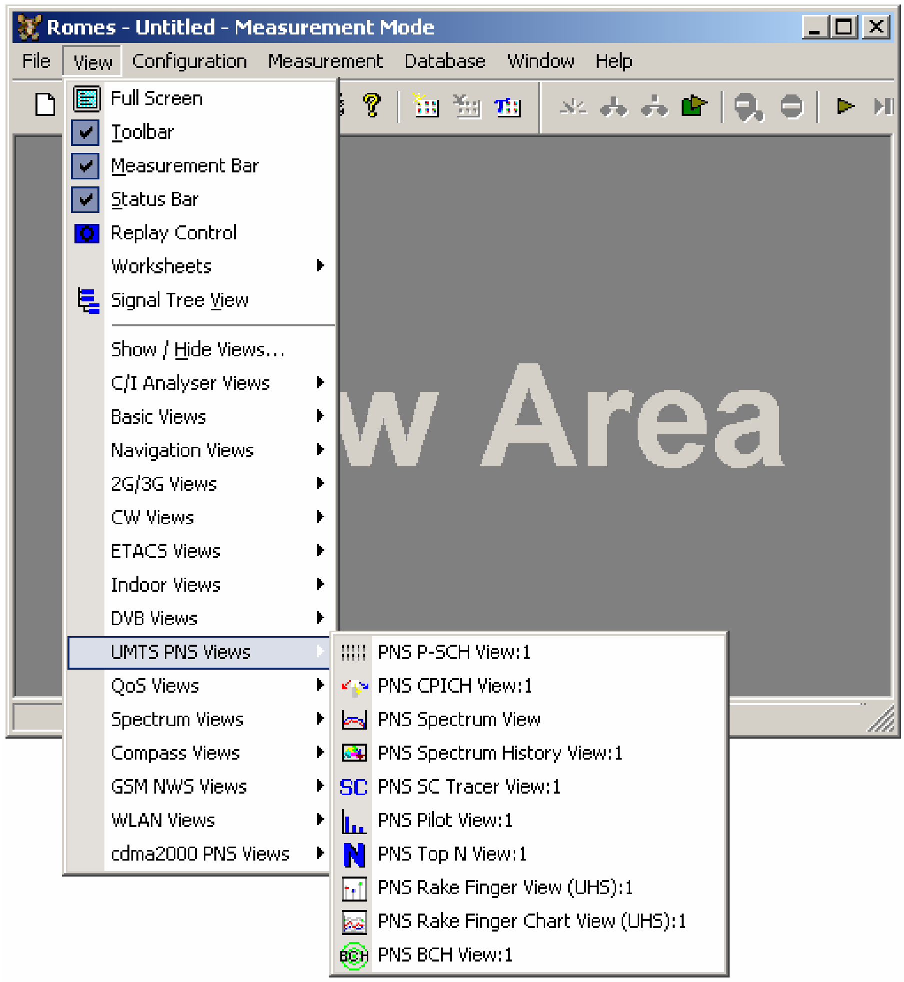
DVB Atlas View — Overview of the configuration and status of the Atlas MK II DVB receiver manufactured by BARCO and of the measurement results.

DVB EFA-T ATSC Histogram View:1	Distribution of the I and Q amplitudes at the decision points of a DVB signal that is 8-level Vestigial Sideband (8VSB) modulated according to the ATSC standard.
DVB EFA-T Amplitude Distribution View:1	Distribution of the (large) signal amplitudes of a DVB carrier signal.
DVB EFA-T CCDF View:1	Complementary Cumulative Distribution Function (CCDF) of a DVB carrier signal.
DVB EFA-T Echo Pattern View:1	Channel impulse response pattern (interfering echoes) of a DVB carrier signal.

UMTS PNS Views

Offers a selection of views to show UMTS Pseudo Noise Scanner data.

GSM views may be opened any time, however, they are empty unless GSM data are available.



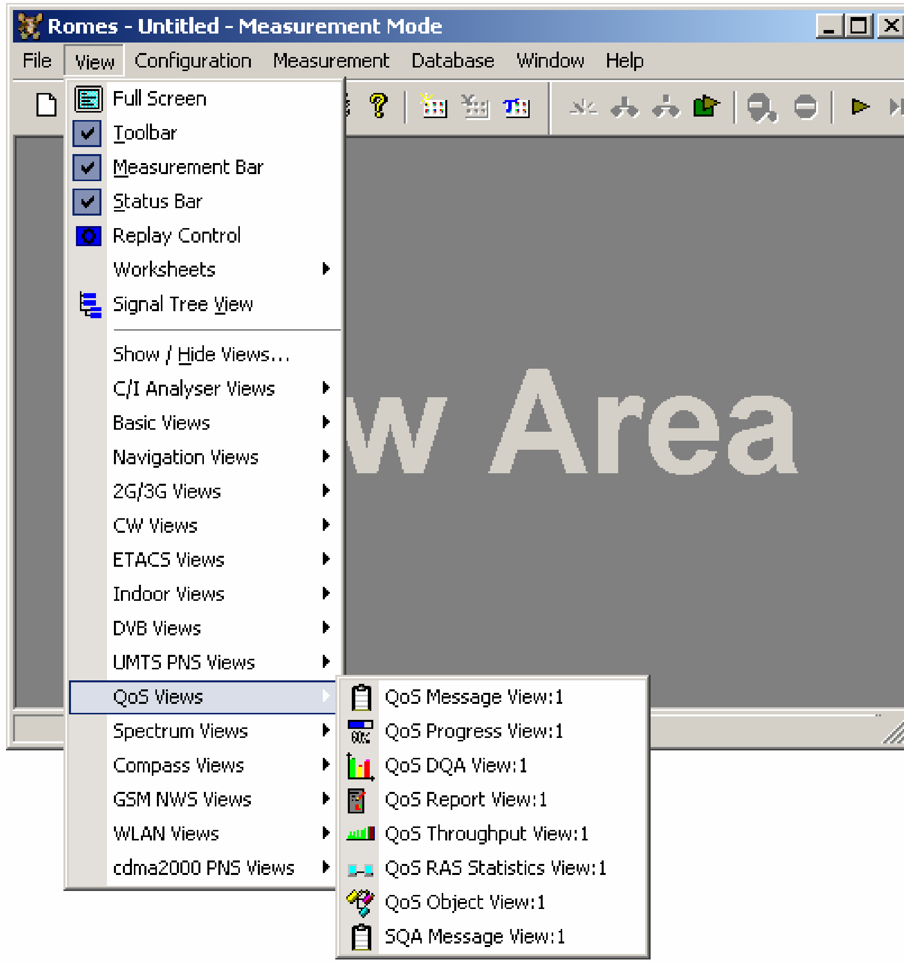
A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information views refer to chapter 4, section UMTS PSN.

PNS P-SCH View:1	Properties of the Primary Synchronization Channel in the DL UMTS signal.
PNS CPICH View:1	Average signal power of the received P-CPICHs and a comprehensive analysis of the properties of all DL signals received in the UMTS PN scan.
PNS Spectrum View	Measured UMTS signal strength in two different frequency ranges.

PNS Spectrum History V.:1	Evolution in time of the measured UMTS signal strength in a specified frequency range.
PNS SC Tracer View: 1	Evolution of the delay time of a single CPICH relative to the frame boundary. Several *PNS SC Tracer Views* with different configurations can be opened simultaneously.
PNS Pilot View: 1	Received Signal Code Power (RSCP) of the Common Pilot Channels (CPICHs) together with their scrambling codes. Several *PNS Pilot Views* with different configurations can be opened simultaneously.
PNS Top N View:1	Properties of the signals from the Node Bs that are elements of the *Top N Pools* defined in the driver configuration menu.
PNS Rake Finger View (UHS):1	Power and timing of multiple echoes of the Node B signal received with the rake receiver of a TSMU operating in ultra high speed mode.
PNS Rake Finger Chart View (UHS):1	Evolution in time of the power of multiple echoes of the Node B signal.
PNS BCH View:1	System Information Blocks (SIBs) and Master Information Blocks (MIBs) decoded from the UMTS BCH with their full contents.

QoS Views

Offers a selection of views to evaluate the Quality of Service of a data connection measured with the Data Quality Tester (DQA).



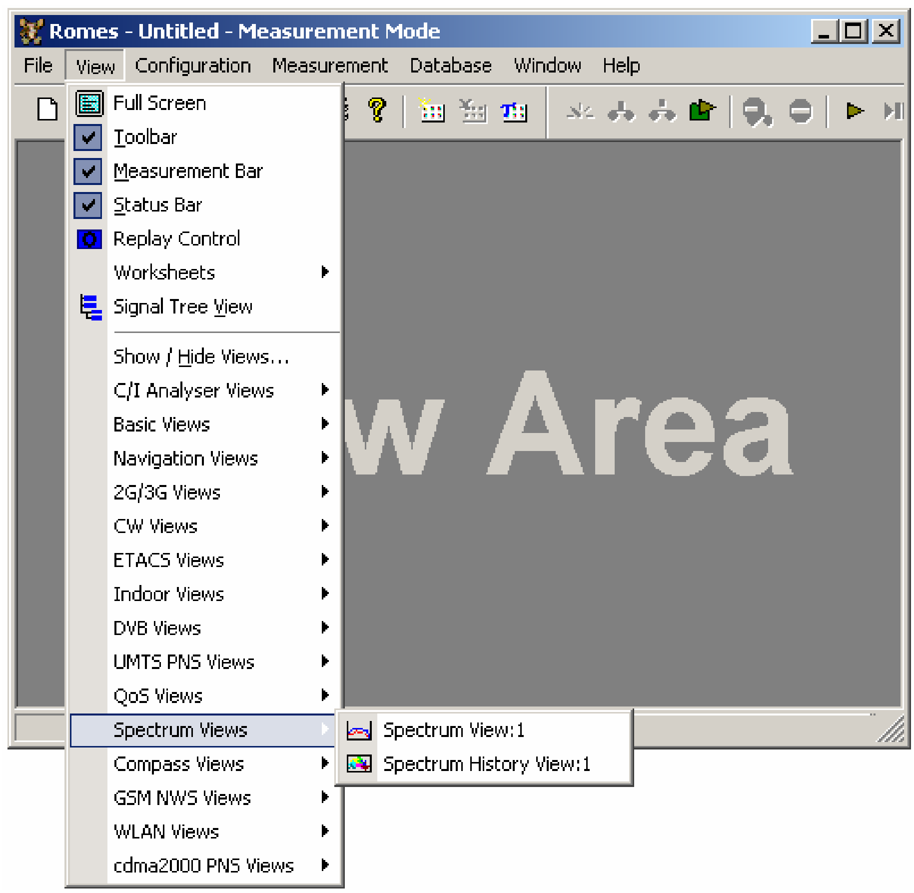
A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section QoS view.

QoS Message View:1	Chronological record of all actions of the current job.
QoS Progress View:1	Bar graph and display of parameters to monitor the progress and the status of the current DQA job.
QoS DQA View:1	Bar graph to monitor the percentage of *Good*, *Blocked* and *Dropped* data transfer jobs in the current session.
QoS Report View:1	Bar graph and display of parameters to monitor the jobs in the current session.
QoS Throughput View:1	Bar graphs to monitor the current and average data rate in upload and download direction.

QoS RAS Statistics View:1	Record of parameters describing the network traffic during the measurement.
QoS Object View:1	Tabular overview of the QoS actions performed with their duration and result.
SQA Message View:1	Result of the Speech Quality Analysis (SQA, with option ROMES-Z8, Voice Quality PESQ).

Spectrum Views

Offers two views to analyze the signal strength of an arbitrary RF signal in a specified frequency range.



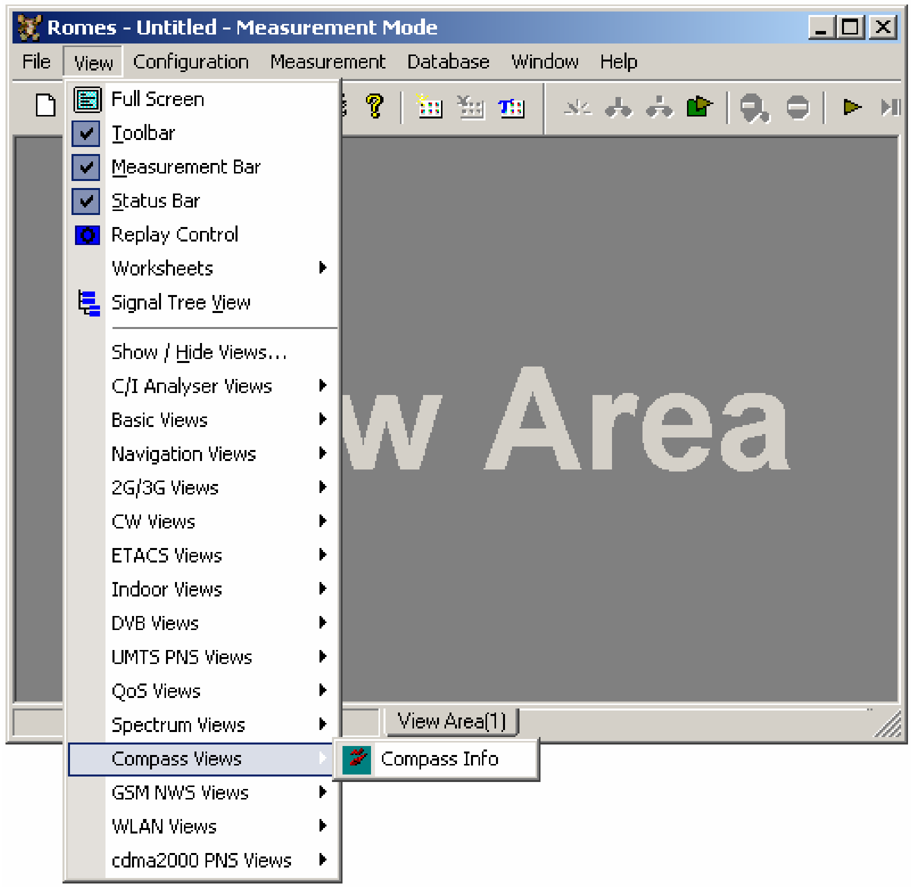
The spectrum can be measured with a R&S FSP spectrum analyzer or a R&S ESPI test receiver. A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section Spectrum views.

Spectrum View:1	Measured RF signal strength in a specified frequency range
Spectrum History View:1	Evolution in time of the measured RF signal strength in a specified frequency range

Compass Views

Offers a view to visualize data recorded with the *Compass* driver.

The data must be provided by the Compass VDO driver.



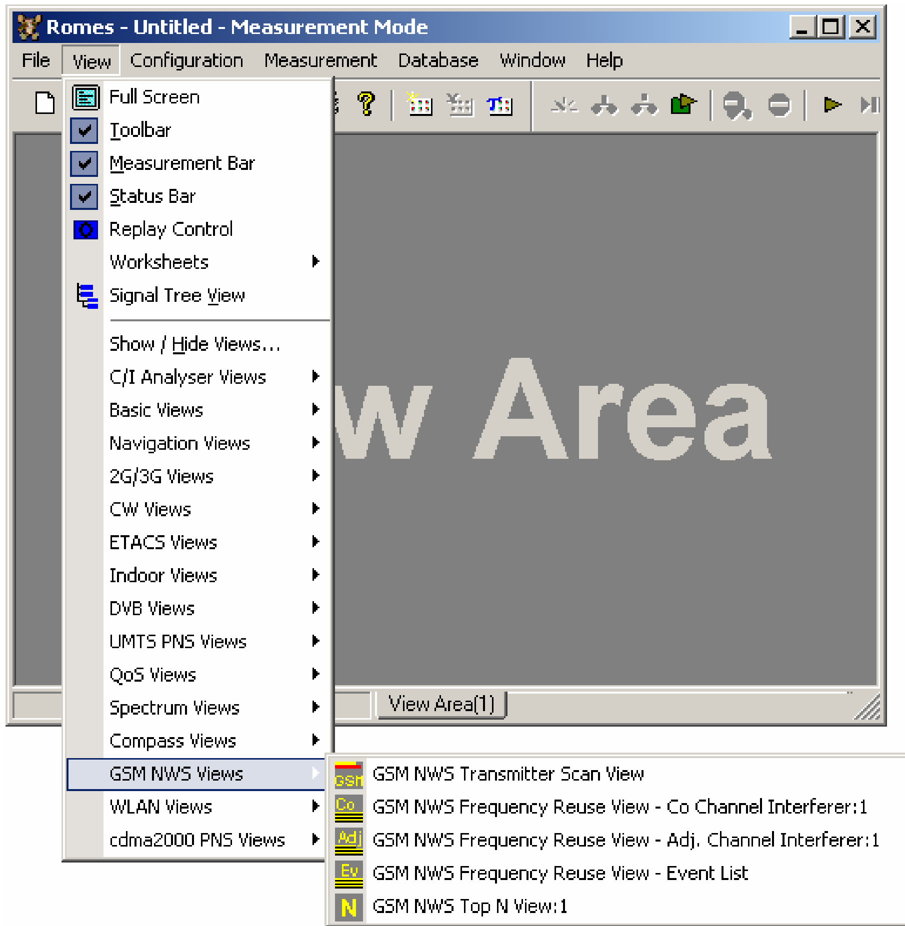
For detailed information refer to chapter 4, section Compass view.

Compass Info Direction *(True Heading)* of the test vehicle carrying the compass and the measurement equipment.

GSM NWS Views

Offers a view to visualize GSM network scan data.

GSM network scans require option ROMES-GS3, *UMTS Network Scanner.*



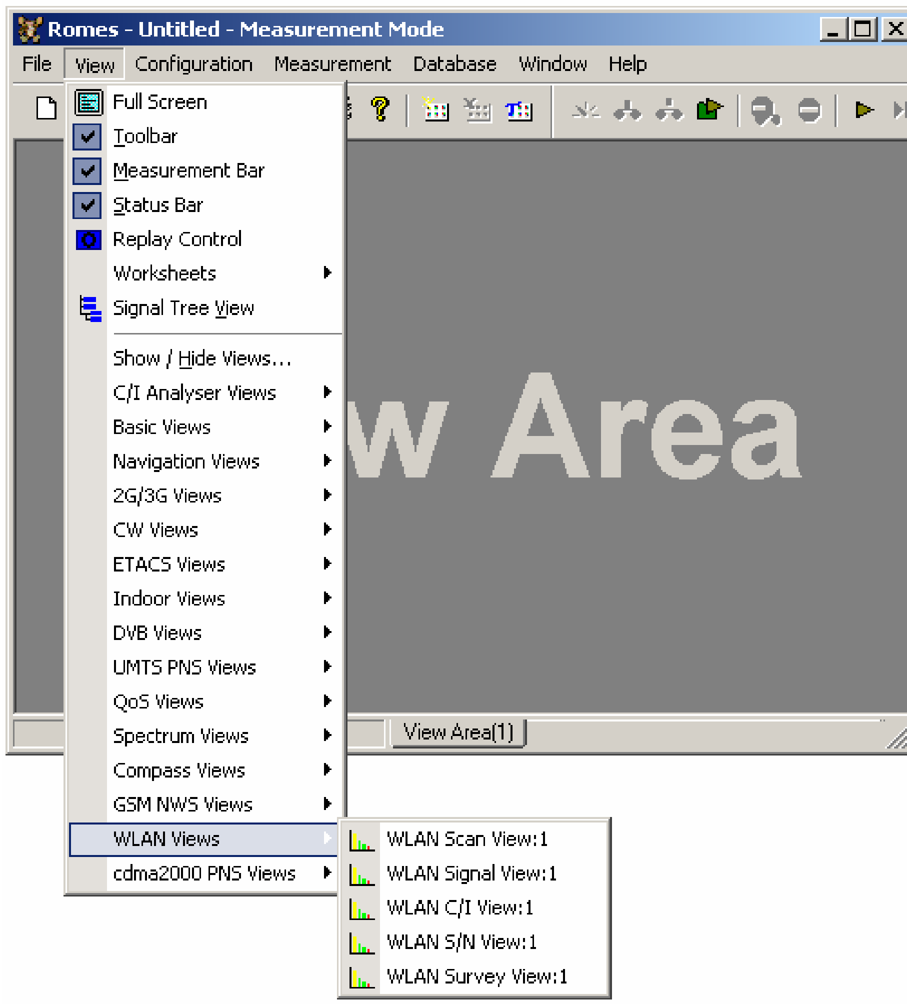
A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section *GSM NWS* view.

GSM NWS Transmitter Scan View	GSM data measured by the TSMU radio network analyzer during the GSM Network Scan and demodulated.
GSM NWS Frequency Reuse View – Co Channel Interferer:1	Information about the serving cell, the potential co-channel interferers, and the characteristics of the interference situations.
GSM NWS Frequency Reuse View – Adj. Channel Interferer:1	Information about the serving cell, the potential adjacent channel interferers, and the characteristics of the interference situations.
GSM NWS Frequency Reuse View – Event List	List of alarm messages generated according to the C/I and RxQual values measured by the test mobile.

GSM NWS Top N View:1	List of the properties of the signals from the base transceiver stations that are elements of the *Top N Pools.*

WLAN Views

Offers different views to analyze the WLAN information obtained in the network scans performed by a WLAN adapter in regular intervals.

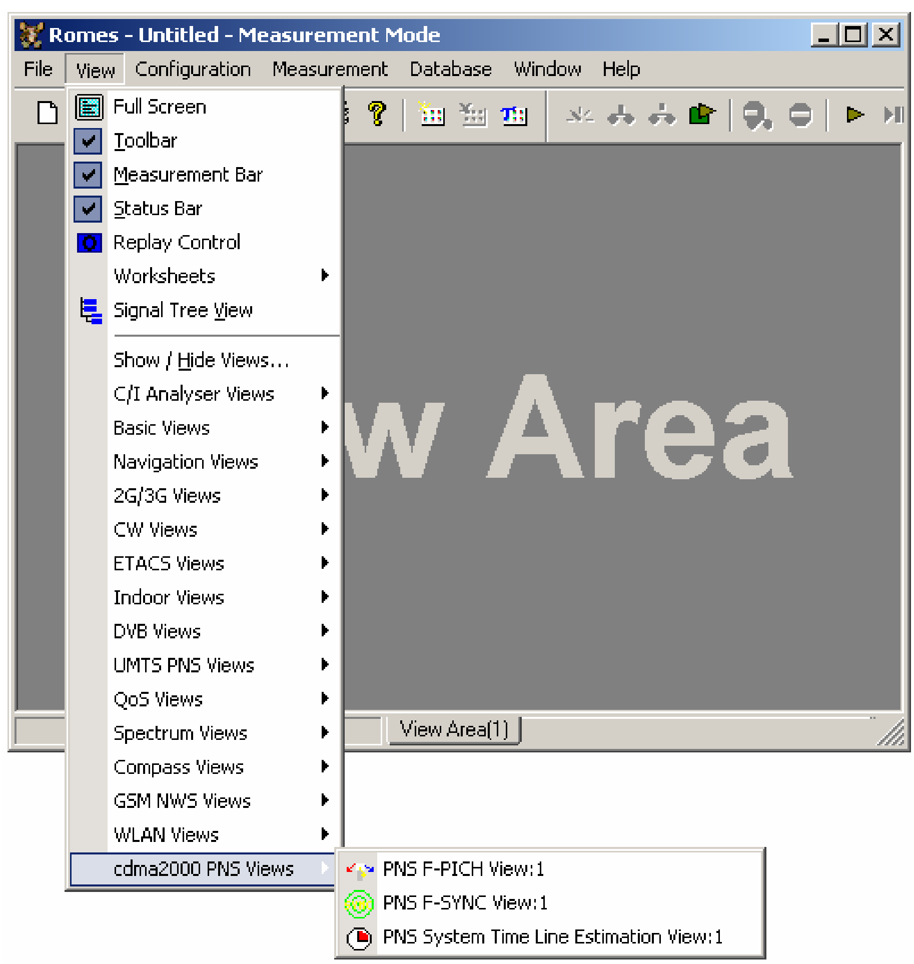


A *:1* is displayed behind the view type, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section WLAN views.

WLAN Scan View: 1	Basic information acquired in a WLAN network scan (WLAN BSSID list information).
WLAN Signal View:1	RSSI of all received signals in a 3-dimensional bar graph.
WLAN C/I View:1	Carrier to Interference ratio *(C/I)* in all channels.
WLAN S/N View:1	Signal to Noise ratio *(C/I)* in a single channel selected in the driver configuration menu.
WLAN Survey View:1	Statistical evaluation of the results in the other WLAN views.

CDMA2000 PNS Views

Offers a selection of views to show CDMA2000 Pseudo Noise Scanner data.



A *:1* is displayed behind each of the view types, indicating that several views of the same type with different configurations can be opened simultaneously. For detailed information refer to chapter 4, section CDMA2000 PNS views.

PNS F-PICH View:1	Average signal power of the received Forward Pilot Channels (F-PICHs) and analysis of the properties of all DL signals received in the CDMA2000 PN scan.

PNS F-SYNC View:1	Information that the TSMU decoded from the Forward Synchronization Channel (F-SYNC).
PNS System Time Line Estimation View:1	Shows the parameters used for the GPS-signal based CDMA system time line.

Configuration Menu

The *Configuration* menu installs the hardware drivers necessary for a measurement, configures the display and defines directories for the different types of files used by the measurement system.

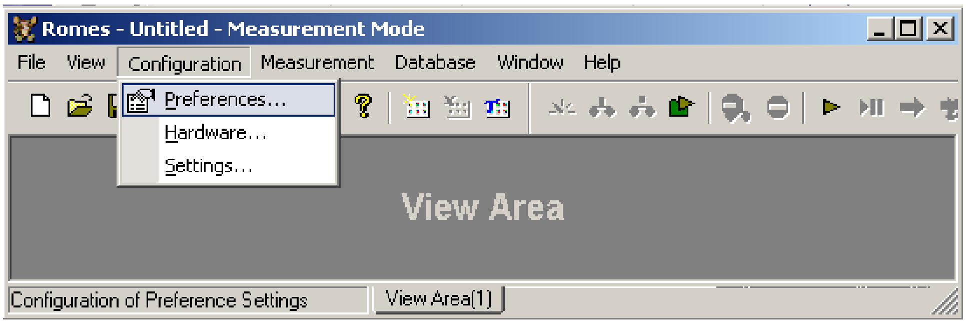


Fig. 3–5 Configuration menu

System Configuration (Preferences)

Configuration – Preferences opens the *ROMES Configuration* menu with the following settings:

- General system and measurement settings *(General* tab)
- Configuration of measured signals *(Available Signals)*
- Selection and definition of events *(Available Events)*
- Selection of technology-specific settings, in particular concerning the GSM BTS data base, UMTS Node B list, and the UMTS PNS and CW signals in the data tree *(Available Technology)*.
- Definition of shortcuts for common program tasks *(Shortcuts)*
- Maximum number of devices and registry entries *(Advanced Settings)*

The signal configuration and the event definitions can be stored to the current workspace. Some of the tabs in the *ROMES Configuration* menu are not available during a measurement or a replay.

General Settings

The *General* tab in the *ROMES Configuration* menu offers general measurement and system settings.

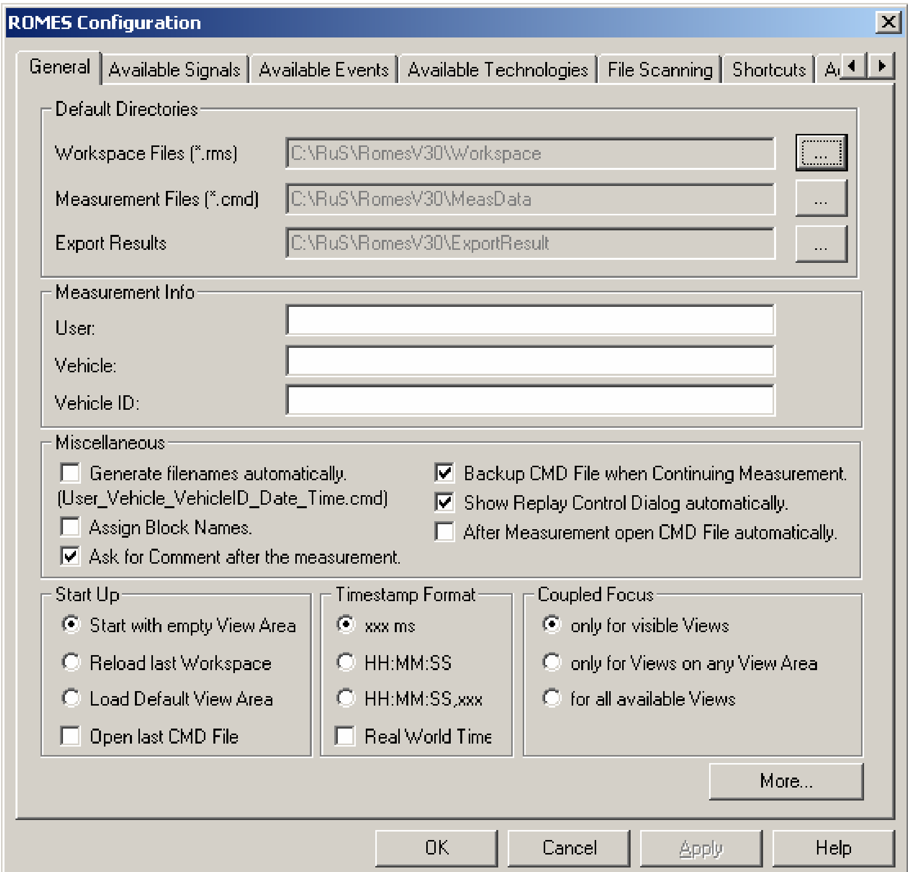


Fig. 3–6 ROMES Configuration – General

Default Directories The *Default Directories* panel indicates the current default directories for measurement (CMD), workspace (RMS), and exported data files (see chapter 7). The directories can be changed in a *Look for Directory* dialog which is opened on clicking the browse (...) buttons.

Measurement Info The *Measurement Info* panel contains three entry fields for the user name, the vehicle used for the measurement tour, and the vehicle ID. The entries are stored in the measurement file and displayed when a measurement file is opened (see *Open CMD File...* command in section *File Menu* on p. 3.5 ff.).

Miscellaneous The *Miscellaneous* panel contains several settings to control the recording of measurement files.

Generate filenames automatically

If the *Generate filenames automatically*... box for recording is checked, ROMES automatically assigns a file name (User_VehicleID_Date_Time.cmd) to any measurement file created on executing the *Start Measurement* or *Start Recording* commands. Otherwise, the two commands first open a dialog window to select the directory and define the name of the measurement file.

Assign Block Names

If the box is checked, a block name can be assigned every time that a new block in a measurement file is generated; see Replay Jump To Block on p. 3.104.

Ask for Comment after the Measurement

If the box is checked, a user-defined comment can be entered before the measurement file is closed on executing the Stop Measurement command.

Backup CMD File when continuing Measurement

If the box is checked, a backup version of the current measurement file is created each time a measurement is continued (Measurement – Continue Measurement; see p. 3.96). The backup file prevents data loss; it is deleted automatically when the measurement is stopped without errors (*Stop Measurement*).

Show Replay Control Dialog automatically

If the box is checked, the Replay Control dialog is opened each time that a measurement file is replayed. Alternatively, the dialog can be opened using *View – Replay Control* (see p. 3.22).

After Measurement open CMD file automatically…

If the box is checked, the CMD file from the last recorded measurement is opened automatically. Alternatively, the CMD file can be opened manually using the *Open CMD File...*dialog*l* (see p. 3.10)..

Start Up

Defines the workspace and measurement file to be loaded when ROMES is started.

Start with empty View Area

Open a single worksheet with no views.

Reload last Workspace

Open the workspace with all sheets and views that was open in the last session.

Load Default View Area

Load all default sheets defined via *View – Worksheets – Save Sheet as Default…* (see Worksheets p. 3.24). To load only part of the defined default sheets, press *More…* and use the *Default Sheets* selection in the extended general settings dialog (see below).

Open last CMD File

Open the CMD file recorded or opened in the last session; see *Open CMD File...* on p. 3.10.

Timestamp Format

The *Timestamp Format* panel defines the format of the *Timestamp* signal to be included in the measurement file. A timestamp of 36.123 s is displayed as follows:

xxx ms	36123
HH:MM:SS	00:00:36
HH:MM:SS, xxx	00:00:36,123

If *Real World Time* is activated, the current time is used as timestamp, e.g. 14:26:36.

Coupled Focus

Specifies which views are synchronized if the coupled focus (see p. 3.4) is active.

Only for visible Views

Synchronize the views in the current worksheet, leaving the views in other sheets unsynchronized.

Only for Views on any Sheet

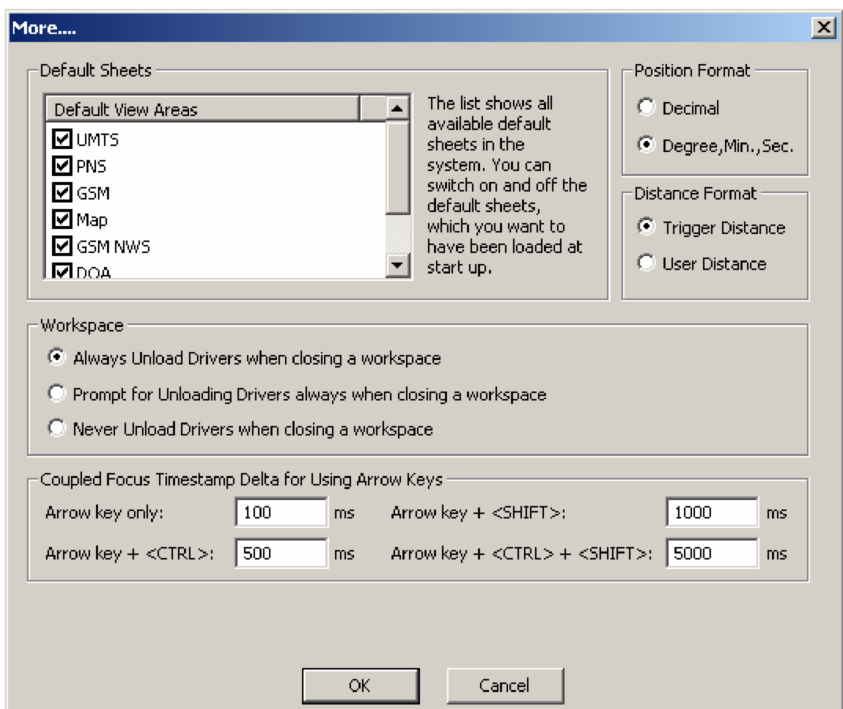
Synchronize all views within the same sheet, leaving the views in different sheets unsynchronized.

For all available Views

Synchronize all views, irrespective of the sheet.

More…

Opens an additional dialog with further general settings.



Default Sheets

Selects the default view area to be loaded on start up if *Load Default View Area* is selected in the *Start Up* panel of the *General* tab; see above.

Position Format

The *Position Format* panel defines whether the position coordinates used in the views are displayed in decimal or degree/minute/second format.

Distance Format

The *Distance Format* panel defines whether the trigger distance or a user-defined distance scale is used in the views, (e.g. in the *Event View*s see chapter 4). The *User Distance* is a generalized distance signal available with the *Trigger Box;* see chapter 6.

Workspace

The *Workspace* panel defines whether or not the loaded drivers and driver configurations are stored to be re-used when a workspace is closed.

The drivers and their configurations are part of the workspace. By default, they are unloaded when the workspace is closed and must be re-loaded into another workspace. With the alternative options, it is possible to keep the current drivers and driver configurations for the next workspace.

Coupled Focus Time-stamp Delta…

The entries in the *Coupled Focus…* panel specify the effect of the arrow keys on the coupled focus (see p. 3.4). The larger the values the faster the focus moves when the arrow keys are pressed. To gain flexibility it is advisable to assign different timestamp intervals to the different key combinations.

Signal Configuration

The *Available Signals* tab in the *ROMES Configuration* menu displays and configures the signals available for viewing.

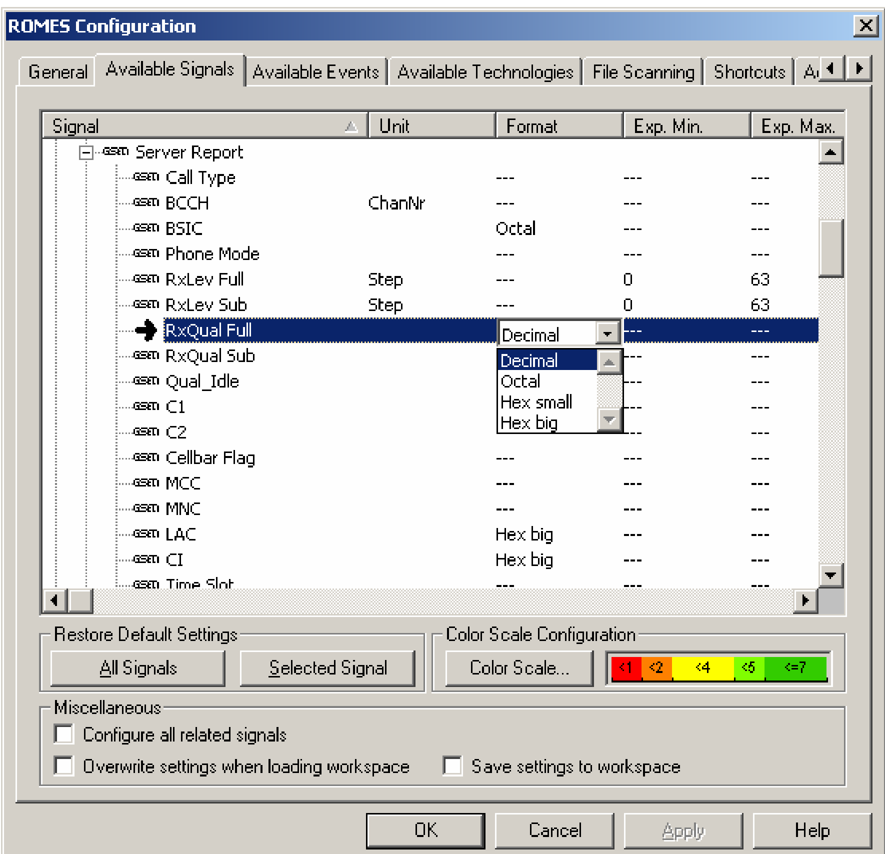


Fig. 3–7 ROMES Configuration – Available Signals

Data tree

The data tree shows all signals available for viewing. By double-clicking the entries in the corresponding columns, the unit, display format, and the range of values to be displayed in the views (expected minimum and maximum) can be modified.

TIP

Exp. Min and Exp. Max. defines the total y-axis scale of several views (e.g. the 2D Chart View). Manual scaling of the y-axis is particularly useful if the actual value range of a signal (or its range of interest) is considerably smaller than its "natural" scale (e.g. if only *small GSM signal levels are measured so that the entire RxLev scale between 0 and 63 is not needed).*

Restore Default Settings

The two buttons in the *Restore Default Settings* panel reset the unit, format, and the expected minimum and maximum to default.

All Signals

Default settings for all signals

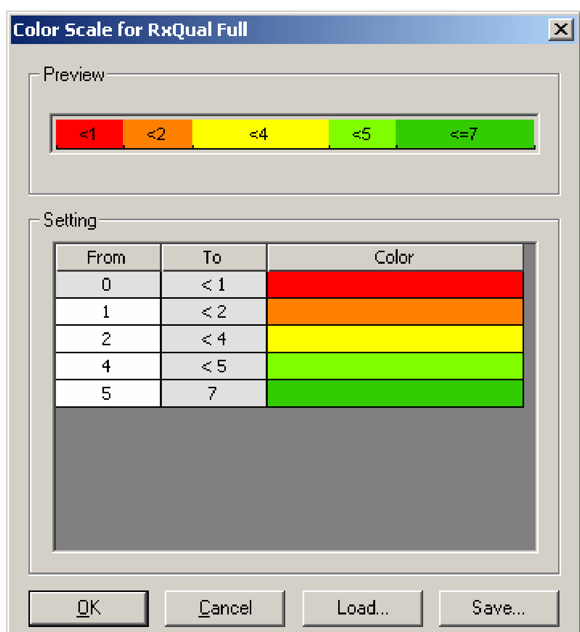
Selected Signal

Default settings for selected signal only

Color Scale Configuration

The *Color Scale* button determines in which way the current signal parameter is visualized in an *Indoor* or *Route Tracking* view. If no meaningful scale can be assigned to the selected signal, the button is disabled (grayed), and *Not Available* is indicated instead of a color scale.

The *Color Scale* button opens the *Color Scale for...* menu assigning display colors to five subranges of the selected parameter range:



Preview

Preview of the current color configuration

Setting

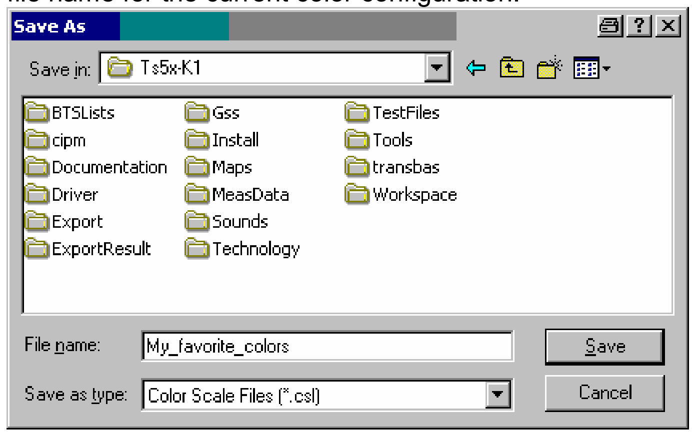
Tabular overview of the five subranges and associated colors. The lower limits (From) can be changed (double-click the white table fields and overwrite the entry) but must remain in ascending order. The colors can be changed in the Colors menu opened on double-clicking a color field. Refer to the context-sensitive help for information on the Colors menu.

Load

Opens a file Open dialog to load a color configuration from a color scale file defined previously. Color scale files are ASCII text files with the extension *.csl.

Save

Opens a file Save as... dialog to select a directory and define a file name for the current color configuration.



Color scale files are ASCII text files with the extension *.csl. They contain the defined colors and the corresponding ranges, e.g.:

```
[Col]
NumberOfEntries=3
RangeMin=0.000000
RangeMax=33.000000
Type=0
Color_0=255
Value_0=0.000000
Color_1=33023
Value_1=12.000000
Color_2=65535
Value_2=25.000000
```

Miscellaneous

The *Miscellaneous* settings can be activated in order to configure related signals simultaneously and to save the signal configuration to the workspace.

Configure all related signals

Changing the properties of a signal affects the properties of all other related signals. Related signals contain the same type of measurement data but differ in one or more parameters so that they can be measured and displayed separately. In the data tree, related signals can belong to the same or to different parent nodes. Checking this function is useful especially for large groups of related signals; see examples below.

Overwrite settings when loading workspace

If a workspace is opened, ROMES activates the signal configuration that may be stored in the workspace and overwrites the current registry settings (see also section Advanced Settings on p. 3.71 ff.). To store the signal configuration in the workspace, Save Settings to Workspace must be active.

Save settings to workspace

The settings made in the Available Signals tab are saved not only in the registry but also in the current workspace.

Examples for related

- GSM parameters such as *RxLev* are measured not only for the serving

signals

cell but also for up to 6 neighbor cells N1 to N6. All signals of the same parameter originating from different cells are related signals.

- The *UMTS – Finger Info* data structure contains signals for the *Scrambling Code (SC)*, E_c/I_0 and *Time Offset* of the signals captured with the different fingers of an UMTS RAKE receiver. All *SC,* E_c/I_0 and *Time Offset* signals are related signals.

- Part of the *UMTS PNS* data is arranged according to the different Top N Pools defined in the UMTS PNS driver configuration menu and their elements. Signals from different pools and elements containing the same type of data *(Rank, Power, SC, ...)* are related signals.

- The optional *CIR…* signals for different frequencies and downlink scrambling codes (see section *TEC for UMTS PNS* on p. 3.92 ff.) are all related signals.

Event Configuration

The *Available Events* tab in the *ROMES Configuration* menu selects the signal events to be recorded during the measurement and configures additional *User Events* and *Comment Events*.

- Signal events are automatically generated by the test system, according to the properties of a measured signal and the configuration settings made in the *Available Events* tab. Examples for signal events are sudden changes of a numeric signal value (e.g. a drop of the measured signal power, a channel change), or recorded actions (e.g. the start of a call or a handover).

- User and comment events must be both triggered manually during the measurement. They can be used to include information into the measurement file that is not automatically recorded but helps to interpret the measurement data.

If an event is activated, the Event symbols can be displayed in many general purpose and other view types, e.g. in a *Route Track,* in an *Indoor,* or in a *2D Chart* view. The *Event View* displays a chronological record of all events that occurred during the measurement.

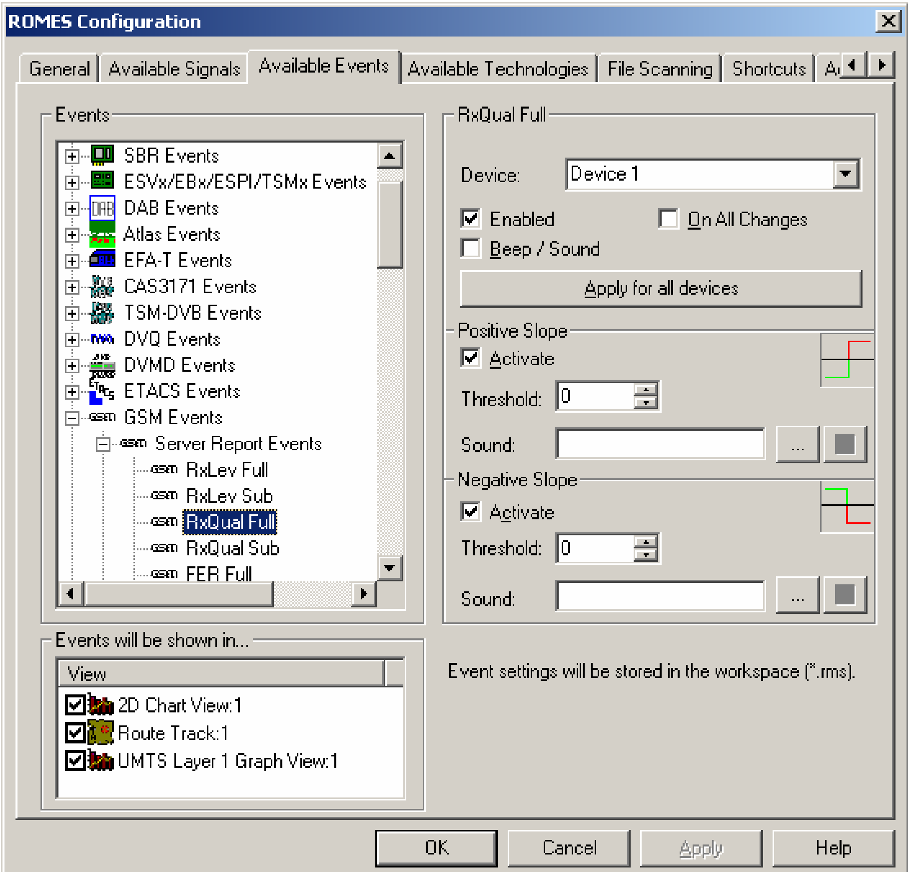


Fig. 3–8 ROMES Configuration – Available Events

Events tree

The *Events* tree shows all events that can be generated by ROMES together with their display symbols in the general purpose views. Selecting an event opens a specific configuration section in the right half of the menu.

Events are activated to be recorded by double-clicking; an activated event is preceded by a checkmark and indented.

<Event>

Depending on the selected (clicked) event, various settings are offered on the right side of the *Available Events* tab.

Device

Events can be generated for only one or for all devices used.

Enabled

Event recording is enabled for the selected device, provided that event recording is generally enabled in the event tree (the event is double-clicked, its symbol is preceded by a checkmark)

Beep/Sound

If the box is checked, a configurable sound announces that an event was triggered, see below.

On All Changes

If the box is checked, an event is selected whenever the value of the selected parameter changes. This function is useful, e.g., to indicate the change of channels, modes etc. It should not be used for measurement parameters that continuously vary in time, like RxLev etc.

Apply for all devices

If the button is clicked (and the label appears in a dashed frame), the event settings are valid for all devices used, not just to the device indicated in the Device field.

Finally, the user events *Event_1* to *Event_10* can be renamed for later identification in the <Event> panel.

Events will be shown in…

List of all open views which are capable of displaying events. The events appear in all selected views.

Positive Slope / Negative Slope

An event can be triggered when a signal parameter passes a given threshold in upward or downward direction (positive/negative slope). This feature is provided for numeric parameters that cover a range of (continuous or discrete) values, e.g. RxLev, FER etc.

Activate

If the box is checked, the positive or negative slope event is triggered, respectively.

Threshold

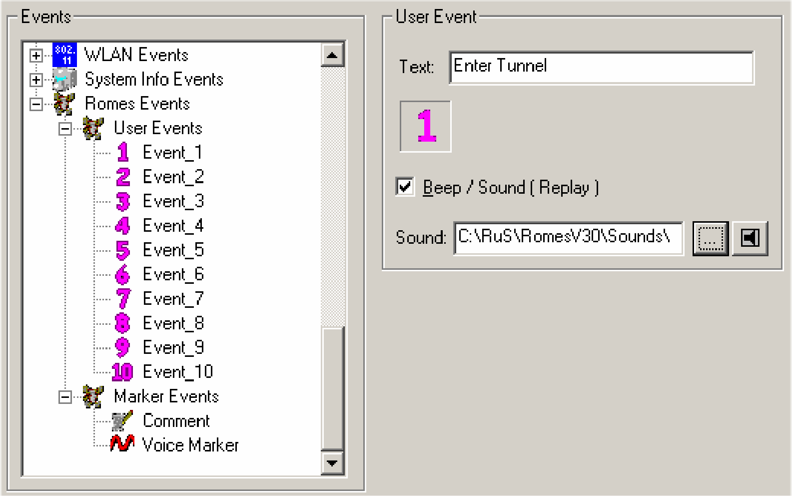
Entry of the positive/negative threshold. The units of the signal are selected automatically.

Sound

A sound to announce the event is activated by loading a *.wav file which can be selected via the browse (…) button. The selected *.wav file is indicated in the Sound window; at the same time, the gray square icon on the right side changes to an icon showing a megaphone. ROMES provides a selection of *.wav files in the *Sounds* sub-directory of its program directory.

User Events

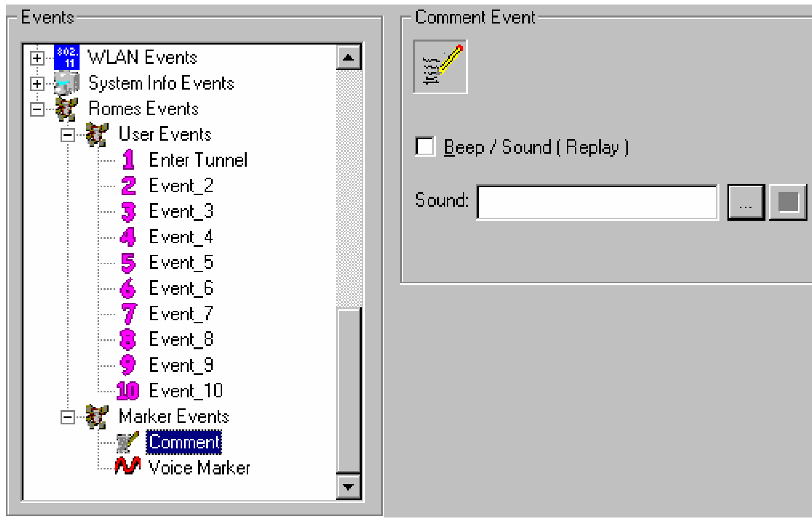
User events are located below the *Romes Events – User Events* node of the event tree. Their name can be changed for later identification (use names such as *Enter_tunnel*, *Leave_tunnel* etc. instead of the default event names *Event_1* to *Event_10*).



The new event names will show in the *User Events* list opened by the *Events* command in the *Measurement* menu or by the corresponding icon in the toolbar. To make event handling easier, shortcuts can be used to trigger the individual user events, see next section. The default shortcuts for user events no. 1 to 10 are the F1 to F10 keys.

Comment Event

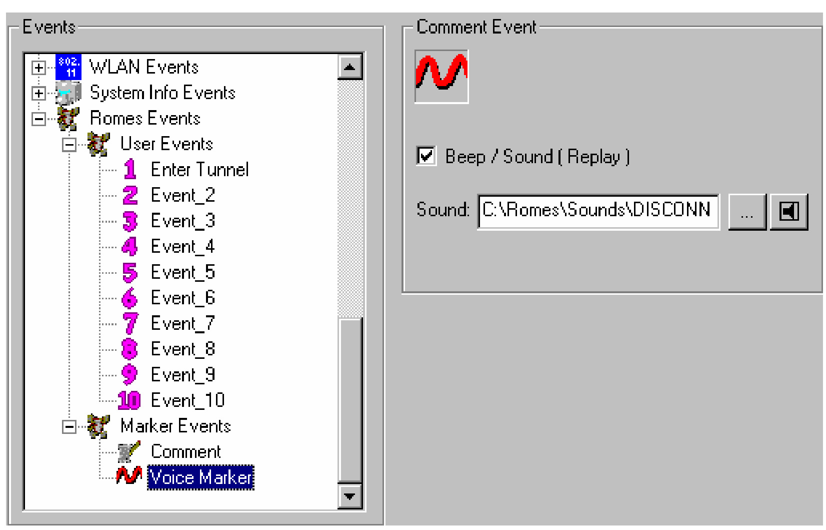
The comment events is located below the *Romes Events – Marker Events* node of the event tree.



The purpose of the comment event is to include written information into the measurement file that is related to a particular time or position. When recording measurement data *(Measurement – Start Recording)*, you can trigger events using the *Set Marker* command in the *Measurement* menu (see p. 3.105) or using a shortcut assigned in the *Assignment of Shortcuts* tab (default: *Ctrl + F12)*. After pressing the shortcut, you can enter the comment into a popup window. In the measurement file the comment is associated with the time when the event was triggered.

Voice Marker Event

The *Voice Marker* events is located below the *Romes Events – Marker Events* node of the event tree.



The purpose of the voice marker event is to include a spoken comment into the measurement file that is related to a particular time or position. When recording measurement data *(Measurement – Start Recording)*, you can trigger voice marker events using the *Set Voice Marker* command in the *Measurement* menu (see p. 3.105) or using a shortcut assigned in the *Assignment of Shortcuts* tab (default: *Ctrl + F11)*. After pressing the shortcut, you can speak your comment into a connected microphone. In the measurement file the comment is associated with the time when the event was triggered.

Technology-Specific Settings

The *Available Technologies* tab in the *ROMES Configuration* menu defines technology-specific settings, in particular settings concerning the GSM BTS data base, UMTS Node B list, and the UMTS PNS and

CW signals in the data tree. All settings are also accessible via *Configuration – Settings – TECs.* The pull-down list across the top of the tab contains the following entries:

- *TEC for GSM NWS* selects the GSM NWS Settings panel; see section *TEC for GSM NWS* on p. 3.76 ff.
- *TEC for GSM* selects the *GSM BTS List Database* tab; see section *GSM Technology* on p. 3.81 ff.
- *TEC for UMTS PNS* selects the *UMTS Technology Settings* tab; see section *TEC for UMTS PNS* on p. 3.92 ff.
- *TEC for UMTS Test Mobiles* selects the *UMTS Node B List Database* tab; see section *UMTS Technology* on p. 3.88 ff.
- *TEC for CW Devices* selects the *CW Technology* tab; see section *TEC for CW Devices* on p. 3.94 ff.
- *TEC for CDMA* opens the *CDMA BTS List Database* tab; see section *CDMA Technology* on p. 3.91 ff.

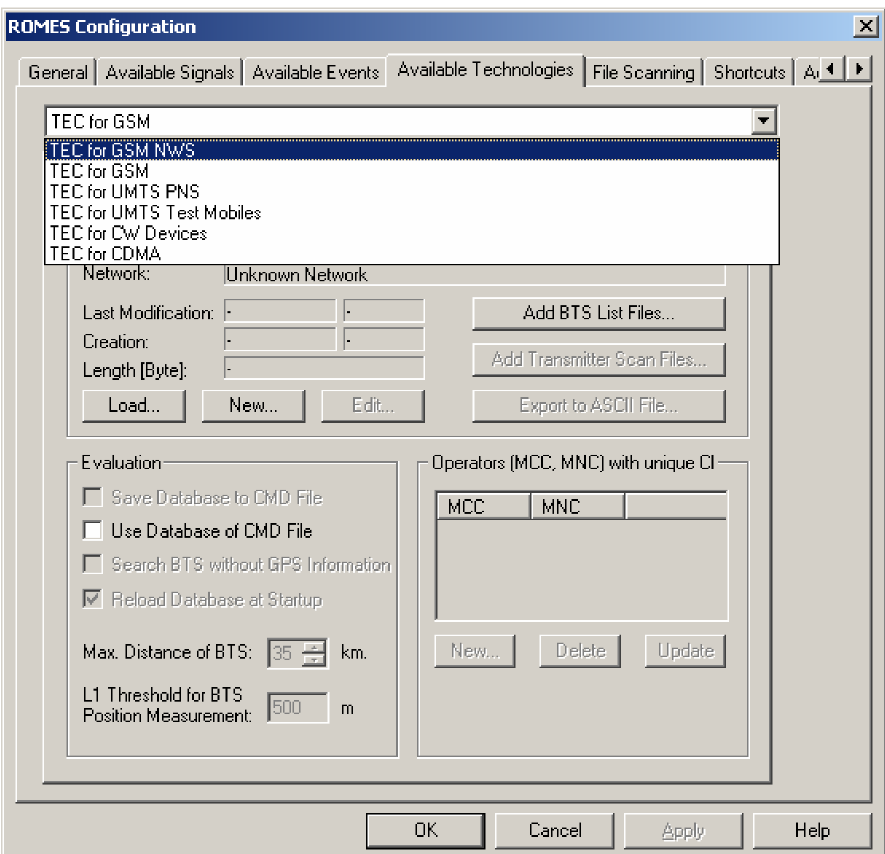


Fig. 3–9 ROMES Configuration – Available Technologies

File Scanning Settings

The *File Scanning* tab in the *ROMES Configuration* menu controls the views and the CMD file scanning behaviour as well as the replay device filtering for new or opened CMD files.

If the *Enable File Scanning* box is checked, ROMES performs a file scan (see p. 3.11) when opening a measurement (CMD) file. After the scan, the entire measurement data is visible immediately in the active views.

If the *Scan File after Measurement* box is checked, the file scan is performed on the last created CMD file right after the measurement, which also leads to immediately visibility of all measurement data in the current views.

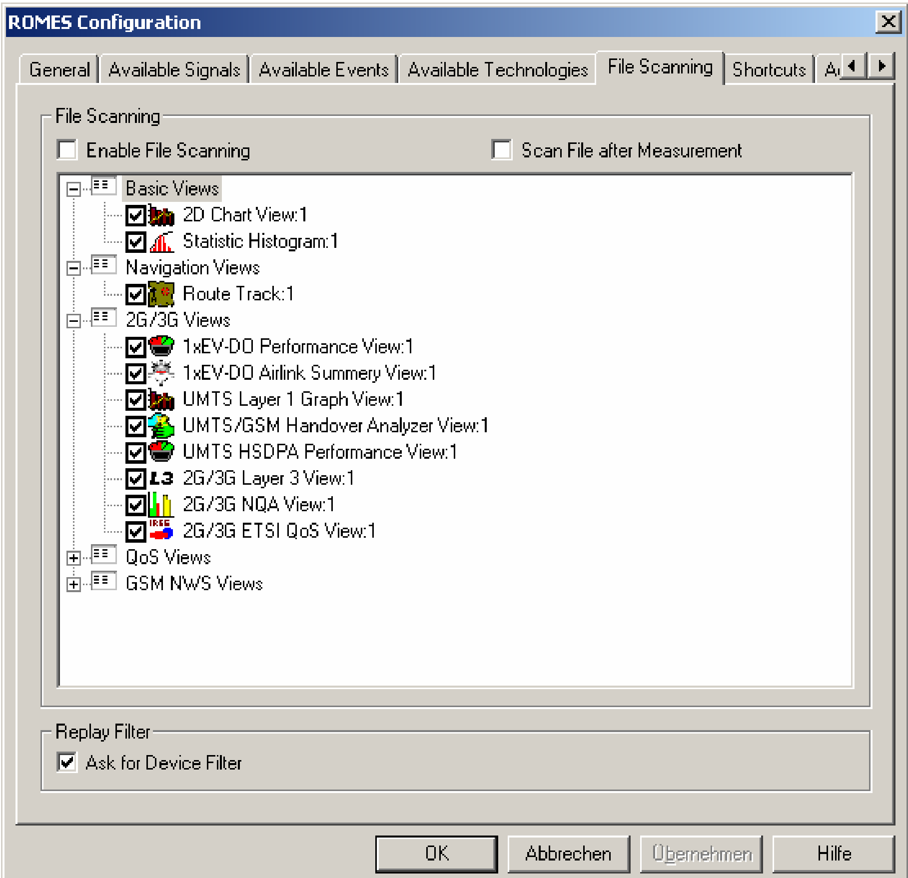


Fig. 3–10 ROMES Configuration – File Scanning

If the *Ask for Device Filter* box is checked, the *Open CMD File...* action (see p. 3.10) opens the *Device Filter* selection dialog:

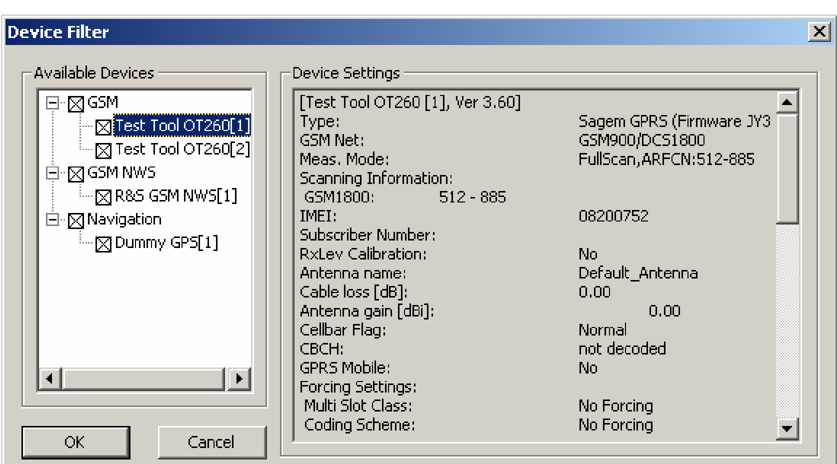


Fig. 3–11 ROMES Configuration – Device Filter

The *Device Filter,* like the *Replay Device Filter* (see p. 3.101) shows the test devices of the currently active measurement file. If no measurement file is open, it shows the devices of the last file replayed. Measurement data from unchecked devices is excluded from the replay. The dialog is updated every time a new measurement file is loaded.

Assignment of Shortcuts

The *Shortcuts* tab in the *ROMES Configuration* menu assigns a shortcut (a combination of keys) to the user events and to the most common commands in the *Measurement* menu. Applying the shortcut (pressing the key combination) is then equivalent to triggering a user event and writing it to the measurement data or to executing a command. The default shortcuts for the *File* menu commands can not be changed.

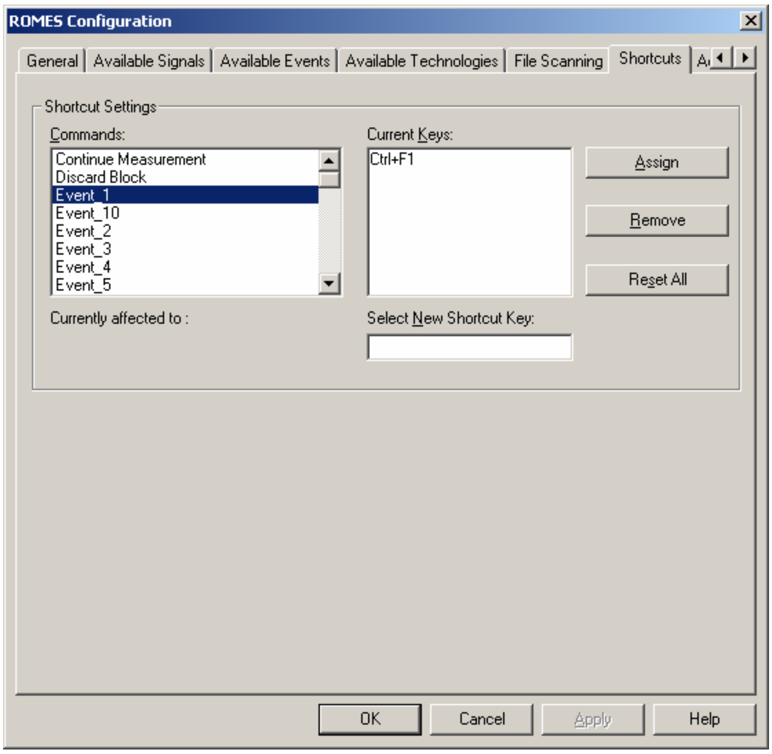


Fig. 3–12 ROMES Configuration – Shortcuts

Advanced Settings

The *Advanced Settings* tab in the *ROMES Configuration* menu defines the maximum number of devices that can be used for each technology and reset registry entries concerning the workspace.

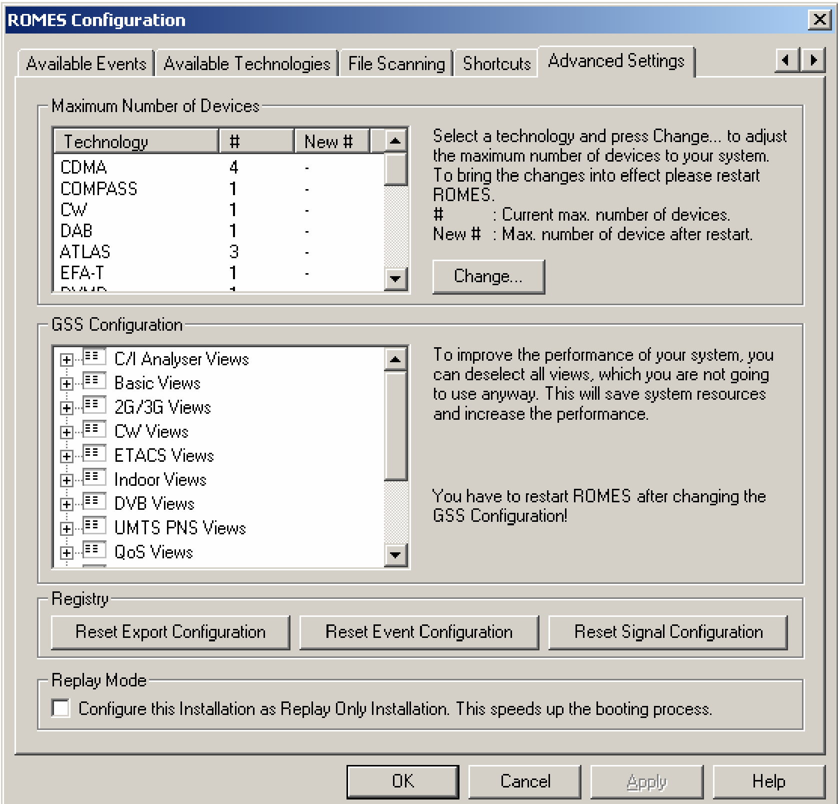


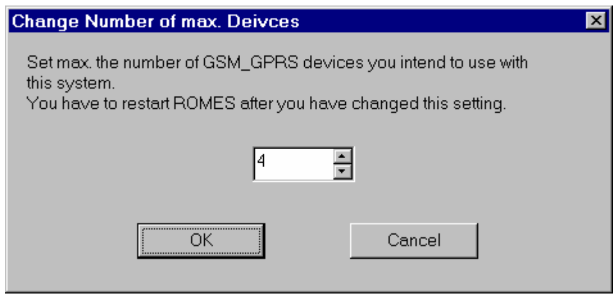
Fig. 3–13 ROMES Configuration – Advanced Settings

Max. Number of Devices

The available technologies are listed in the *Technology* column of the *Max. Number of Devices* table together with the current number of devices (# column) and the changed max. number of devices *(New #* column, see below). To change the current number of devices for a technology, select the technology in the table and press the *Change* button.

Change

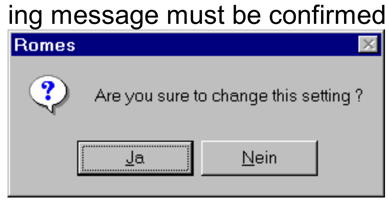
The *Change* button opens a popup window to change the current maximum number of devices assigned to the selected technology. It is possible to overwrite the number or increment/decrement it by clicking on the arrow buttons. Numbers between 1 and 32 are allowed for each technology.



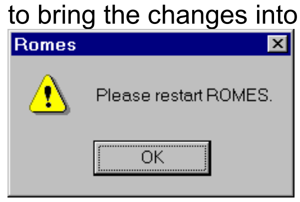
In practice, the maximum number of devices will be limited by the number of interfaces (COM ports etc., see chapter 6) available. Also, a driver license is required for each device used. Increasing the maximum number of drivers is necessary, e.g., if additional licenses are purchased to extend the measurement system, or if measurement data acquired on a different system with more interfaces are replayed. Otherwise, it is recommended to keep the default settings in order to ensure optimum system performance.

OK

Change the current setting. Before this can be done, the following message must be confirmed:



On pressing OK, ROMES reminds you that it must be restarted to bring the changes into effect:



Cancel

Discard the changes made and return to the Advanced Settings tab.

GSS Configuration

The *GSS Configuration* panel contains a tree view of all ROMES views. Deselected views will no longer appear in the *View* menu when ROMES is started next time. A GSS is an application file providing one of the view groups listed in the tree *(C/I Analyzer Views, Basic Views, …).*

Discarding views that are not needed saves system resources and simplifies the selection of views in the *View* menu. Discarded view types appear at the bottom of the *GSS Configuration* list where they can be re-activated any time.

TIP

The GSS Configuration is particularly useful if only some of the views provided by the same GSS are not needed. Typical examples:
- The Polar View is a Basic View type which requires special drivers.
- Some GSM/UMTS Views depend on a particular test mobile type.
If an entire GSS is not needed, it is more efficient to discard the corresponding replay component during the installation.

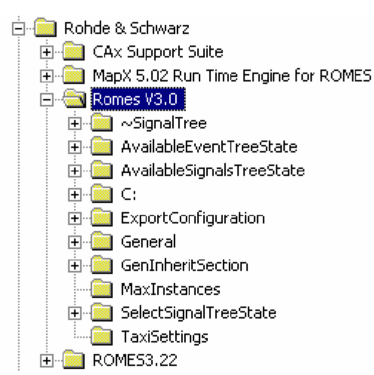
Registry

The three buttons in the *Registry* panel delete the *~SignalTree/AvailableSignalsTreeState, AvailableEventTreeState,* and *ExportConfiguration* keys in the Windows registry with all their subkeys and entries, and thus reset the corresponding settings to default.

- The *~SignalTree/AvailableSignalsTreeState* keys contain all changes made in the configuration of the *Available Signals* (see section *Signal Configuration* on p. 3.60 ff.).

- The *AvailableEventTreeState* key contains all changes made in the *Available Events* tab (see section *Event Configuration* on p. 3.63 ff.).

- The *ExportConfiguration* key contains all changes made in the *Available Events* tab (see *Export CMD File* on p. 3.15 ff.).



All keys are only created when the default ROMES configuration is changed.

A reset of the registry entries is not necessary during normal operation of the system. It is recommended if ROMES repeatedly generates a error message after loading and modifying an older workspace.

To save the current *Signal Configuration* settings for a later session before resetting the registry entries, proceed as follows:

➢ In the *Available Signals* tab of the *ROMES Configuration* menu, select *Save Settings to Workspace*.

➢ Click *OK*.

Replay Mode

If the box in the *Replay Mode* panel is checked, the current installation is configured as a *Replay Only* installation.

This setting is suitable if ROMES is used to evaluate data recorded previously for some time, so that no measuring functionality is needed. In *Replay Only* mode, software components such as drivers will not be loaded so that booting is accelerated considerably.

Note:
In Replay Only mode, most of the CMD File Export modules are not available.

Selecting the *Replay Only* mode is reversible any time. It does not require a re-installation but only a simple restart of ROMES.

Driver Installation (Hardware)

The *Configuration – Hardware* command installs the hardware drivers necessary for a measurement.

Hardware drivers are required for the system and the different types of mobile phones before a measurement is started. They can be provided in two different ways:

- Implicitly, by loading a workspace file
- Explicitly, via the *Hardware* command

The installation process is menu-guided. For further information refer to chapter 6, *Carrier-to-Interference Analysis.*

Note:

It is not necessary to install drivers for evaluating data in the replay mode. On the other hand, the Hardware... command is disabled as long as a measurement file is open.

Overview of Settings (Settings)

The *Configuration – Settings* command selects the data to be displayed in the different types of views, shows the driver configuration and retrieves detailed information on the installed software modules. The *Settings* command calls up the *Configuration of Software Modules* menu:

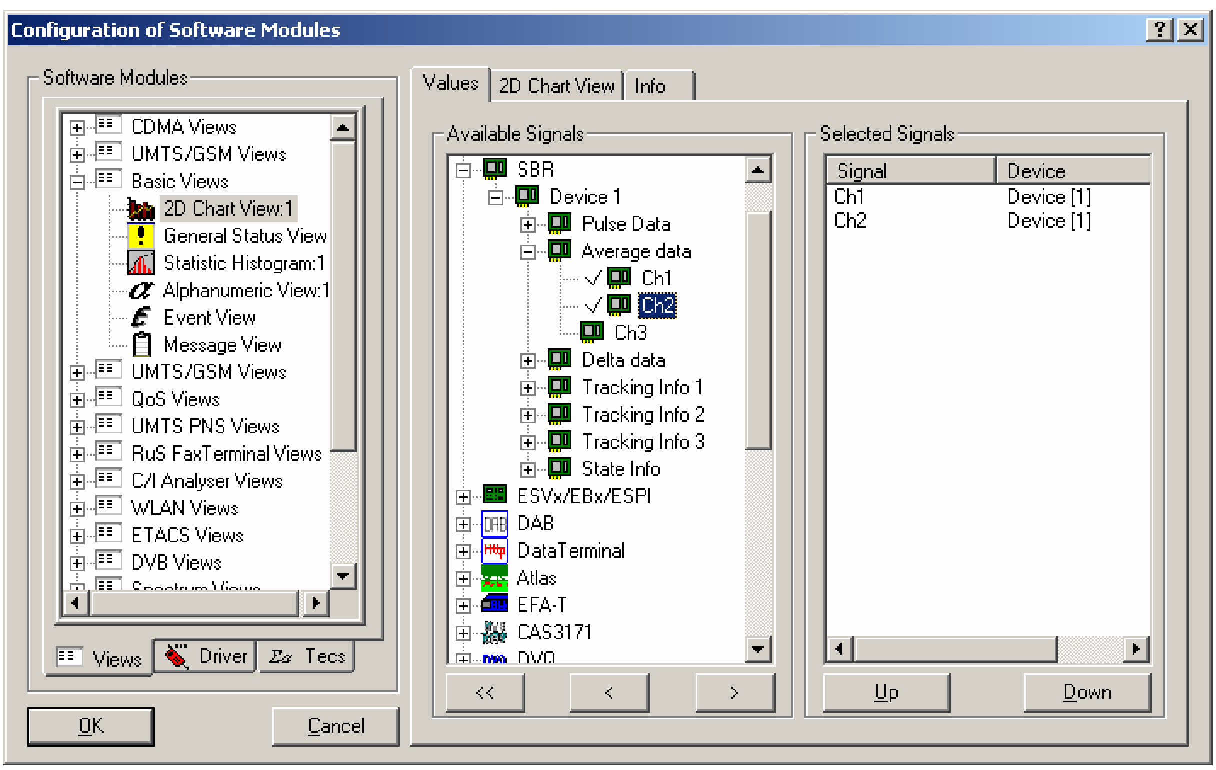


Fig. 3–14 Configuration of Software Modules – Views

The *Configuration of Software Modules* menu is divided into three tabs:

Views The *Views* tab configures the different types of views used to visualize the measurement data. The data structure is generally shown in a tree view *(Available Signals;* for an explanation of data selection in trees refer to chapter 1, Data Selection) from which one or several nodes can be selected *(Se-*

lected Signals). Alternatively, some classes of output parameters can be selected from lists. The view configuration menus are also accessible from the individual view menus (click the right mouse button and select *Configure...* from the popup window). They are explained in chapter 4, Section Display and Evaluation of Results together with the corresponding view windows.

Driver

The *Driver* tab shows the configuration of the different hardware drivers installed. It is identical with the *Serial Port Driver Info* tab of the driver configuration menus described in chapter 6. If no hardware drivers are installed, the menu is empty.

Tecs

The *Tecs* tab displays information on the installed technology modules. Besides, the *Tecs* tabs for several technologies contain particular configuration panels that are described in the following sections.

TEC for GSM/UMTS/CDMA Test Mobiles

The GSM, UMTS, and CDMA technologies each use a *BTS/Node B List Data Base* which can be loaded and modified in the corresponding panel as soon as one of the entries *TEC for GSM, TEC for UMTS Test Mobiles* or *TEC for CDMA* is selected. The data bases are completely independent from each other so that different measurements can be performed simultaneously using separate databases.

BTS/Node B databases

A BTS or Node B database contains the operator list (BTS list) including all information about the sectors and base stations in a particular area provided by the network operator. This information can be used in several view types; see e.g. description of *GSM Measurement Report View, GSM Frequency Hopping View, GSM Handover View, Alphanumeric View, Route Track View* in chapter 4. The GSM BTS data base is also used for the GSM Carrier-to-Interference analysis (with option ROMES-GS) where it provides essential information for tracing back the source of the different interfering signals.

TEC for GSM NWS

Clicking *TEC for GSM NWS* on the ROMES Configuration – Preferences – Available Technologies tab opens a panel with three tabs for the GSM NWS Top N Settings, the GSM NWS Scan Signal Settings, and for GSM NWS driver Info.

Note:
The TEC for GSM NWS tabs are also accessible from the Configuration – Settings menu.

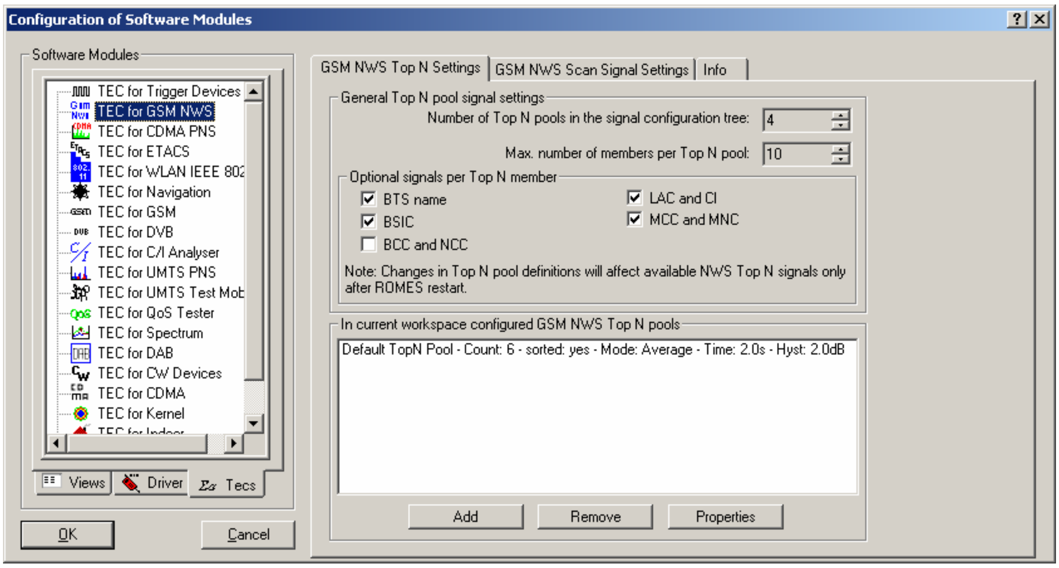


Fig. 3–15 Configuration of Software Modules – TEC for GSM

GSM NWS Top N Settings

The *GSM NWS Top N Settings tab* is divided in an upper panel *(General Top N pool signal settings)* to set preferences for the General Top N pool signals and a lower panel *(In current workspace configured GSM NWS Top N pools)* to administrate the Top N pools of the current workspace.

General Top N pool signal settings

The changes in Top N pool definitions made on this panel will affect available NWS Top N signals only after ROMES is restarted:

Number of Top N pools in the signal configuration tree

Defines the maximum number of Top N pools in the list of Available Signals (see section *Signal Configuration* on p. 3.60 ff.).

Max. Number of members per Top N pool

Defines the maximum members per pool in the list of Available Signals (see section Signal Configuration on p. 3.60 ff.).

Optional signals per Top N member

BTS Name

Name of the BTS, taken from the GSM BTS database (if available).

BSIC

Base transceiver station (BTS) identity code. In this view, the BSIC is always octal (so that BSIC = ab where a is the NCC and b is the BCC), irrespective of the format selected in the Available Signals tab of the Preferences menu (octal/decimal/hex).

BCC and NCC

BTS Color Code (BCC) and Network Color Code (NCC)

LAC and CI

Location Area Code (LAC) and Cell Identity (CI)

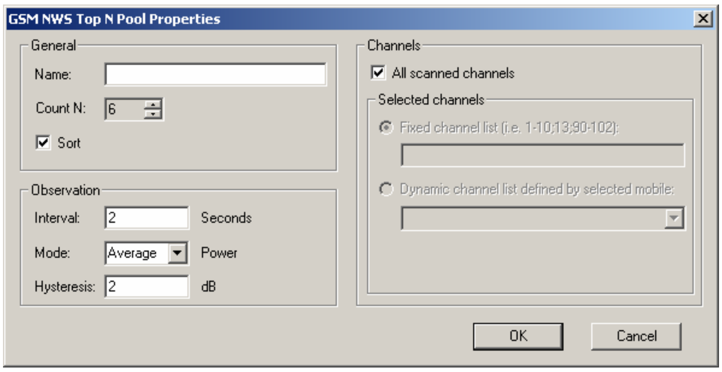
MCC and MNC

Mobile Country Code (MCC) and Mobile Network Code (MNC)

In current workspace configured GSM NWS Top N pools

This panel shows a list box with the GSM MWS Top N pools configured in the current workspace. The Top N pool list can be amended using the *Add* button, list items can be deleted using the *Remove* button, and the list entry properties can be viewed or modified using the *Properties* button:

Add Adds a user-defined Top N pools in the list of *Available Signals* (see section *Signal Configuration* on p. 3.60 ff.).



The *Add* dialog contains the following panels:

General

Name Name of the GSM NWS Top N pool.

Count N Number of pool elements (range 1 to 16). The display of pool elements in the in the list of *Available Signals* is limited to the *Max. Number of members per Top N pool.*

Sort If this is checked, the initial Top N View list is sorted by the averaged measured signal power during the observation in the Top N pool.

Observation

Interval Measurement interval in seconds (range 0 to 300)

Mode The measured power value defines the sort order for the Top N View. The sort mode can be set to Average/Max./Min.power values, which is not shown in the Top N View.

Hysteresis The hysteresis parameter (in dB) is used for FDD cells if the quality measure for cell selection and reselection is set to CPICH Ec/No.

Channels / Selected Channels A list of RF channels to be displayed in the Top N list can be entered manually. In the channel list the absolute RF channel numbers are placed in increasing order of ARFCN.

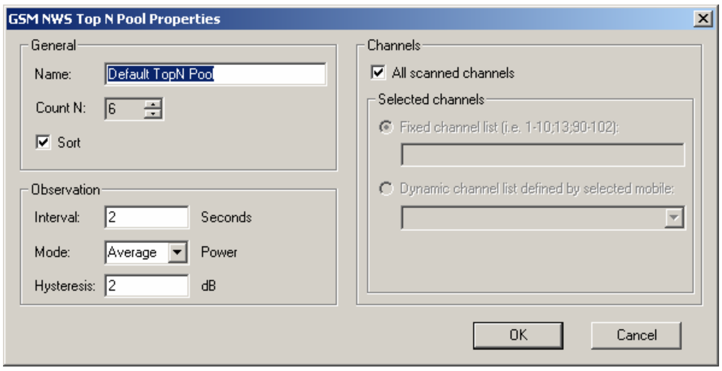
All scanned channels All scanned BCCH channels are displayed in the Top N list.

Selected *Fixed Channel list* allows the manual entry of the RF *channels* channel numbers to be displayed in the Top N list. The channels or channel ranges for the scan signals are set separated by commas (e.g. 1-10,13,90-102)

Dynamic channel list defined by selected mobile: The displayed channels are defined by the configured test mobile.

Remove Deletes the selected GSM NWS Top N pool from the list, after the following dialog is confirmed.

Properties Allows the modification of the properties for the selected Top N pool.



The *Properties* dialog contains the same panels as the *Add* dialog, all field descriptions are defined there:

GSM NWS Scan Signal Settings

The *GSM NWS Scan Signal Settings tab* is divided into four panels *(General, Optional Signals per channel, Optional signals (per measurement station), and Channel assignment)* to administrate the scan signal settings of the current workspace.

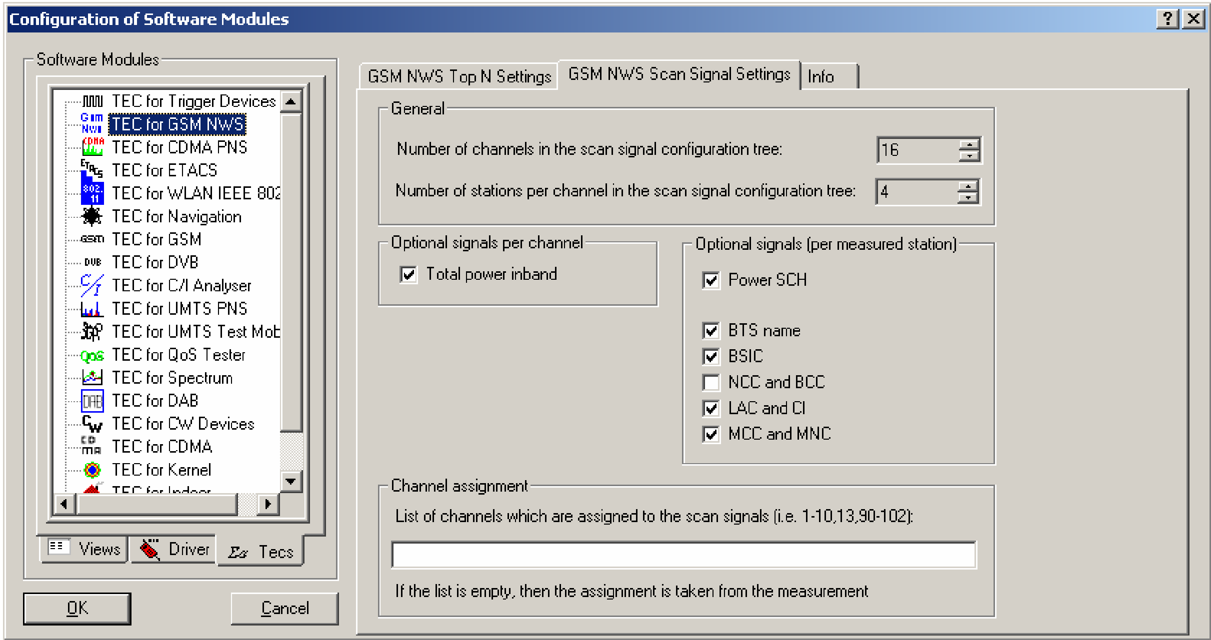


Fig. 3–16 Configuration of Software Modules – TEC for GSM

General panel

The changes in scan signal settings made on this panel will affect available NWS scan signals only after ROMES is restarted:

Number of channels in the scan signal configuration tree

Defines the maximum number of channels in the list of *Available Signals* (see section *Signal Configuration* on p. 3.60 ff.).

Number of stations per channel in the scan signal configuration tree

Defines the maximum number of stations per channel. This is e.g. the case if several stations are found on a given channel, a default of 4 stations can be shown by parameters.

Optional signals per channel panel

Total power inband

Name of the BTS, taken from the GSM BTS database (if available).

Optional signals (per measurement station) panel

Power SCH

Code power of the SCH (Synchronization Channel)

BTS Name

Name of the BTS, taken from the GSM BTS database (if available).

BSIC

Base transceiver station (BTS) identity code. In this view, the BSIC is always octal (so that BSIC = ab where a is the NCC and b is the BCC), irrespective of the format selected in the Available Signals tab of the Preferences menu (octal/decimal/hex).

NCC and BCC

BTS Color Code (BCC) and Network Color Code (NCC).

LAC and CI

Location Area Code (LAC) and Cell Identity (CI)

MCC and MNC

Mobile Country Code (MCC) and Mobile Network Code (MNC)

Channel assignment

This panel allows to enter a list of channels which are assigned to the scan signals. After assignment, e.g. 16 signal parameters are available for each channel in the tree view. If the channel assignment field is left blank, these are assigned to the first 16 found channels at run-time (e.g. 1, 2, 3, .., 16 for GSM900 or 512, 513, 514, ... for GSM1800). The channel assignment field s or channel ranges for the scan signals are set, separated by commas (e.g. 1-10,13,90-95). If the channel assignment field is filled, the available signal parameters are assigned to the entered channels. The signal parameters can be displayed in the *Alphanumeric View,* for example.

Info tab

The *Info tab* is divided in an upper panel *(Custom Name)* to set a user-defined name of the TEC for GSM NWS and a lower panel *(File Version)* which shows the GSM TEC for GSM NWS link library properties.

The *Info* panel shows file information of the dynamic link library which implements the selected TEC.

The *Info* tab includes the *Custom Name* field, which has no function in a view context. It is only useful in a driver context, where different connected devices can be associated with different custom names, e.g. for separate mobiles in different networks, or when simultaneously operated mobiles perform different tasks.

GSM Technology

Clicking *TEC for GSM* opens the *GSM BTS List Database* tab to create, select or modify the GSM BTS database, and to extend it by adding files.

The information of the GSM BTS data base must be stored in a .ndb (network data base) file to be used internally. Data from the .ndb file can be exported to an ASCII BTS list file (*.txt); on the other hand it is possible to import BTS data from BTS list files in one of the formats (*.txt, *.atd) described in chapter 7.

Note:

The GSM BTS List Database tab is also accessible from the Database – GSM BTS Database menu.

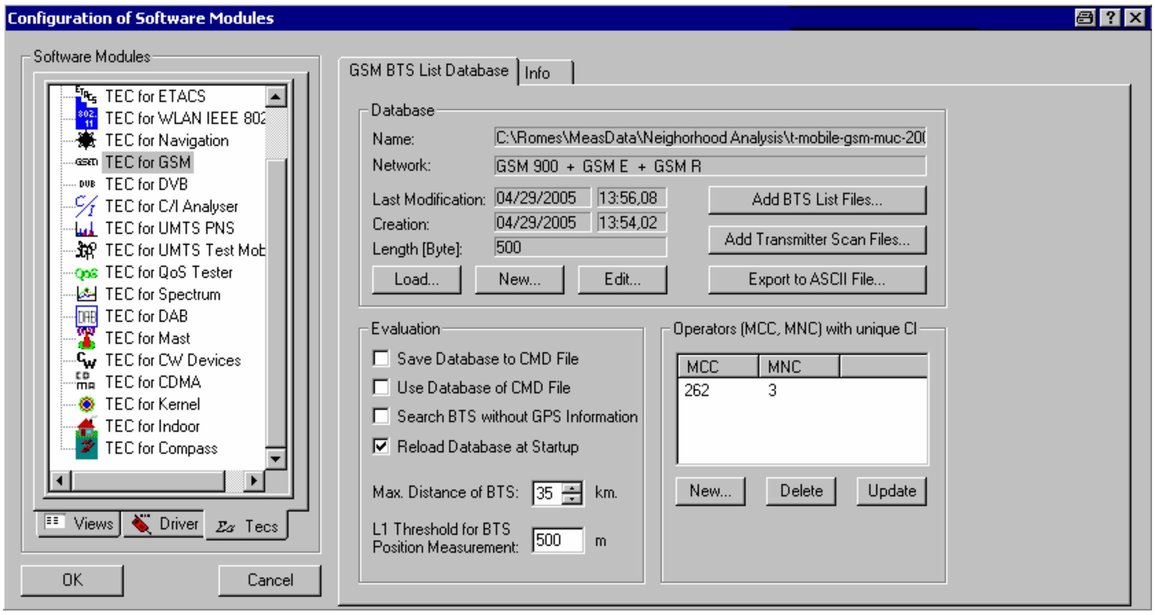


Fig. 3–17 Configuration of Software Modules – TEC for GSM

Creating a Database File

To create a new database file (*.ndb),

➢ In the *Database* panel, click *New* to open the *Create Database* dialog.

➢ Select your network from the *Network* pull-down list. For data bases containing both GSM900 and GSM1800 base stations, select *GSM Dualband*.

The selected network acts as a filter when the BTS data is imported into the data base file. If a particular GSM band is selected, data from all other bands will not be imported into the data base.

➢ Selecta directory and enter a file name. The extension *.ndb will be appended automatically.

➢ Click *Open* to create the file and close the *Create Database* dialog.

See also *Importing a BTS List File into the Data Base* below.

Importing a BTS List File into the Data Base

To import an existing BTS list file (*.atd, *.buf, *.txt, *.vig) into the data base,

➢ Ensure that an empty or non-empty data base file (*.ndb) is available or create a *.ndb file (see *Creating a Database File*).

➢ If your BTS list file contains valid MCC and MNC information go to item no. 4. Otherwise click *New* in the Operators (MCC, NCC) with unique CI panel to open the *Add Network...* dialog box and enter your Mobile Country Code (MCC, e.g 262 for Germany) and Mobile Network Code (MNC). Click *OK* to confirm your entries and close the dialog box.

➢ Click *Update* to confirm the new entries and update the *MCC/MNC* list.

➢ In the *Database* panel, click *Add BTS List Files...*.

➢ In the message box Do you want to create a new database? opened, click No.

➢ In the file selection dialog opened, select the BTS list file. If your BTS list file contains valid MCC and MNC information go to item no. 7. Otherwise check the *MCC* and *MNC* boxes and enter your MCC and MNC into the input fields.

➢ Click *Open* import the BTS list file.

The file import is terminated after you confirm the *BTS list successfully imported* message box. The new data extends the previous data base file.

Database Management

Database

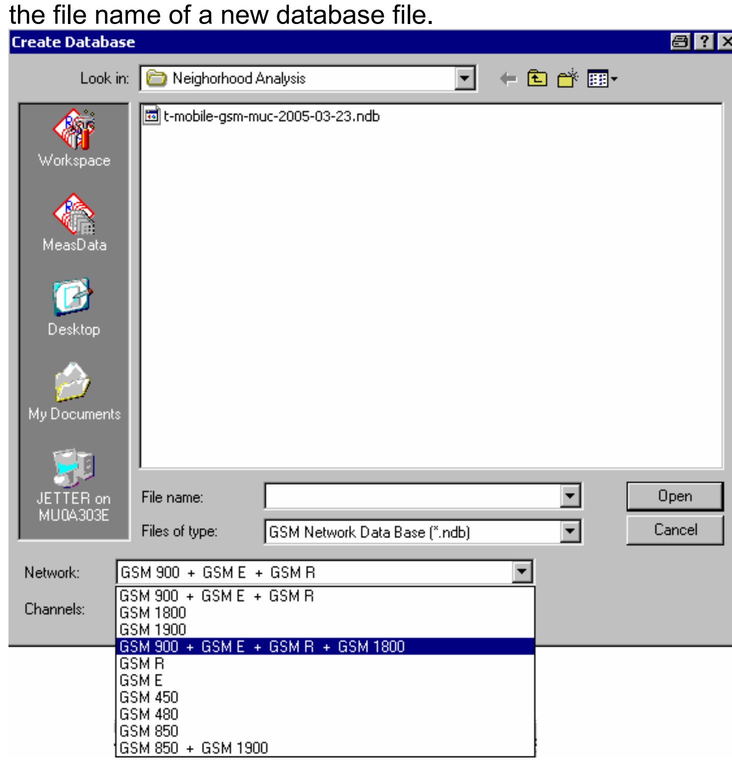
The *Database* panel shows the current *.ndb (network database) file with its properties and contains buttons to load, create or modify *.ndb files.

Load

Opens a dialog to select an existing database (*.ndb) file.

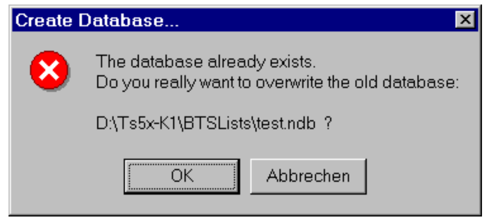
New

Opens a *Create Database* dialog to select a directory and define the file name of a new database file.



The Network pull-down list defines the GSM hyperband for the created BTS data base file. Band selection acts as a filter: BTSs from other bands will not be imported into the data base. Therefore, for data bases containing both GSM900 and GSM1800 base stations, GSM 900 +GSM E + GSM R + GSM 1800 must be selected.

Open creates the new (empty) data base file and closes the Create Database dialog. If the selected data base file already exists in the directory, Romes displays a message box:



OK deletes all entries in the old data base file and closes the message box. Cancel closes the box without overwriting the old data base file.

Edit

Opens the *BTS List Editor* dialog to modify the entries in the current data base file; see description on p. 3.87.

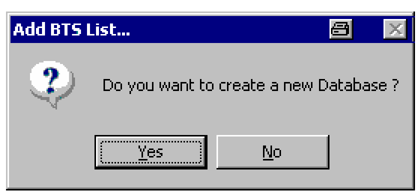
Database – Importing/Exporting data

The three buttons on the right side of the *Database* panel import data from a file into the data base or export the information stored in the data base to a file.

Add BTS List Files

Add BTS List Files

Imports data from an existing BTS list file into the BTS data base. Clicking the button first opens a message box:

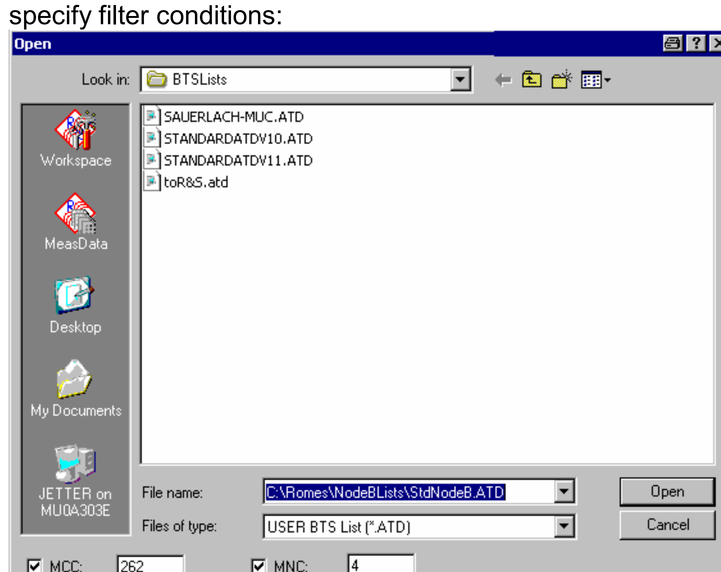


Yes

Opens the *Create Database* dialog to create a new *.ndb file (see above).

No

Opens a dialog to select the BTS list file to be imported and specify filter conditions:



Files of Type

Pull-down list providing all supported data formats for BTS list files (*.atd, *.buf, *.txt, *.vig; see description of data formats in chapter 7).

MCC/MNC

Check boxes with associated input fields assigning a specific Mobile Country Code (MCC) and Mobile Network Code (MNC) to the imported BTS data. They must be checked unless the MCC and MNC information is explicitly included in the BTS list file. In this case the MCC and MNC values must correspond to one of the MCC/MNC pairs defined in the Operators (MCC, MNC)... panel; see below.

Open

Starts the import of data from the selected file. An error message may be displayed if
The imported file contains a syntax error (see chapter 7)
The MCC/MNC is missing or invalid; see Operators (MCC, MNC)... panel below
Otherwise a message indicates that the BTS list was successfully imported.

Adding or replacing BTS sectors

When a BTS list is imported into an existing data base, base stations that are already included in the data base are replaced, and new base stations are added to the data base. Two BTSs are considered to be identical if both their geographical position and the clock codes of their sectors match. For more information see section *BTS List Formats* in chapter 7.

Add Transmitter Scan Files

Add a file containing data acquired within the framework of a Carrier to Interference measurement (transmitter scan data, with option ROMES-GS).

This feature can be used to include TS files taken by another measurement system or to add former TS data with improved position estimates to the database, see *L1 Threshold for BTS Position Measurement* below. The added TS-file is displayed in the *Message View* window (see section *Basic Views* in chapter 4).

Export to ASCII File

Exports all data in the current data base (*.ndb) file to an ASCII BTS list file (*.txt) including a header describing the different columns and additional columns (e.g. MCC/MNC) generated when the data base file was created or edited. This additional information means that the two actions *Add BTS List Files...* and *Export to ASCII File* are not simply inverse to each other.

Evaluation

The *Evaluation* panel specifies how ROMES exploits the information in the GSM BTS data base during a measurement or replay. All settings come into effect when the next measurement is started using the *Measurement – Start Measurement* command.

Save Database to CMD File

The current BTS data base is included into the measurement file (*.cmd) created for the next measurement.

Use Database of CMD File

The next replay does not use the current BTS data base but the BTS information included in an existing measurement file (*.cmd).

Search BTS without GPS information

In the default case where the option is deselected, ROMES checks each BTS for valid GPS information (geographical coordinates) and omits all BTSs without GPS information from the data base. Otherwise, no GPS plausibility checks are carried out and all BTSs are included in the data base.

Reload Database at Startup

The current BTS data base is stored and automatically loaded when ROMES is started for the next time. If the option is deselected, ROMES starts without loading the data base.

Max. Distance of BTS

Assume that only BTSs within a definite radius around the measurement position have any influence. Excluding distant base stations saves processing time. The maximum GSM cell radius of approx. 35 km is a good estimate for the maximum distance.

L1 Threshold for BTS Position Measurement

Estimated accuracy of the BTS position determined in a Transmitter Scan. The BTS position is determined by the time delays of the T51 at different measurement locations. The calculation is based on an iterative algorithm which stops once the standard deviation of the position falls below the L1 Threshold ... The threshold must assume a value between 50 m and 1 km.

If the accuracy can not be reached with the current TS data, the position estimate is continued as soon as there are more data available, either during the same measurement or even in a later one. For that purpose the necessary TS data can be stored in the network database; see Add Transmitter Scan Files button above.

For enhanced performance during measurement it is recommended to use a larger L1 Threshold ... while the measurement is running. A better estimate of the position can then be obtained by adding the same TS file offline, using small values for the L1 Threshold ...

Operators (MCC, MNC) with unique CI

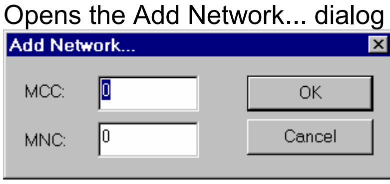
This panel defines pairs of Mobile Country Code (MCC) and Mobile Network Code (MNC) values to be assigned to the entries in the BTS data base. The values are imported into the data base together with the BTS list files; they are not needed for BTS list files that already contain MCC and MNC values.

The MCC and MNC are required to identify the base stations together with their Cell Identity (CI). The CI is usually unique within a country and a given network; however, providers assign the same CIs in different countries and networks. Only the combination of the CI, the MCC and the MNC is a unique identifier for any base station worldwide.

There are some exceptions where a CI occurs repeatedly within the same country and network. In those cases the Location Area Code (LAC) is required as a fourth identifier. This code number must be included in the BTS list file or entered in the BTS database by means of the *BTS List Editor* dialog; see p. 3.87.

New

Opens the Add Network... dialog box to define a new pair of MCC and MNC values:



OK closes the box and enters the two values in the MCC/MNC list. The list may contain several pairs of values.

Delete

Deletes a pair of values selected in the MCC/MNC list.

Update

Confirms the new entries and update the list: All MCC/MNC values are now available to be imported together with BTS list files.

BTS List Editor

The *BTS List Editor* dialog modifies the entries in the current GSM data base file. It is opened by means of the *Edit* button in the *GSM BTS List Database* tab.

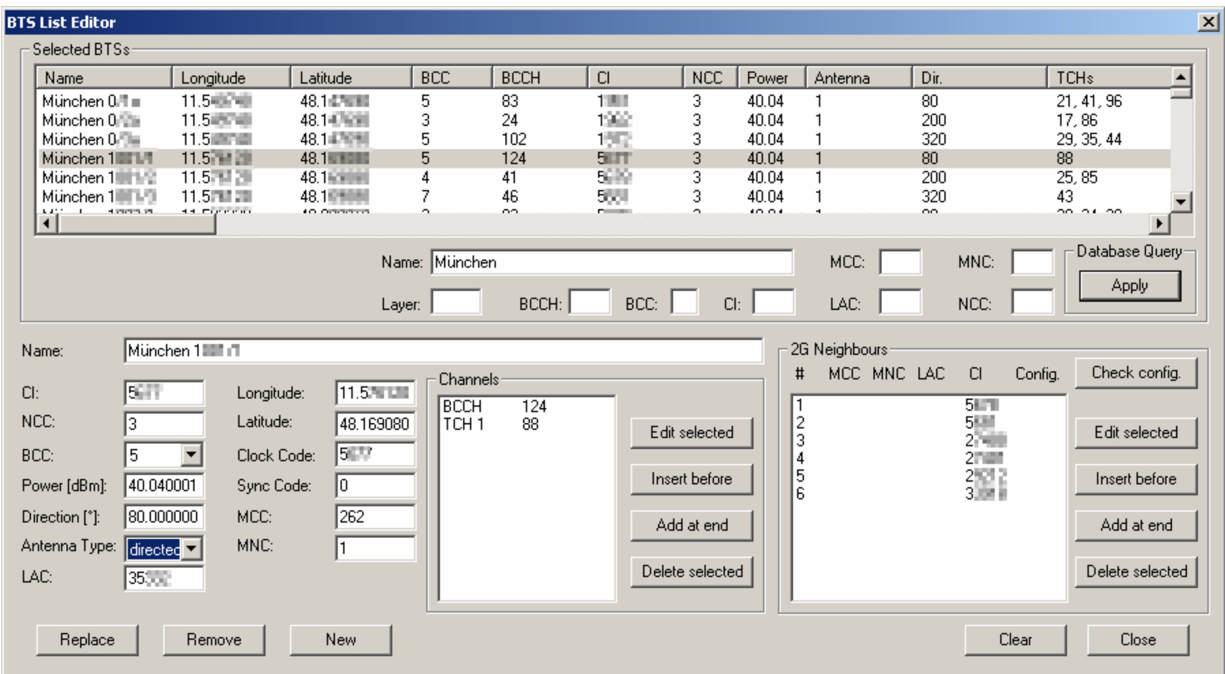


Fig. 3–18 BTS List Editor

The *BTS List Editor* is divided in an upper panel *(Selected BTSs)* to sort and select BTS sectors and a lower panel *(Edit BTS Sector)* to modify a particular entry.

Selected BTSs

The *Select BTSs* panel contains a table listing the base stations in the current data base file.

The input fields below the table restrict the BTS selection in the table to BTSs with a particular *Name, MCC, MNC* etc. or BTSs fulfilling a combination of filter conditions. With no entries made, all base stations in the current data base file are displayed. The *Apply* button in the *Database Query* area updates the contents of the table according to the current filter condition.

The table remains empty if no data base file is selected or if the current data base file contains no valid BTS sectors (e.g. because the import of a BTS list file failed).

Edit BTS Sector

The *Edit BTS Sector* panel modifies a particular sector (= table row) of the *Selected BTSs* table. Double-clicking the BTS sector copies it into the input fields in the *Edit BTS Sector* panel where the individual values can be edited. A dash "–" in an input field indicates that the parameter is currently undefined.

Replace

Copy the current BTS sector back into the Selected BTSs table.

Remove

Removes the current BTS sector from the table. The action must be confirmed in a message box.

New

Copy the current BTS sector into the Selected BTSs table as a new BTS sector. If the parameters of the current BTS sector are inconsistent, the sector is not added to the data base but an error message is displayed in the in the *Message View* (see *Basic Views – Message View* in chapter 4).

Clear

Deletes all entries in the Edit BTS Sector panel.

Close

Close the BTS List Editor dialog.

UMTS Technology

Clicking *TEC for UMTS Test Mobiles* opens the *UMTS Node B List Database* tab to create, select or modify the UMTS Node B database, and to extend it by adding files.

The information of the UMTS Node B data base must be stored in a .nbdb (Node B data base) file to be used internally. Data from the .nbdb file can be exported to an ASCII BTS list file (*.txt); on the other hand it is possible to import Node B data from Node B list files in one of the formats (*.txt, *.atd, *asc) described in chapter 7.

Note:

The UMTS Node B List Database tab is also accessible from the Database – UMTS Node B Database menu.

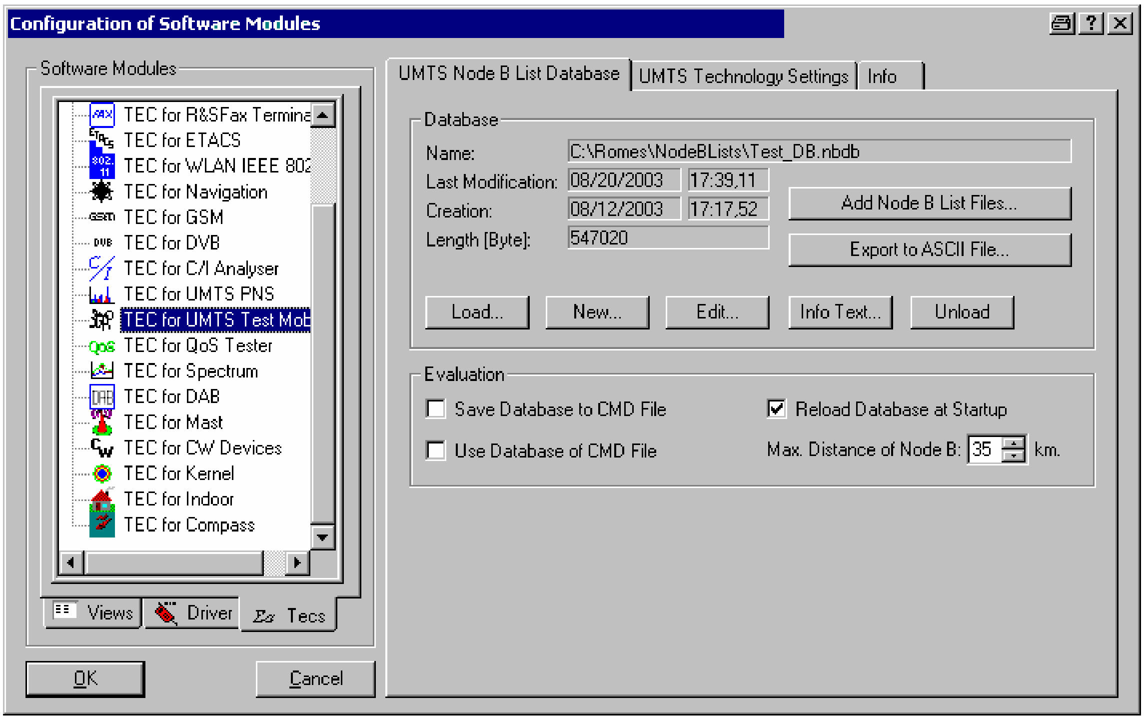


Fig. 3–19 TEC for UMTS Test Mobiles– Node B List Database

The data base is handled in analogy to the GSM data base described in section *Importing a BTS List File into the Data Base* on p. 3.82. In particular, the function of all controls in the *UMTS Node B List Database* dialog is identical to the corresponding GSM controls.

The *Info Text…* button opens a dialog to assign an alias text to the different parameters that characterize the Node Bs the columns in the *Tx Database Editor;* (*see below)* and to select them for the Node B info field in the UMTS layer of the *Route Track* view.

The Node B info field is displayed by clicking the hot zone around a Node B sector symbol in the *Route Track* view. The info field indicates all selected parameters with their alias names and current values.

Creating a Data Base File

To create a new data base file (*.nbdb),

- In the *Database* panel, click *New* to open the *Create Database* dialog.
- Select a directory and enter a file name. The extension *.nbdb will be appended automatically.
- Click *Open* to create the file and close the *Create Database* dialog.

See also *Importing a BTS List File into the Data Base* below.

Importing a Node B List File into the Data Base

To import an existing Node B list file (*.atd, *.buf, *.txt, *.vig) into the data base,

- Ensure that an empty or non-empty data base file (*.nbdb) is available or create a *.nbdb file (see *Creating a Data Base File).*
- In the *Database* panel, click *Add Node B Files...*.
- In the file selection dialog opened, select the Node B list file.
- Click *Open* import the Node B list file.
- In the message box *Do you want to create a new database?* opened, click *No*.

The file import is terminated after you confirm the *Node B list successfully imported* message box. The new data extends the previous data base file.

Tx Database Editor

The *Tx Database Editor* dialog displays and modifies the entries in the current Node B list data base. It is opened by means of the *Edit* button in the *UMTS Node B List Database* tab.

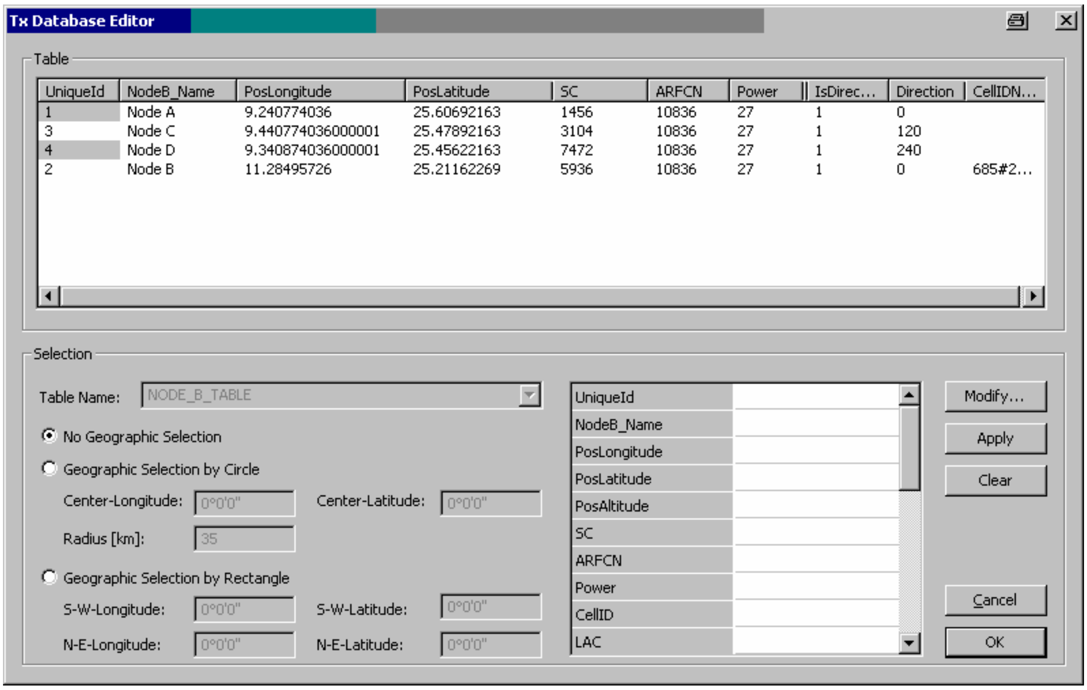


Fig. 3–20 Tx Database Editor

The *Tx Database Editor* is divided in an upper panel *(Table)* to sort and select Node B sectors and a lower panel *(Selection)* to modify a particular entry.

Table

The table in the upper part of the dialog lists the Node B sectors in the current data base file. The format of the SC depends on the settings made in the *UMTS Technology Settings* tab (see p. 3.91).

The table remains empty if no data base file is selected or if the current data base file contains no valid Node B sectors (e.g. because the import of a Node B list file failed).

Selection

The input fields below the table restrict the Node B selection in the table to Node Bs with a particular *UniqueID, NodeB:Name, PosLongitude* etc. or Node Bs in a particular geographic area. With no entries made, all Node Bs in the current data base file are displayed.

The buttons on the right side initiate the following actions:

Modify…

Open a dialog to edit the properties of the Node B selected in the upper table. The modifications update the Node B data base. As an alternative, it is possible to double click a line in the table.

Apply

Update the contents of the upper table according to the current filter condition.

Clear

Clear the current filter conditions.

Cancel

Discard all changes made and close the Tx Database Editor.

OK

Store all changes to the Node B data base and close the editor.

UMTS Technology Settings

The *UMTS Technology Settings* dialog defines the data format for the scrambling code. It is opened by means of the *Edit* button in the *GSM Node B List Database* tab.

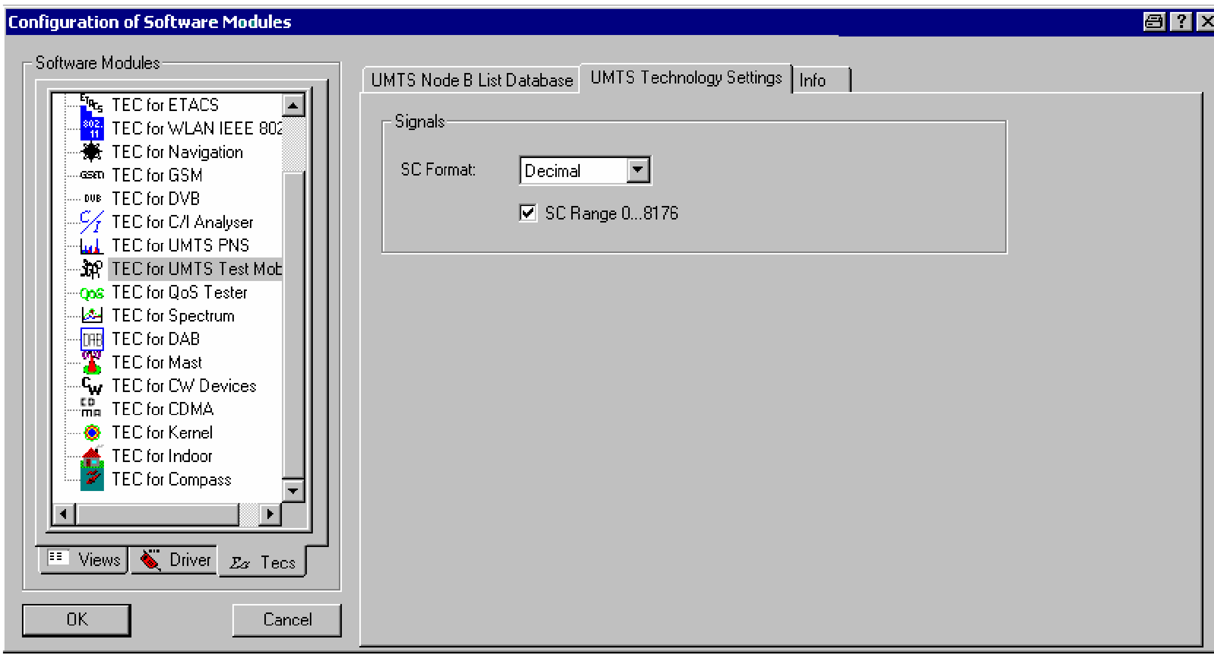


Fig. 3–21 TEC for UMTS Test Mobiles – UMTS Technology Settings

The settings are analogous to the settings in the *TEC for UMTS PNS* tab (see *SC Format* on p. 3.93), however, the SC format applies to the representation in the *Tx Database Editor*.

CDMA Technology

Clicking *TEC for CDMA* opens the *CDMA BTS List Database* tab to create, select or modify the *CDMA BTS List Database*, and to extend it by adding files.

The information of the *CDMA BTS List Database* must be stored in a .cndb (CDMA data base) file to be used internally. Data from the .cndb file can be exported to an ASCII BTS list file (*.txt); on the other hand it is possible to import Node B data from Node B list files in one of the formats (*.txt, *.atd, *asc) described in Chapter 7.

Note:

The CDMA BTS List Database tab is also accessible from the Database – CDMA BTS Database menu.

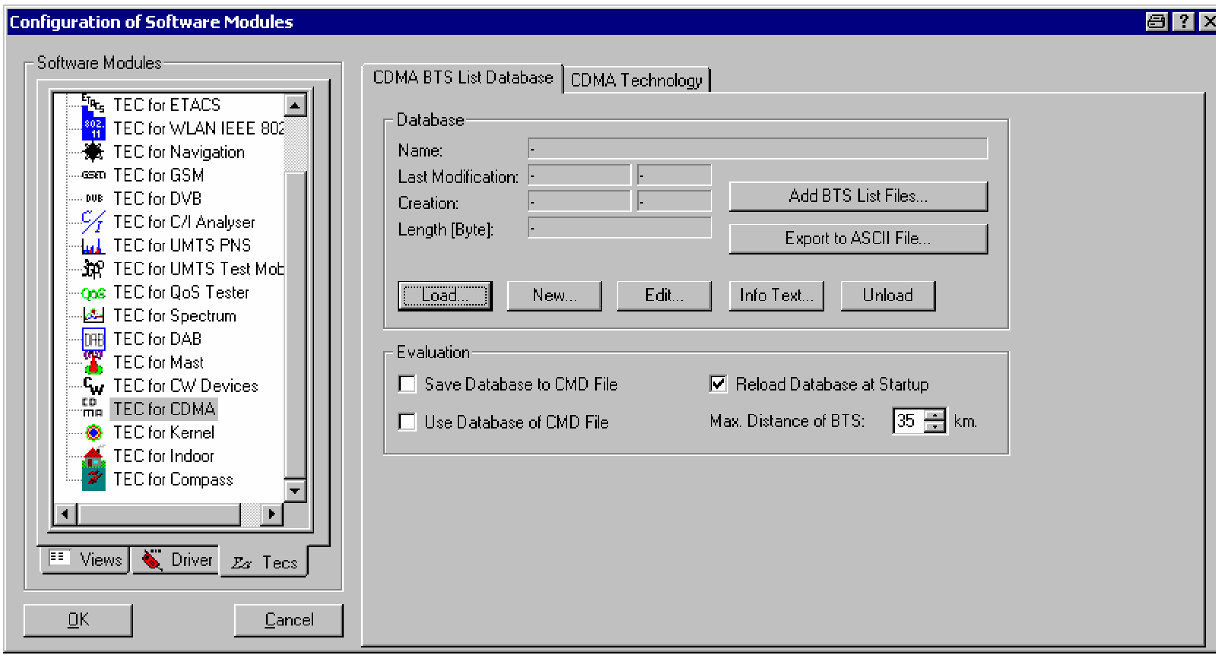


Fig. 3–22 TEC for CDMA – CDMA BTS List Database

The data base is handled in analogy to the UMTS data base described in section *UMTS Technology* on p. 3.88. In particular, the function of all controls in the *CDMA BTS List Database* dialog is identical to the corresponding UMTS controls.

TEC for UMTS PNS

The *UMTS Technology Settings* tab in the *TEC for UMTS PNS* dialog selects the number of signals that are displayed in the data trees and the data format of the scrambling code.

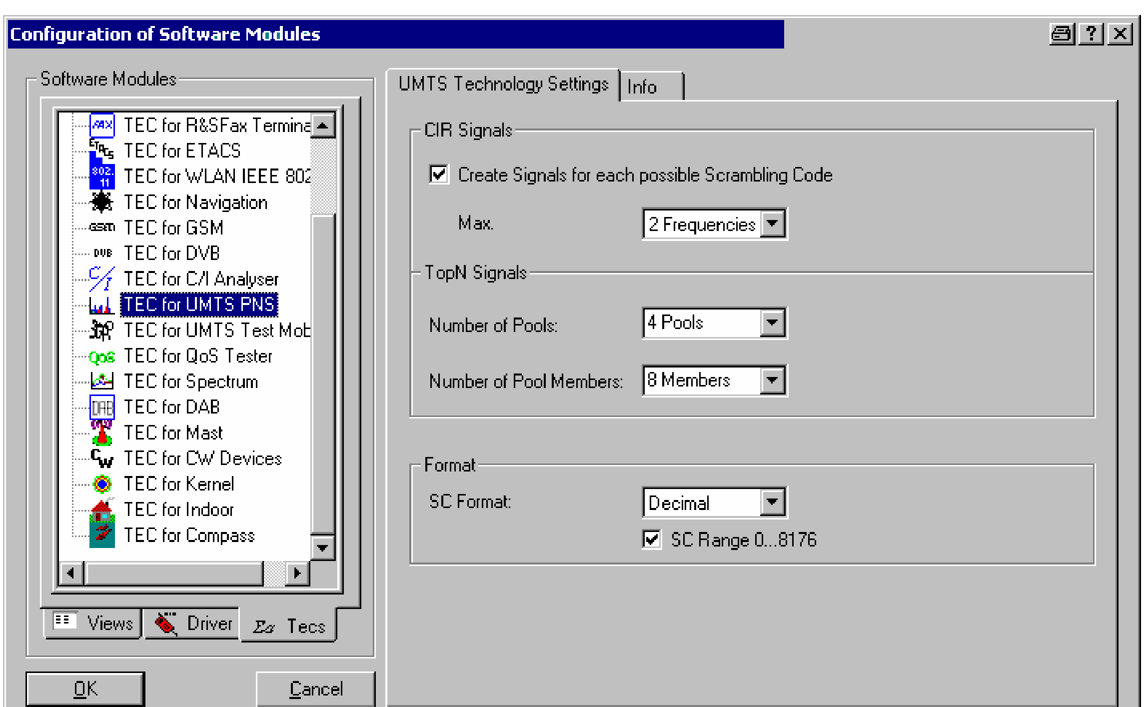
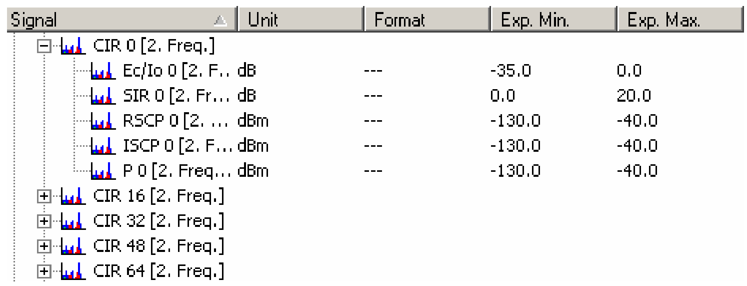


Fig. 3–23 Configuration of Software Modules – TEC for UMTS PNS

Create Signals for each Possible SC

If *Create Signals…* is checked, ROMES creates a signal for each of the 512 Primary Scrambling Codes allowed for the downlink UMTS signal and for the number of frequencies selected in the *Max.* drop-down list. The number of created signals is 512*n, where n denotes the selected number of frequencies.

The signals can be configured in the *Available Signals* tab of the *ROMES Configuration* menu (see p. 3.60 ff.) and analyzed in many generic views, e. g. the *2D Chart* view. The signals are displayed as follows:



Signal	Unit	Format	Exp. Min.	Exp. Max.
CIR 0 [2. Freq.]				
Ec/Io 0 [2. F..	dB	---	-35.0	0.0
SIR 0 [2. Fr…	dB	---	0.0	20.0
RSCP 0 [2. …	dBm	---	-130.0	-40.0
ISCP 0 [2. F…	dBm	---	-130.0	-40.0
P 0 [2. Freq…	dBm	---	-130.0	-40.0
CIR 16 [2. Freq.]				
CIR 32 [2. Freq.]				
CIR 48 [2. Freq.]				
CIR 64 [2. Freq.]				

CIR stands for the Carrier to Interference Ratio and the numbers 0, 16, 32, …, 8176 denote the SC. The signals are filled with data as soon as a measurement or replay session is started.

➢ To view signals conveniently, use the *Available Signals Drag & Drop* dialog described on p. 3.25.

Note:
To activate a changed signal configuration, ROMES must be closed and re-started.

Practical considerations

The number of signals leaves the test receiver driver configuration and the enabled options unchanged and therefore does not affect the measurement. In the replay session, however, a small number of displayed signals has several advantages:

- The data tree is easier to handle as unwanted signals are omitted.
- The performance is improved as less system resources are needed.

Omitting the CIR signals does not affect the functionality of the *UMTS PNS Views* described in Chapter 4.

Top N Signals

Defines the maximum no. of Top N pools and max. members per pool in the list of *Available Signals* (see section *Signal Configuration* on p. 3.60 ff.). the setting limits the signals that are available for display but has no impact on the Top N pools defined in the driver configuration menu.

SC Format

SC Format opens a drop-down list to select whether the Primary Scrambling Code in the signals and in the views (e. g. the *PNS CPICH View* described in Chapter 4) is displayed in decimal, octal, Hex small or Hex big format.

SC Range

According to standard 3GPP TS 35.213, the primary scrambling codes are numbered n = 16*i (i = 0 to 512), whereas the 15*512 numbers n = 16*i + k (i = 0 to 512, k = 1 to 15) are reserved for the optional secondary scrambling codes. This convention is used if *SC Range 0 … 8176* is checked.

In the alternative convention, the Primary Scrambling Codes numbers are divided by 16 and cover the range 0 to 511.

TEC for CW Devices

The *Number of Signals* panel in the *TEC for CW Devices* tab selects the number of CW test receiver signals that are displayed in the data trees (e.g. in the *Values* tab of the *2D Chart* configuration menu). This number leaves the test receiver driver configuration and the enabled options unchanged and therefore does not affect the measurement. In the replay session, however, a small number of displayed signals has several advantages:

- The data tree is easier to handle as unwanted signals are omitted.
- The performance is improved as less system resources are needed.

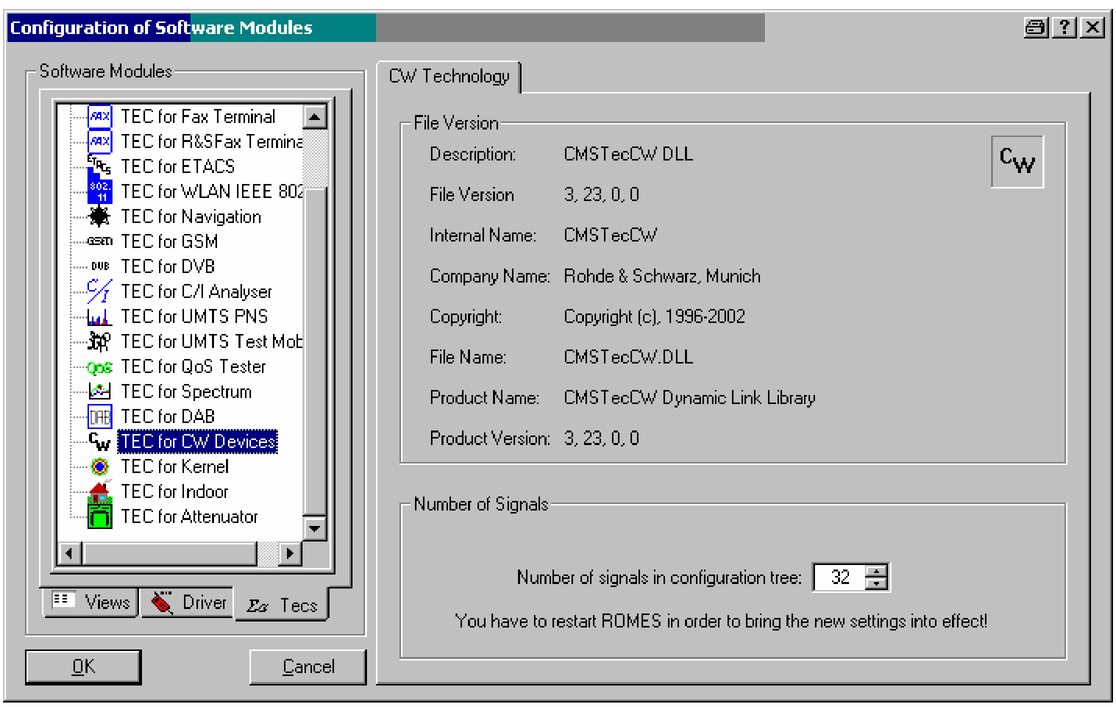


Fig. 3–24 Configuration of Software Modules – TEC for CW Devices

Measurement Menu

The *Measurement* menu starts and stops a measurement, starts and stops the replay of a measurement file and displays the list of event settings.

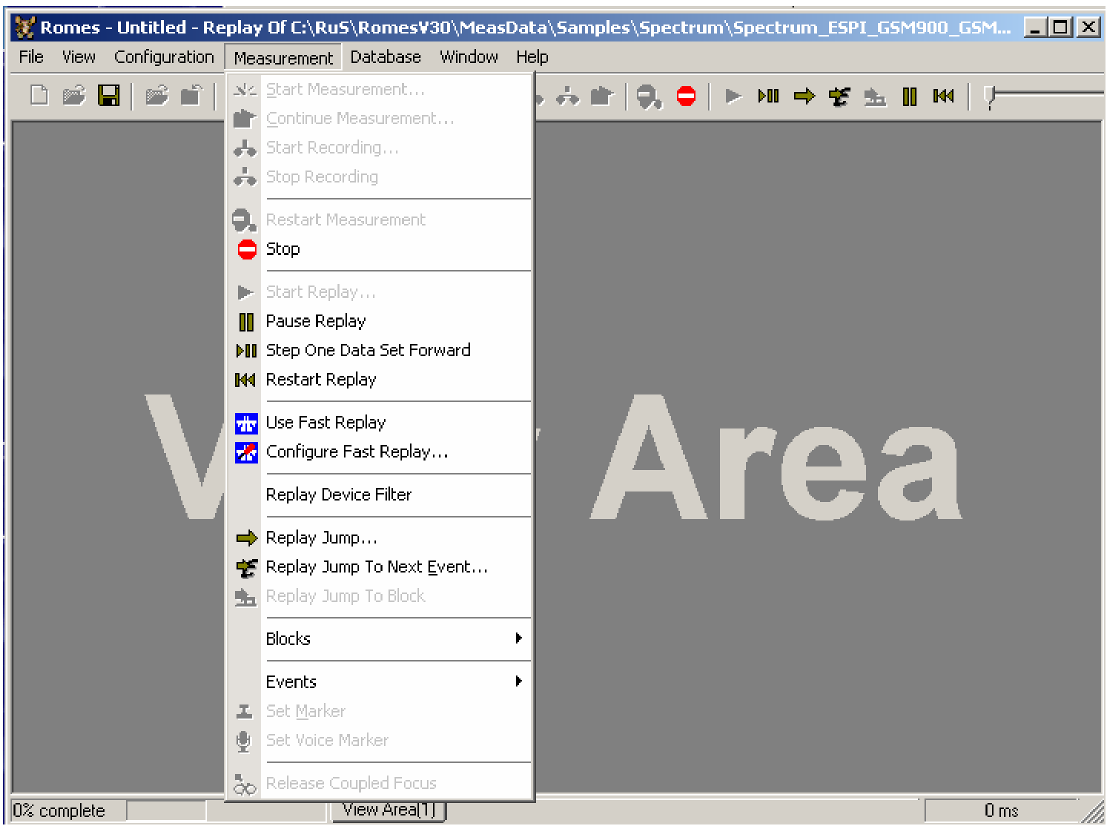
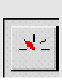


Fig. 3–25 Measurement menu

Start Measurement...



Starts the measurement without writing the data to a file.

A measurement can also be started with the *Start measurement* button on the measurement bar.

Note:
The Start Measurement command is disabled unless at least one device driver has been loaded using the Configuration – Hardware command.

Before the measurement starts, a temporary *measurement file* (extension *.cmd) must be defined. To this end, the *Open* window (see *Open Workspace* command) pops up and offers a list of already existing data files.

- ➢ Select one of the existing files to overwrite previous measurement data.
- ➢ Define a new measurement file if you do not want to overwrite any existing data.
- ➢ Press the *Open* button to open the selected/defined file for writing and return to the measurement, which will now start immediately.

With a temporary *.cmd file it is possible to switch over to *Recording* without delay while a measurement is running (see *Start Recording* command below). Otherwise, nothing is recorded and the temporary *.cmd file will be deleted after the end of the measurement.

Continue Measurement...

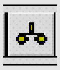
Continues a measurement, adding the data to a measurement file created earlier.

A measurement can also be continued with the *Continue measurement* button on the measurement bar.

Note:
Continue Measurement is enabled irrespective of the current screen and driver configuration. ROMES performs all necessary settings using the workspace information stored in the measurement file.

Continue Measurement opens a standard *Save As* dialog to select an existing measurement file. The file must contain workspace settings, i.e. it must be created with a ROMES version ≥ V3.50. To prevent data loss a backup version of the selected file is created and kept until the continued measurement is stopped. The backup can be disabled in the *General* tab of the *ROMES Configuration* menu (see section *General Settings* on p. 3.57 ff.).

Start Recording



Starts the measurement (if not yet running) and writes the data to a measurement file so that a replay of the results is possible later.

Data recording can also be started the *Start recording* button on the measurement bar. A measurement file (not temporary this time) must be defined as explained in the *Start measurement* command.

Note:
The Start Recording command is disabled unless at least one device driver has been loaded using the Configuration – Hardware command.

Start Recording creates a new block in the measurement file; see *Replay Jump To Block* below.

TIP

For ROMES versions ≥ V3.50 the current workspace settings are stored with the measurement file. A workspace recorded in a *.cmd file can be re-loaded using *Open Workspace* in the File menu.

Data recording rate:

The data recording rate depends on the number and kind of used devices and on the measurement settings.

Example:

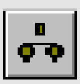
A system with two GSM mobiles in Normal *mode, using both the* Autodial *and* NQA *function, will roughly estimated generate 1 MB of data in about 20 minutes. To keep file handling easy, it is recommended to keep a limit of 1 MB to 1.5 MB per measurement data file. This offers also the advantage to save the files to floppy disks without using backup or compressing tools, which may be important for portable test case systems.*

> **Note:**
> *An exception is the time-triggered CW measurement recording raw data. Here, especially when only one channel is measured, the rate may rise up to 20 MB to 30 MB per hour. So take care of your disk storage capacity if you use a test receiver, and slow down the recording rate if possible without violating the test criterions - see also section Test receiver driver ESVx in chapter 6.*

Measurement file

The *Start Recording* command overwrites the current measurement (*.cmd) file, i.e. the file opened via the *File – Open CMD File...* command (see section *File Menu* on page 3.5 ff). If no measurement file has been selected yet, the *Open CMD File..* command is executed first, i.e. an *Open* window is called up.

Stop Recording

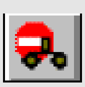


Stops data recording without stopping the measurement.

Data recording can also be stopped with the *Stop recording* button on the measurement bar.

Stop Recording terminates the current block in the measurement file; see *Replay Jump To Block* below.

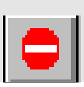
Restart Measurement



Stops the current measurement, requests the user-defined comment for the current measurement (if enabled) and the name for the new measurement *.cmd file, and then continues with the new measurement.

With long measurements, the risk of measurement data loss increases due to e.g. computer buffer problems. If a long mesurement is split into several segments using the *Restart Measurement* function, the data loss is limited to the current measurement segment.

Stop



Stops the measurement and data recording or the replay.

An ongoing measurement or replay can also be stopped with the *Stop* button on the measurement bar.

If *Ask for Comment after the Measurement* is enabled in the *ROMES Configuration* dialog (see section General Settings on p. 3.57 ff.), a user-defined comment can be stored with the measurement file header.

Status of the measurement

The measurement bar indicates the current status of the measurement:

Measurement disabled

All icons except *Continue Measurement* are grayed. *Continue Measurement* works with previously defined workspace settings. For all other icons, you have to load and configure your device drivers first.

This status is always active after starting ROMES.

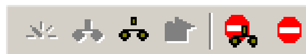
Waiting for measurement

Buttons 1 and 2 are enabled because no measurement is running. Click one of these icons to start a measurement and/or recording.

Measurement without recording

The measurement is running, as button 1 is disabled. As button 2 is still active, no recording has started yet. You can either start recording or stop the measurement.

Recording data



Finally recording has started. Click button 3 to stop the recording or button 4 to stop recording *and* measurement.

Start Replay

Loads a measurement file and replays it on the screen.

The replay mode can also be started with the *Start Replay* button on the measurement bar. If *Show Replay Control Dialog Automatically...* is selected in the ROMES Configuration dialog (see section *General Settings* on p. 3.57 ff.), *Replay* also opens the *Replay Control* dialog described on p. 3.22.

Hardware drivers

To replay a file, it is not necessary to load any device drivers. You only have to configure the desired views. The number of devices in the replayed file must not exceed the *Maximum Number of Devices* set in the *Advanced Settings* tab of the *ROMES Configuration* menu (see p. 3.71).

Measurement file

The *Replay* command replays the current measurement (*.cmd) file, i.e. the file opened via the *File – Open CMD File...* command (see section *File Menu* on page 3.5 ff). If no measurement file has been selected yet, the *Open CMD File...* command is executed first, i.e. an *Open* window is called up.

Note:
A replayed measurement file must not have the file attribute Read Only. To replay files from a CD-ROM the files must be copied to the hard disk or another appropriate medium and the file attributes must be changed.

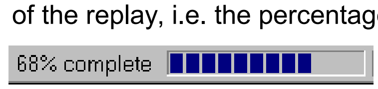
Monitoring the replay process

Two different tools are indicated while the measurement file is replayed:

- In the measurement bar, next to the icons controlling the replay mode, the *Replay Speed* is indicated on a marker bar with an arrow symbol:

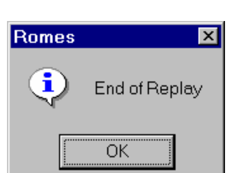
By default the measurement file is loaded at *Min* speed (arrow at the left end of the scale. The replay speed may be enhanced by dragging and dropping the arrow symbol on the marker bar to the right. Minimum and maximum speed depend on your system resources.

- In the left-hand part of the status bar a bar graph indicates the progress of the replay, i.e. the percentage of data already loaded.



End of the replay process

The end of the replay process is indicated by the message:



This message box must be closed via the *OK* button.

Pause Replay

Pauses (interrupts) the replay process.

A pause can also be initiated with the *Pause* button on the measurement bar. This function is available irrespective of the replay speed set. The replay process is resumed by pressing *Pause* again.

Status of the replay process

The measurement bar indicates the current status of the replay process:

No replay active

All icons are grayed except the *Start replay* icon. This is the status after starting the measurement system or after a replay was completed or stopped.

Replay running or paused

A measurement file is being replayed. You can now pause, jump to another position in the file, pause, or stop the replay. A paused replay can be continued by clicking the *Pause* icon again or stopped.

Step One Data Set Forward

Pauses (interrupts) the replay process after the next data frame.

A pause after the next data frame (i.e. the next time when data were recorded) can also be initiated with the *Step One Data Set Forward* button on the measurement bar. This function is available while a measurement file is being replayed. If applied repeatedly, it can be used to step through the measurement file and monitor the individual data frames recorded.

Restart Replay

Stops and re-starts the current replay process.

A restart can also be initiated with the *Restart Replay* button on the measurement bar. This function is available while a measurement file is being replayed. It corresponds to the command sequence *Stop – Start Replay.*

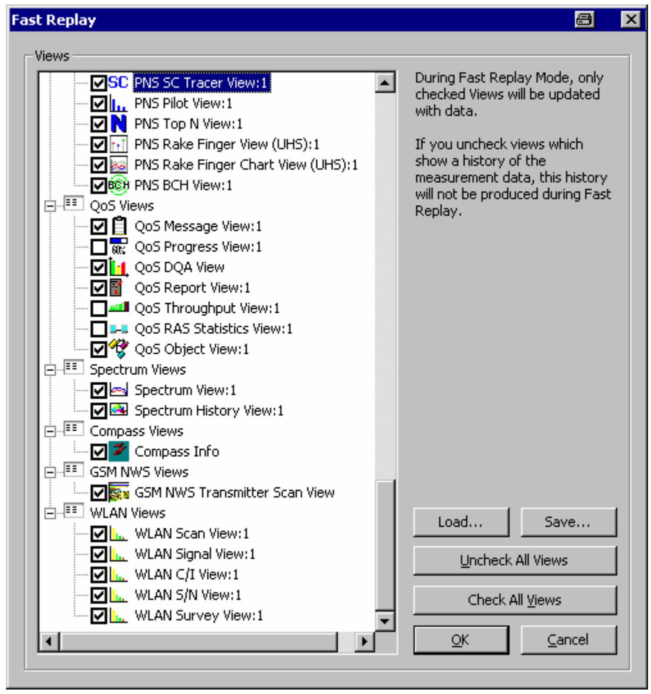
Use Fast Replay

Enables or disables the fast replay mode.

In the fast replay mode, the replay speed is enhanced because only part of the views are filled with data and continuously updated. The updated views can be selected via *Configure Fast Replay…* (see below). In the default configuration, views that show current values (e.g. the *Alphanumeric View)* are typically excluded from the replay; views that show the progression of signals (e.g. the *2D Chart View)* are included.

Configure Fast Replay…

Opens the configuration menu for the fast replay mode.



If the fast replay mode is active, only the views checked in the tree view are updated. If all views are checked *(Check All Views)*, the fast replay mode is effectively deactivated.

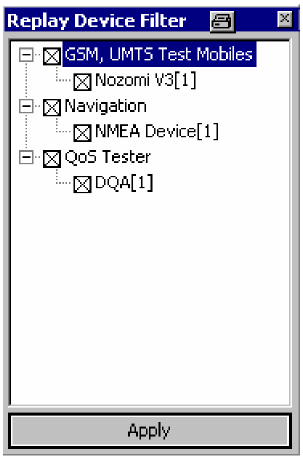
It is possible to store *(Save…)* the current fast replay configuration to a file and re-load *(Load…)* it in other ROMES sessions. Fast replay configuration files are ASCII files with the extension .fr.

TIP

You can select or de-select many views for fast replay using the context menu; see *Fast replay* in section *General View Properties* in chapter 4.

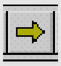
Replay Device Filter

Opens a selection dialog for the test devices in the replayed file.



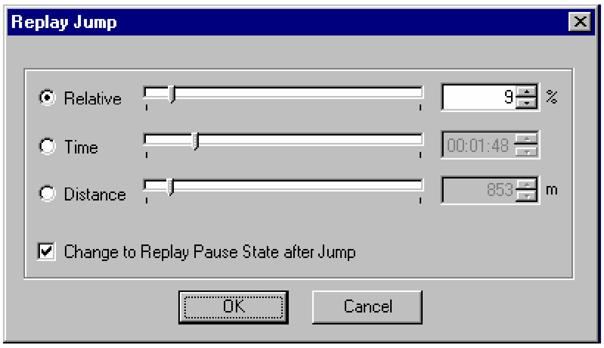
The *Replay Device Filter* dialog shows the test devices of the currently replayed measurement file. If no measurement file is open, it shows the devices of the last file replayed. Measurement data from unchecked devices is excluded from the replay. The dialog is updated each time a new measurement file is loaded.

Replay Jump



Jumps forward and backward in the measurement file.

A replay jump can also be initiated with the *Replay Jump* button on the measurement bar. The *Replay Jump* window is opened:



The current position within the measurement file, the current measurement time, and the current driven distance is indicated in the three fields to the right of the *Relative/Time/Distance* radio buttons. The position of the arrows on the marker bar corresponds to the relative time needed to replay the file up to this position/the time relative to the total measurement time/the current distance relative to the total distance.

After selecting one of the three parameters *Relative/Time/Distance,* the current position in the measurement file can be changed by overwriting the value in the field, by incrementing/decrementing the indicated value with the up/down buttons on the right side, or by dragging the arrow across the marker bar.

Measurement files are recorded such that a later measurement time corresponds to a later file position of the measurement data. The *Replay Jump* function can therefore be used to select a particular stage of the measurement tour.

If the *Change to Replay Pause State after Jump* box is checked, the replay is paused after the jump; otherwise, it will be continued.

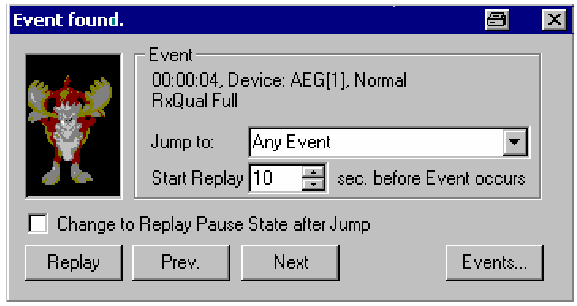
TIP

In many views it is possible to initiate a replay jump to a particular timestamp in the measurement file; see *Replay jump to timestamp* in section *General View Properties* in chapter 4.

R. Jump To Next Event

Jumps forward to the next event in the measurement file.

A event jump can also be initiated with the *Event Jump* button on the measurement bar. The *Jumping... Event found* window is opened:



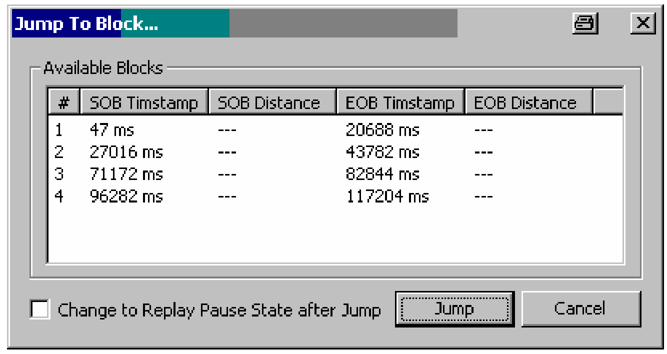
The events to be searched for must be defined in the *Available Events* tab of the *ROMES Configuration* menu (see section *Event Configuration* on p. 3.63 ff.) before the replay is started. The event found is indicated in the *Event* panel, together with its time stamp in the measurement file and the name of the measuring device.

Jump to	List of events, according to the current Event Configuration.
Start Replay…	Defines the start time of the Replay to be initiated after a particular event is found.
Replay	Closes the Event found window and resumes the replay session, refreshing the contents of all views. The replay is paused or re-started at the Start Replay… time, depending on whether Change to Replay Pause… is enabled or disabled. At the end of the file, the Replay button is replaced by Close, the title bar of the window indicates End of File.
Prev. / Next	Jumps to the previous or to the next event in the measurement file. This button is disabled if no event is found.
Events...	Opens the *Available Events* tab of the ROMES Configuration menu to change the current event selection. This button is disabled if no event is found.

Replay Jump To Block

Jumps to a block in the measurement file.

A event jump can also be initiated with the *Block Jump* button on the measurement bar. Recording is interrupted and the *Jump to Block* dialog is opened:



Note:

Replay Jump to Block is only enabled if a measurement file recorded with ROMES V3.22 or higher containing several blocks is replayed. The blocks must be defined during the measurement using the Blocks submenu; see below. A new block is defined each time that recording is started (Start Recording). Stop Recording closes the current block. A name can be assigned to each block if this feature is enabled in the ROMES Configuration dialog; see section General Settings on p. 3.57 ff.

The blocks in a measurement file can be exported separately; see description of data export in chapter 8.

The *Jump to Blocks* dialog displays a complete list of the blocks in the replayed measurement file. Each block is characterized by the timestamp for the start (SOB) and end of the block (EOB). An SOB and EOB distance is available in addition if the *Trigger Box* is used for the measurement (see chapter 6).

Jump Jumps to the selected block and closes the dialog. The replay is resumed or pauses at the start of the selected block, depending on whether Change to Replay Pause State after Jump box is checked. Jump is disabled if no block is selected in the list.

Cancel Closes the dialog without any further action.

Blocks

Opens a submenu to define blocks within a measurement file.

The *Blocks* submenu is enabled only while a measurement is running. The menu commands *Start Block* and *Close Block* define the start and end of a block, respectively. *Discard Current Block* is enabled after *Start Block.*

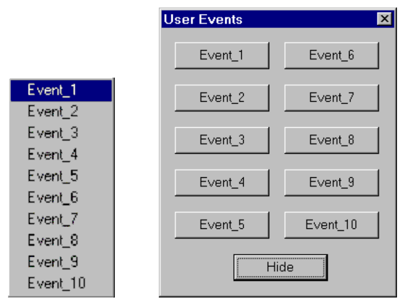
Blocks represent a useful navigation tool within the replayed measurement file; see *Replay Jump to Block* above.

Events

Triggers a user-defined event which is stored in the measurement file currently recorded.

A list of up to 10 user event types is shown in a pop-up list displayed on the right of the *Measurement* menu as soon as the cursor is placed on the *Events* command line. This menu is equivalent to the *User Events* menu opened via the corresponding icon in the measurement bar. Both menus are enabled only during measurement recording. The event names *Event_1* to *Event_10* can be changed via the *Configurations – Preferences* command, see *Event Configuration* on p. 3.63 ff.

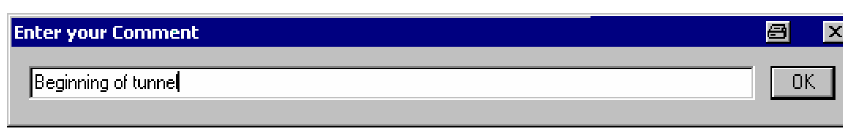
Event_1 Triggers an event of type Event_1 and includes it in the measurement data.



Set Marker

Triggers a comment event to be included in the recorded measurement file.

The purpose of the comment event is to include written information into the measurement file that is related to a particular time or position. The comment is entered into a popup window after *Set Marker* is activated.



Set Marker is enabled after *Start Recording.* For *Comment Event* configuration refer to p. 3.66.

Set Voice Marker

Triggers or stops a voice marker event to be included in the measurement file.

The purpose of the voice marker event is to include a spoken comment into the measurement file that is related to a particular time or position. After *Set Voice Marker* is activated, the *On Air* message in the status bar indicates that ROMES is ready for recording the comment spoken into a connected microphone:

At the end of the comment, click *Set Voice Marker* again to continue the measurement. *Set Voice Marker* is enabled after *Start Recording.* For *Voice Marker Event* configuration refer to p. 3.67.

Please note that the measurement recording cannot be stopped unless the Voice Marker is closed or disabled.

Release Coupled Focus

Releases the coupled focus between several views (see p. 3.4).

Database Menu

The *Database* menu offers a command for creating or modifying the GSM BTS data base that can be used for GSM measurements as well as for the GSM Carrier-to-Interference (C/I) analysis (with option ROMES-GS) and the UMTS Node B database.

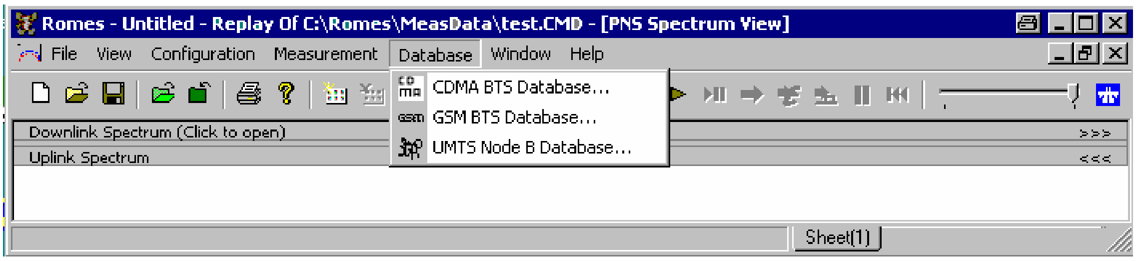


Fig. 3–26 Database menu

CDMA BTS Database

Open the *TEC for CDMA* dialog.

The *TEC for CDMA* dialog is used to create or modify a CDMA BTS List data base. It is identical with the dialog opened by means of the *Configuration – Settings* command; see section *CDMA Technology* on p. 3.91.

GSM BTS Database

Open the *TEC for GSM* dialog to create or modify a GSM BTS data base.

The *TEC for GSM* dialog is identical with the dialog opened by means of the *Configuration – Settings* command; see section *GSM Technology* on p. 3.81.

UMTS Node B Database

Open the *TEC for UMTS Test Mobiles* dialog.

The *TEC for UMTS Test Mobiles* dialog is used to create or modify a UMTS Node B data base. It is identical with the dialog opened by means of the *Configuration – Settings* command; see section *UMTS Technology* on p. 3.88.

Window Menu

The *Window* menu offers commands for arranging and handling the view windows and shows a list of all open views.

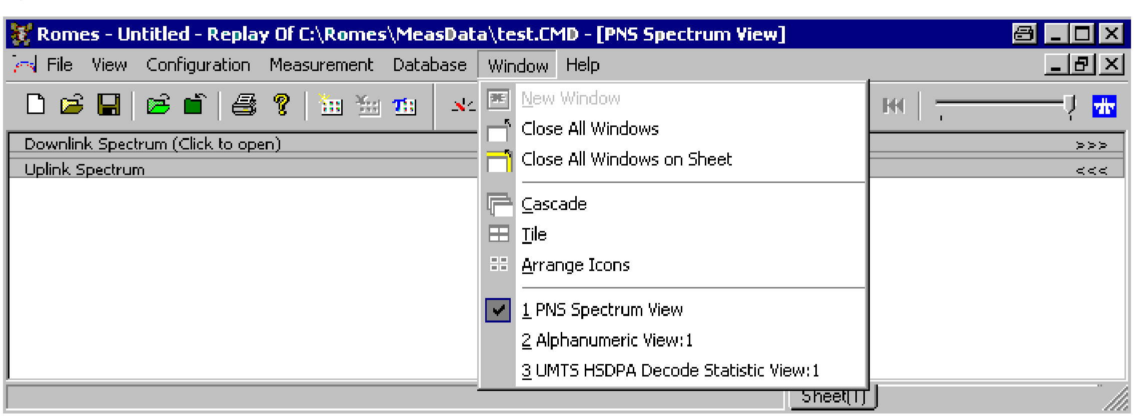


Fig. 3–27 Window menu

New Window

Create a new view of the same type as the active window.

The *New Window* command is enabled for multiple view types. Those types are characterized by a current number behind the view title (e.g. *Measurement Report View: 1).* The *New Window* is also available in the context menu associated to multiple views.

Close All Windows

Close all windows on all worksheets.

Close All Windows on <S>

Close all windows on the worksheet named <S>.

Cascade

Superimpose all open view windows showing each one's title bar. The active window is placed in the foreground.

Tile

Place all open view windows side by side so that they don't overlap.

Arrange Icons

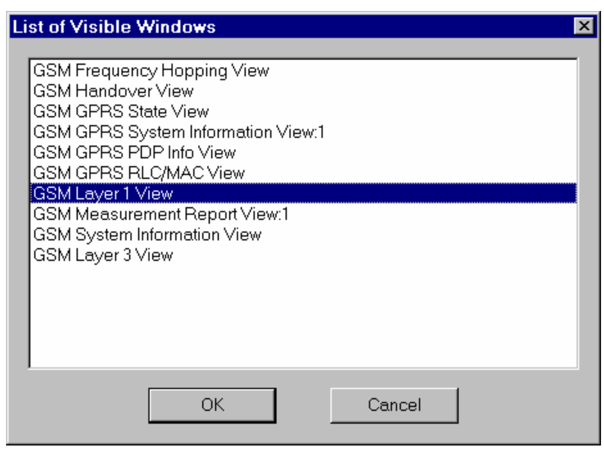
Arrange the icons for minimized windows across the bottom of the main window.

An open window located at the bottom of the main window may cover and hide some or all of the icons.

1 <ViewName> View

List of all open view windows.

A view selected in the list is activated and appears in the foreground, if the *Cascade* display option is selected. If more than 10 views are available, the last entry, *All Window*, opens a popup window showing all open windows.



A view that is selected in the *List of Visible Windows* appears in the foreground and is moved on top of the list.

Help Menu

The *Help* menu provides online help and general information about the measurement system.

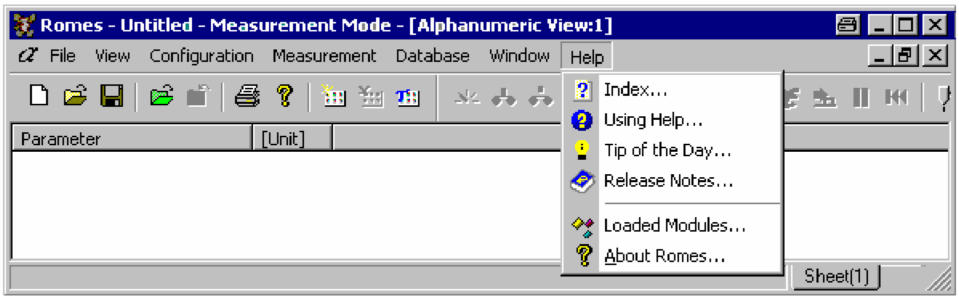


Fig. 3–28 Help menu

Index

Opens the online help.

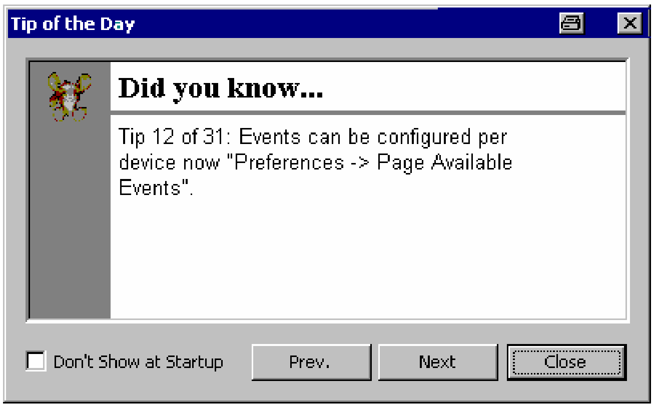
From the opening screen, navigation tools such as a table of contents, index of keywords, and hyperlinks will help you quickly find all information needed for using the measurement system.

Using Help

Opens a help topic on the online help. The online help system itself is accessible from the help page.

Tip of the Day

Opens the *Tip of the Day* window.



The *Tip of the Day* is a small window that displays a new tip each time ROMES is started. These tips are a convenient way to learn more about what you can do in the program. If you do not want the Tip of the Day to display the next time you start the program, select the *Don't Show at Startup* check box.

Loaded Modules

Opens the *Loaded Modules* dialog showing all software modules available in the current ROMES installation.

Detailed information on the modules can be obtained by clicking on a module name.

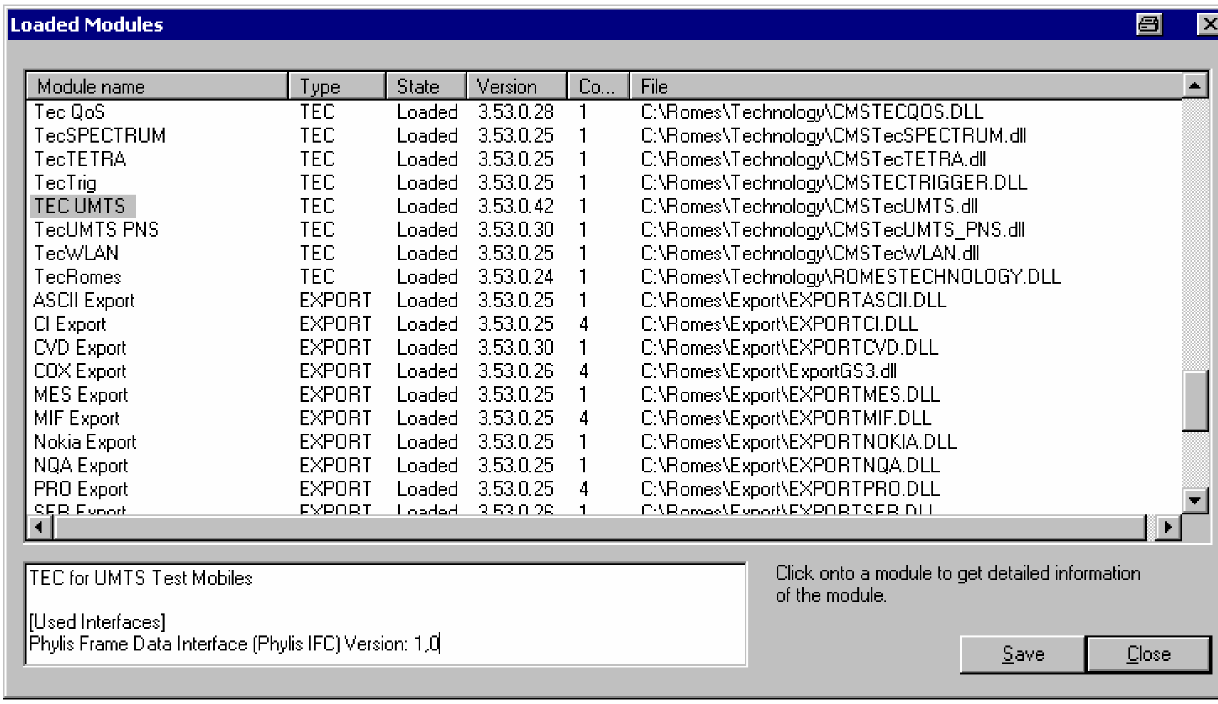
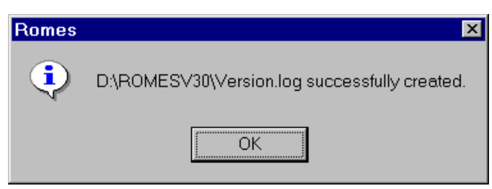


Fig. 3–29 Loaded Modules dialog

Save Writes the module list shown in the *Loaded Modules* dialog to a text file. The name and directory of the file are shown in a popup window.



Close Closes the *Loaded Modules* dialog.

TSMx Installation

Opens the *TSMx Installation* dialog showing all TSMx-related software modules available in the current ROMES installation.

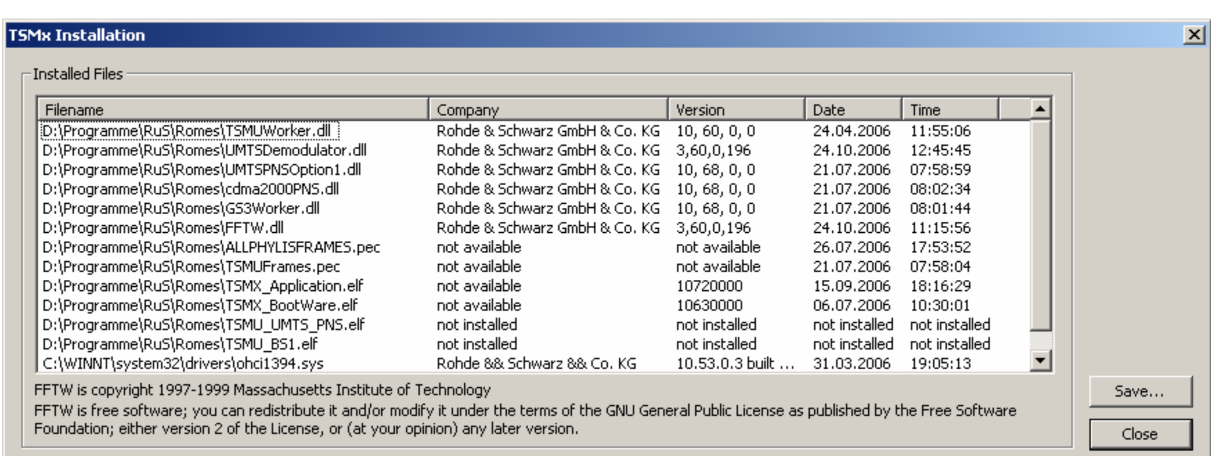


Fig. 3–30 TSMx Installation dialog

Save Writes the module list shown in the *TSMx Installation* dialog to a text file. The name and directory of the file are shown in a popup window.

Close Closes the *TSMx Installation* dialog.

About ROMES

Displays the ROMES startup window indicating the name and version number of your ROMES copy.
In addition the window provides a selection of useful URL links.

Contents

4 Display and Evaluation of Results 4.1

General View Properties 4.1

C/I Analyser Views 4.6

Basic Views 4.7

Alphanumeric View 4.7

Alphanumeric View Configuration 4.9

2D Chart View 4.11

2D Chart View Configuration: Values Tab 4.14

2D Chart View Configuration: Chart Configuration 4.15

Statistic Histogram View 4.17

Statistic Histogram View Configuration 4.20

Event View 4.22

Message View 4.23

General Status View 4.28

General Status View Configuration 4.29

Polar View 4.30

Polar View Configuration 4.32

Navigation Views 4.33

GPS Info 4.34

GPS Info Configuration 4.36

Route Track 4.37

Route Track Configuration 4.41

Route Track Configuration: Values Tab 4.41

Route Track Configuration: Route Tracking Tab 4.41

Route Track Configuration: Archive Tab 4.44

Route Track Configuration: Technology Modules Tab 4.45

Bitmap Handling and Positioning (Calibration) 4.46

Cursor modes 4.46

Raster image map 4.47

Positioning softkeys 4.48

Bitmap positioning 4.48

Entry of coordinates 4.48

GSM BTS Layer Configuration 4.51

Configuration 4.51

UMTS Layer Configuration 4.56

CDMA BTS Layer Configuration 4.63

CDMA 1xEV-DO BTS Layer Configuration 4.69
C/I Layer Configuration 4.74

2G/3G Views 4.75

UMTS HSDPA Views 4.75
UMTS HSDPA UL HS-DPCCH View 4.77
UMTS HSDPA HS Decode Status View 4.78
UMTS HSDPA HARQ Statistic View 4.81
UMTS HSDPA HARQ Statistic View Configuration 4.82
UMTS HSDPA Configuration View 4.83
UMTS HSDPA MAC Configuration View 4.87
UMTS HSDPA MAC Status View 4.89
UMTS HSDPA MAC Status View Configuration 4.91
UMTS HSDPA MAC Header View 4.91
UMTS HSDPA MAC Header View Configuration 4.93
UMTS HSDPA Performance View 4.94
UMTS HSDPA Performance View Configuration 4.97
UMTS HSDPA Decode Statistic View 4.97
UMTS HSDPA Decode Statistic View Configuration 4.99

UMTS Views 4.100
UMTS Finger Data View 4.101
UMTS Finger Data View Configuration 4.103
UMTS Layer 1 View 4.104
UMTS Layer 1 View Configuration 4.107
UMTS CellSet View 4.108
UMTS CellSet View Configuration 4.110
UMTS NAS Status View 4.111
UMTS TrCH View 4.114
UMTS TrCH View Configuration 4.116
UMTS Physical Channels View 4.117
UMTS Physical Channels View Configuration 4.120
UMTS SIB View 4.121
UMTS RLC/MAC View 4.123
UMTS RLC/MAC View Configuration 4.125
UMTS Measurement Report View 4.125
UMTS Reselection View 4.127
UMTS Reselection View Configuration 4.129
UMTS Power Control View 4.130
UMTS Layer 1 Graph View 4.132
UMTS Neighborhood Analyzer View 4.132
UMTS/GSM Neighborhood Analyzer View Configuration 4.137

1xEV-DO Views 4.141
1xEV-DO Pilot Set View 4.141
1xEV-DO Pilot Set View Configuration 4.144
1xEV-DO Overview View 4.146

1xEV-DO Link View....4.150
1xEV-DO Performance View 4.155
1xEV-DO Performance View Configuration 4.158
1xEV-DO Airlink Summary View....4.159
1xEV-DO Airlink Summary View Configuration....4.162
1xEV-DO Forward Statistic Summary View....4.163
1xEV-DO Forward Statistic Summary View Configuration....4.164
1xEV-DO PN Grid View 4.165
1xEV-DO PN Grid View Configuration 4.167
1xEV-DO RLP Statistics View....4.168
CDMA Views 4.170
CDMA Overview View....4.171
CDMA Overview View Configuration....4.174
CDMA Pilot View....4.175
CDMA Pilot View Configuration....4.177
CDMA Finger View....4.179
CDMA Power View....4.180
CDMA Searcher View 4.181
CDMA Frame Error Rate View....4.182
CDMA Vocoder Rate View....4.184
CDMA Vocoder Rate View Configuration....4.185
CDMA Markov Statistic View 4.186
CDMA PN Grid View 4.187
CDMA PN Grid View Configuration....4.189
GPRS Views....4.190
Mobiles to provide GPRS Parameters 4.190
GSM GPRS State View....4.191
GSM GPRS System Information View....4.192
GSM GPRS PDP Info View....4.192
GSM GPRS RLC/MAC View....4.194
GSM GPRS RLC/MAC View Configuration....4.198
GSM GPRS TS/CS View 4.199
GSM GPRS TS/CS View Configuration 4.200
GSM GPRS RLC/MAC Header View....4.201
GSM GPRS/EGPRS View 4.203
GSM GPRS RLC MAC Release Indicators View....4.206
GSM GPRS RLC MAC Release Indicators View Configuration....4.207
GSM Views....4.207
GSM Layer 1 View 4.208
GSM Layer 1 View Configuration 4.209
GSM Layer 2 View 4.210
GSM Layer 2 View Configuration 4.211
GSM Measurement Report View 4.212
GSM Measurement Report Configuration....4.214
GSM System Information View 4.215

GSM System Information Configuration 4.216

GSM Handover View 4.217
GSM Handover View Configuration 4.218

GSM Frequency Hopping View 4.219
GSM Scan View 4.221
GSM Scan View Configuration 4.223

GSM SMS View 4.223
GSM CBCH View 4.225
GSM QoS View 4.226
GSM QoS View Configuration 4.228

GSM Dedicated 3G Cell List View 4.229
GSM Dedicated 3G Cell List View Configuration 4.231

GSM Idle 3G Cell List View 4.232
GSM Idle 3G Cell List View Configuration 4.234

GSM RR 3G Reselection Measurements View 4.235
GSM RR 3G Reselection Measurements View Configuration 4.236

GSM Rejected 3G Cells View 4.237
GSM Rejected 3G Cells View Configuration 4.239

GSM RR 3G Reselection Measurements Parameters View 4.240
GSM Neighborhood Analyzer View 4.243
GSM Neighborhood Analyzer View Configuration 4.247

UMTS/GSM NQA State View 4.249

UMTS/GSM Handover Analyzer View 4.252
UMTS/GSM Handover Analyzer View Configuration 4.258
2G/3G Layer 3 View 4.259
2G/3G Layer 3 View Configuration 4.261
2G/3G NQA View 4.271
2G/3G NQA View Configuration 4.272
2G/3G ETSI QoS View 4.273
2G/3G ETSI QoS View Configuration 4.276

CW Views 4.278

CW Info View 4.279

ETACS Views 4.280

ETACS Signaling View 4.281

ETACS Scan View 4.281

Indoor Views 4.283

Indoor View 4.284
Indoor View Configuration 4.287
Indoor Measurement Control 4.288

DVB Views 4.291

DVB DVQ Meter View 4.292

DVB DVQ Meter View Configuration....4.293
DVB EFA-T Status View....4.294
DVB EFA-T Status View Configuration....4.295
DVB EFA-T CIR View....4.296
DVB EFA-T CIR View Configuration....4.297
DVB Atlas View....4.298
DVB EFA-T ATSC Histogram View....4.300
DVB EFA-T Amplitude Distribution View....4.302
DVB EFA-T CCDF View....4.303
DVB EFA-T Echo Pattern View....4.306

UMTS PNS Views....4.307

PNS P-SCH View....4.308
PNS P-SCH Configuration....4.309
PNS CPICH View....4.310
PNS CPICH Configuration....4.315
PNS Spectrum View....4.317
PNS Spectrum Configuration....4.319
PNS Spectrum History View....4.320
PNS Spectrum History Configuration....4.321
PNS SC Tracer View....4.323
PNS SC Tracer Configuration....4.326
PNS Pilot View....4.328
PNS Pilot Configuration....4.330
PNS Top N View....4.331
PNS Top N Configuration....4.334
PNS Rake Finger View....4.335
PNS Rake Finger View Configuration....4.336
PNS Rake Finger Chart View....4.337
PNS Rake Finger Chart View Configuration....4.339
PNS BCH View....4.341
PNS BCH View Configuration....4.342

QoS Views....4.343

QoS Message View....4.344
QoS Progress View....4.344
QoS DQA View....4.348
QoS Report View....4.349
QoS Report View Configuration....4.352
QoS Throughput View....4.354
QoS Throughput View Configuration....4.356
QoS RAS Statistics View....4.357
QoS Object View....4.358

SQA Message View 4.359

Spectrum Views 4.364

Spectrum View 4.365

Spectrum Configuration 4.367

Spectrum History View 4.368

Spectrum History Configuration 4.370

Compass Views 4.371

Compass Info 4.372

GSM NWS Views 4.373

GSM NWS Transmitter Scan View 4.374

GSM NWS Frequency Reuse Views....4.375

GSM NWS Frequency Reuse View – Co Channel Interferer....4.376

GSM NWS Frequency Reuse View – Co Channel Interferer Configuration 4.379

GSM NWS Frequency Reuse View – Adj. Channel Interferer 4.381

GSM NWS Frequency Reuse View – Event List....4.382

GSM NWS Frequency Reuse View – Event List Configuration 4.384

GSM NWS Top N View 4.385

GSM NWS Top N Configuration 4.388

WLAN Views 4.389

WLAN Scan View 4.390

WLAN Scan View Configuration 4.392

WLAN Signal View 4.394

WLAN C/I View 4.395

WLAN S/N View 4.396

WLAN Survey View 4.397

WLAN Survey View Configuration 4.400

CDMA2000 PNS Views 4.401

PNS F-PICH View 4.402

PNS F-PICH Configuration 4.405

PNS F-SYNC View 4.408

PNS F-SYNC Configuration 4.410

PNS Time Line Estimation View....4.411

4 Display and Evaluation of Results

This chapter describes how to display and analyze the data measured or stored in a measurement file and replayed. Data selection and configuration of the view properties is performed in the *Configuration of Software Modules* menu opened via the *Settings* command in the *Configuration* menu. The view configuration menus are also accessible from the individual view menus (click the right mouse button and select *Configure...* from the popup window). The view windows can be called up in the *View* menu.

For an overview of all menus and menu commands refer to chapter 3.

General View Properties

The views are optimized for different data types from different sources and therefore vary in appearance and functionality. In spite of the differences, some properties are common to many or all views.

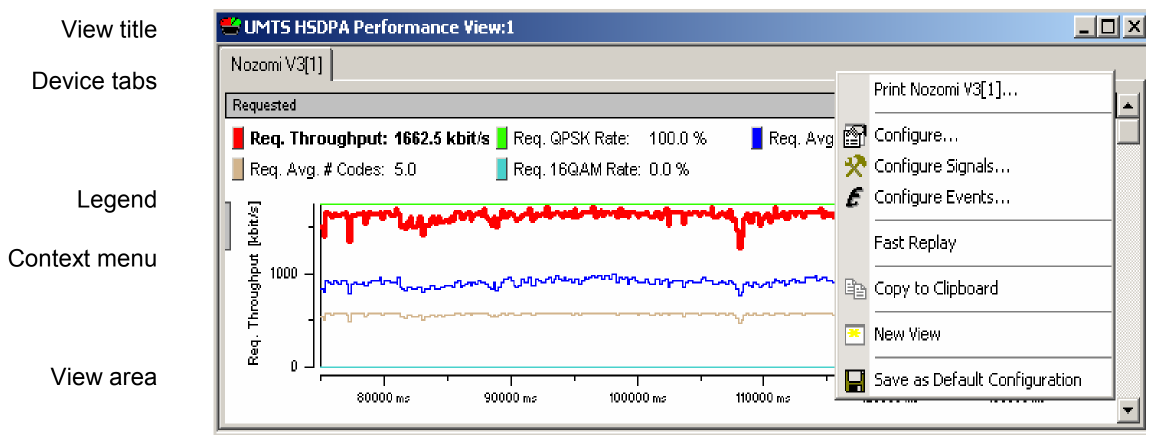


Fig. 4-1 General view properties

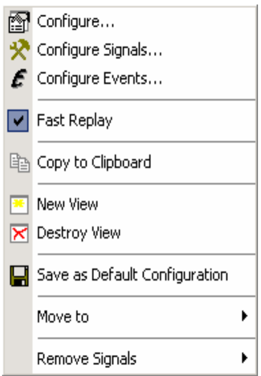
View title The title bar contains the name of the view and three icons to minimize, maximize and close the view. A sequence number *(: 1)* behind the name indicates that it is allowed to open several views of the same type.

Device tabs Many views are divided into separate tabs to display the data originating from different test devices (e.g. different test mobiles, receivers etc.). A mouse click on a tab places it into the foreground.

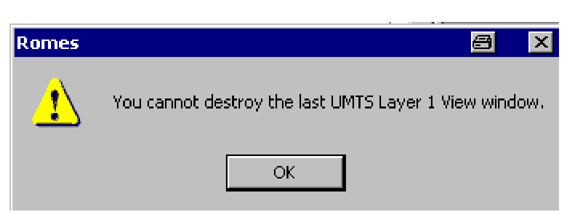
The device tabs in all open views are coupled: Selecting a device tab in any one view activates the same tab in all other views. The *Control* key disables this coupling mechanism.

Context menu

Most views provide a context menu to access typical configurations and perform actions. A right click on a point anywhere in the view area opens the context menu. The following context menu commands are often used:



Print ...	Opens the Print menu to print the contents of the view or a part of it. A preview of the pages to be printed is accessible via the Print preview command in the File menu, see chapter 3.
Configure…	Opens the configuration menu associated with the view; see below.
Configure Signals	Opens the Available Signals tab of the ROMES Configuration menu (see chapter 3) to configure the signals available for viewing.
Configure Events	Opens the Available Events tab of the ROMES Configuration menu (see chapter 3) to select the signal events to be recorded during the measurement and configure additional *User Events* and *Comment Events*.
Fast Replay	Select or de-select the current view for the fast replay mode. If *Fast Replay* is disabled the view is not updated when a measurement file is replayed. To select arbitrary views for fast replay use *Measurement – Configure Fast Replay…*
Copy to Clipboard	Copy a screenshot of the current view to the clipboard in order to paste it into another application.
New View...	Opens an additional view of the same type. A practically unlimited number of views can be opened at the same time. Views of the same type are distinguished by the current number in the title bar (e.g. the 1 in Fig. 4-1) indicating the order in which they have been created.
Destroy View...	Deletes the active view with its contents. New View can not restore a deleted view. A workspace must contain at least one view of each type, so *Destroy View...* is disabled for the last view of each type. ROMES generates a warning:



Save as Default Configuration	Save the current configuration of the view to an ASCII file named *Master.rms* in the Workspace subdirectory of ROMES program directory. The configuration comprises everything that is defined in the configuration menu associated with the view, including the selected signals. The default view configuration is used whenever a new view of the same type is created, irrespective of the current workspace. It is changed when a new default configuration is saved; it is reset by deleting the configuration file *Master.rms*.
Move to	Move the view to one of the worksheets to be selected in the submenu (see description of worksheets at the beginning of chapter 3). This command is not available if the current workspace contains only one sheet.
Remove Signals	Opens a secondary context menu with all signals selected to be displayed. Clicking a signal removes it from the *Selected Param.* list. *Remove Signal* is not shown when the *Selected Param.* list is empty.

Configuration menu

Most views are associated with a configuration menu that can be opened from the context menu. The configuration menus provide view-specific settings.

Each configuration menu contains an *Info* tab listing information on the current view version.

The *Info* tabs include the *Custom Name* field, which has no function in a view context. It is only useful in a driver context, where different connected devices can be associated with different custom names, e.g. for separate mobiles in different networks, or when simultaneously operated mobiles perform different tasks.

The *Info* tabs are analogous for all view types and will be omitted in the following.

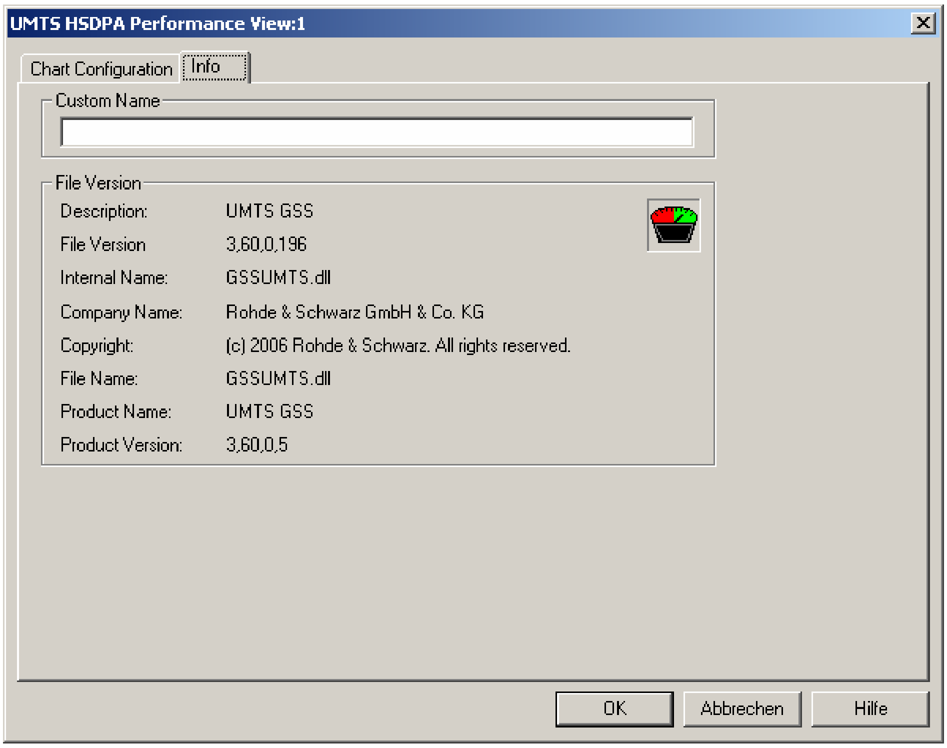


Fig. 4-2 Info tab

Replay jump to timestamp

In many views (e.g. the *GSM/UMTS Layer 3 View, 2D Chart View, Route Track View etc.)*, it is possible to initiate a replay jump to a particular message, event, or characteristic position spotted in the view (in general, to a particular timestamp in the message file). This type of replay jump must be initiated during a replay pause. The replay is continued at the selected timestamp.

To initiate a replay jump to a timestamp (e.g. in the *GSM/UMTS Layer 3 View)*, proceed as follows:

1. Open the view, replay a measurement file *(Measurement – Replay* or) and pause the replay *(Measurement – Replay Pause* or).

2. Keep the *Ctrl* key on your keyboard pressed.

A clock symbol is added to the cursor icon.

3. Double-click a particular message.

The screen is refreshed. After clicking *Measurement – Replay Pause* or again, the replay starts with the message selected in the last step.

Coupled Focus

Many views provide graphical tools to highlight special areas and read a particular result. The focus in several views can be coupled, which makes it easier to analyze different aspects of a coverage measurement at a particular position using a set of appropriate views. For details see description of the coupled focus at the beginning of chapter 3.

C/I Analyser Views

The *C/I Analyser Views* display and evaluate the results of a Carrier-to-Interference analysis performed by means of options PCSD-K6/-K7. C/I Analyser Views are empty if no C/I analysis is performed or if the measurement file replayed contains no C/I analysis data.

The *C/I Analyser Views* can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *C/I Analyser Views*.

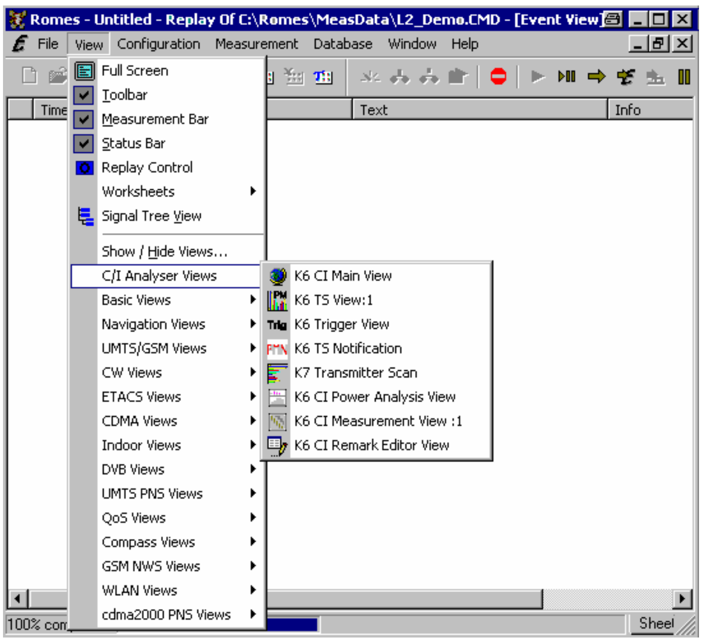


Fig. 4-3 C/I Analyser Views

The Carrier-to-Interference analysis is described in chapter 5.

Basic Views

The *Basic Views* can be used to analyze data from various sources. Basic views are available irrespective of the kind of measurement performed or of the type of measurement data replayed.

Click the icon *in the measurement bar and use the* Available Signals Drag & Drop.. *dialog to display signals in the basic views.*

The *Basic* views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *Basic Views*.

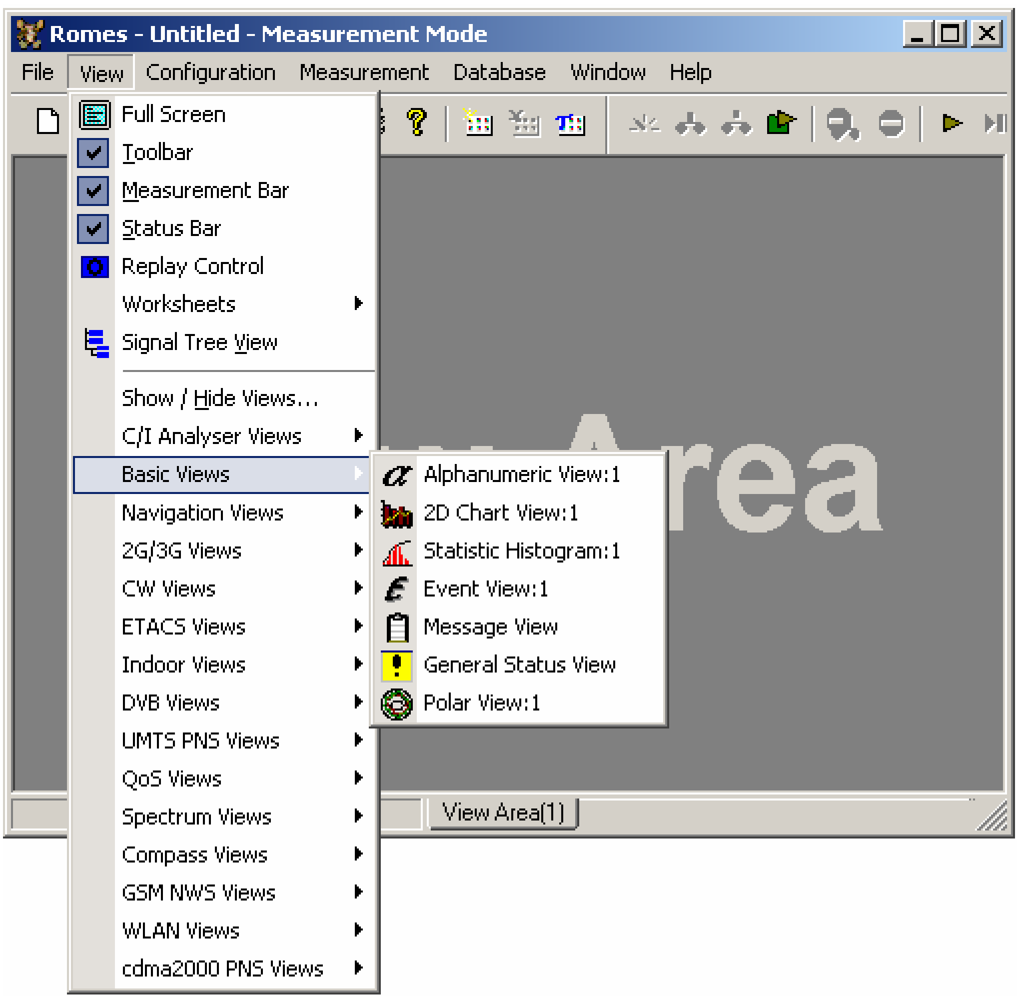


Fig. 4-4 View – Basic menu

Alphanumeric View

The *Alphanumeric View* displays current values of the signals selected in the corresponding configuration menu. The values are continuously updated while the measurement or replay session is going on.

Example for several devices:

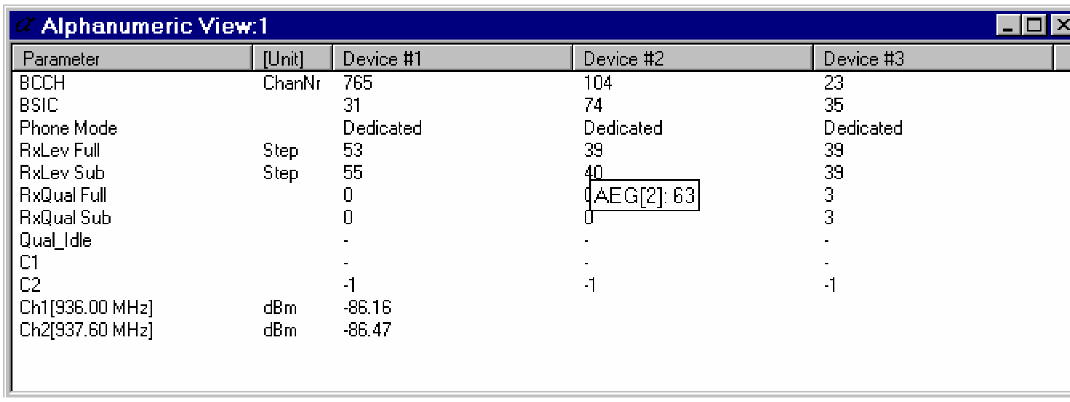


Fig. 4-5 Alphanumeric View

In the *Alphanumeric View,* signals from different measurement devices (e.g. from different GSM or CDMA devices) are displayed in different columns. If only mobile phone parameters are viewed, the device name for each column is unambiguous and therefore indicated in the table heading.

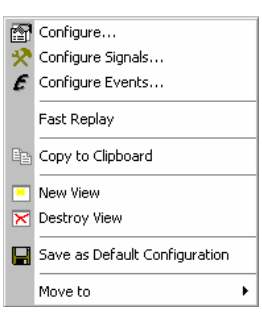
Device parameters from other technologies, e.g. from test receivers or GPS receivers, are always displayed in the first column. If the first column contains parameters from several devices, the table headings read *Device #1, Device #2* etc. The device for each parameter value can still be obtained: It is indicated in a yellow popup window as soon as the pointer is placed on the parameter value; see *Fig. 4-5* above.

After clicking a parameter (or selecting a group of parameters using the shift or control keys), it is possible to change the order or remove the parameters from the view.

Note that the *Serving Cell* name can only be displayed if a correct BTS list is provided. In this case, also the distance to the BTS will be displayed (example: BTS1 (2.6 km)).

Context menu

A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.



Alphanumeric View Configuration

The *Alphanumeric View* configuration menu defines the signals to be viewed, sets the display colors, and shows information on the current view version. It is opened via a right mouse click on a point inside *Alphanumeric View* or via the *Configuration – Settings* command (see chapter 3).

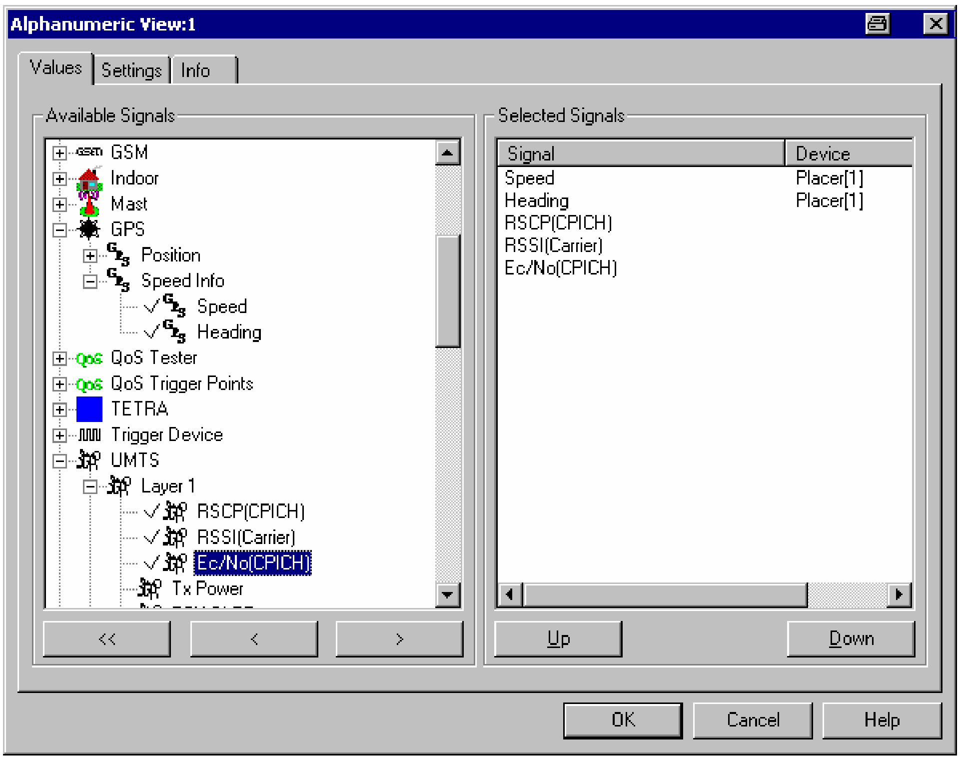


Fig. 4-6 Alphanumeric View: Configuration

The *Values* tab is analogous to the *Values* tab of the 2D Chart View configuration menu, see Fig. 4-10 on p 4.14. The devices for many signals are also indicated in the *Selected Signals* list.

Some comments concerning the signals are in order:

C/I In the *GSM Measurement Report,* the *C/I* parameter provides a rough estimate for the carrier-to-interference ratio. The quantity is calculated according to the formula:

$$C/I = \frac{1}{4.41} \text{RxLevF} \times \text{RxQualF} \; ; \quad 0 \le C/I \le 100$$

Large *C/I* values indicate that the signal quality is low although the received signal level is rather high. The reason might be an interferer situation. C/I is useful to obtain hints about possible interferences but can not take the place of a detailed carrier-to-interference analysis performed with PCDS-K6.

DTX In the *GSM Server Report*, the *DTX* parameter indicates the current DTX mode of the GSM mobile station (uplink DTX). The *GSM System Information View* and the detailed information in the *UMTS/GSM Layer 3* view show the DTX mode that the network commands the mobile station to use *(shall* or *shall not* or *may use DTX)*. Downlink DTX can be detected indirectly; see section *GSM Measurement Report View* on page 4.212.

The *Settings* tab defines the colors for the text and the background. A colored background or text makes it easier to distinguish when a signal value changes.

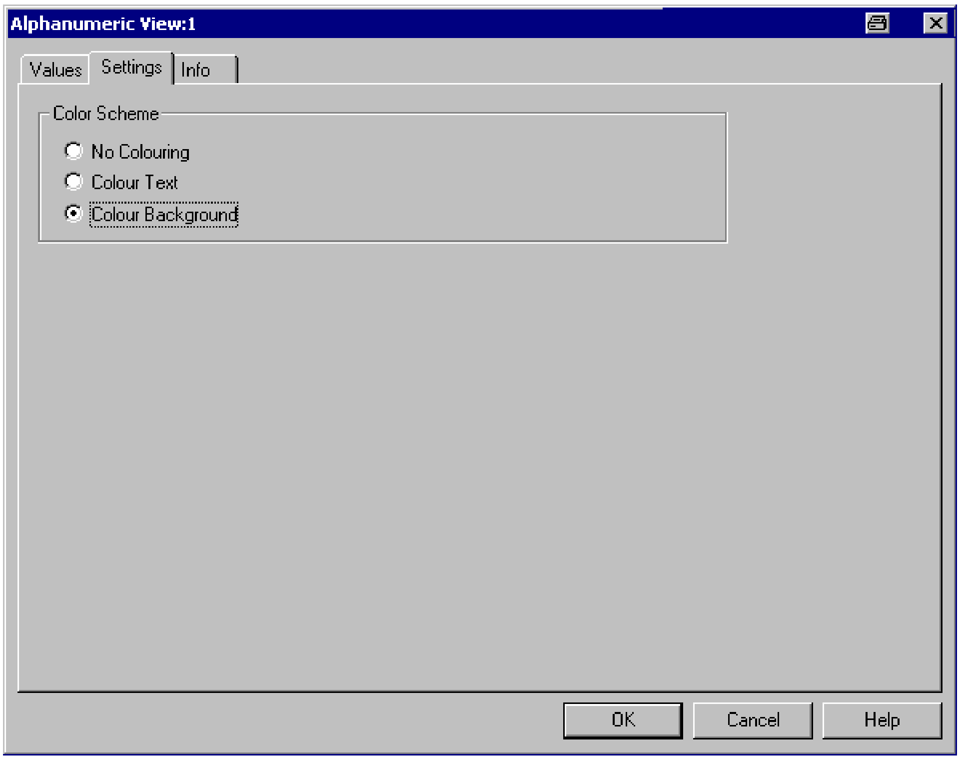


Fig. 4-7 Alphanumeric View: Configuration

2D Chart View

A *2D Chart View* contains a Cartesian diagram showing one or several signals as a function of time. If a signal for which no data is available is selected (e.g. RxQual while the mobile is in *Scan(ning)* mode), no trace is plotted. As an alternative to superimposing many quantities in the same diagram, ROMES allows to open several independent diagrams simultaneously.

To complement the *2D Chart View*, the *Statistic Histogram View* (see p. 4.17*)* provides a statistical evaluation of a signal.

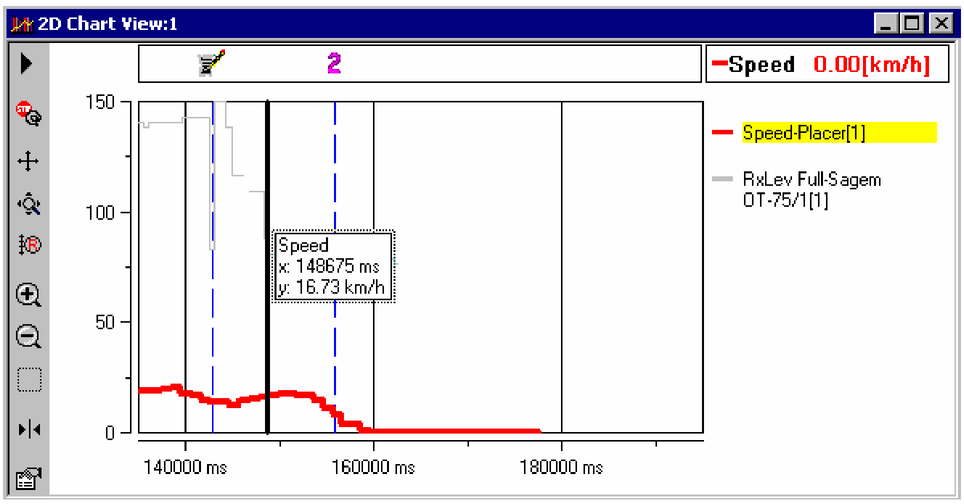


Fig. 4-8 2D Chart View

Diagram

The diagram may contain a selected curve (the signal, the mobile type, and the current value is shown in the legend to the right of the diagram) plus a practically unlimited number of secondary curves. The curves are step functions with different line colors; the selected curve is distinguished by its line width. In addition to the curves, events (represented by the icons shown in the *Available Events* tab of the ROMES configuration menu, see chapter 3) can be displayed.

The time information stored in the measurement file provides the x-axis scaling. If the measurement data is recorded with a trigger device (see section *Test Receiver Drivers* in chapter 6), it is possible to select the distance driven between the individual data points as x-axis scale. This is done in the *Chart Configuration* tab of the configuration menu, see *Fig. 4-11* on page 4.15.

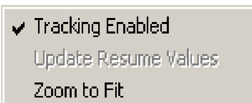
The y-axis is scaled by the value range of the selected curve (many signals provide a "natural" scale, e.g. the RxLev step scale of a GSM mobile is between 0 and 63). To display the scale of a secondary curve, this curve can be selected in the legend.

TIP

To change the y-axis scale manually, you can use the tools across the left diagram edge. Alternatively, open the Available Signals *tab in the* ROMES Configuration *menu* (Configuration – Preferences *or* Configure Signals… *in the context menu) and adjust the expected minimum and maximum value* (Exp. Min, Exp. Max) *of the signal. Manual scaling is particularly useful if the actual value range of a signal (or its range of interest) is considerably smaller than its "natural" scale (e.g. if only small signal levels are measured).*

The curves are plotted from the left to the right at the pace of the measurement or replay. If the end of the display range is reached while the measurement or replay is still going on, the whole diagram is shifted to the left so the curves can be continued. This may occur repeatedly until the end of the measurement file is reached.

Context menus for the axes



The context menus of the axes (opened upon a right-click) provide additional scaling options for the diagram:

- *Tracking* means that the axes are dynamically scaled so that the current measurement results fit into the diagram. See also *Signal Tracking* on p. 4.16.
- *Zoom to Fit* adjusts the scale of the axes so that the entire measurement curve fits into the diagram.
-

Legend

The legend to the right of the diagram shows all signals in the current *2D Chart View* together with their display color, the type and current number of the test device. The selected signal appears on a colored background. The ordinate is labeled with the range of the selected signal, the corresponding curve is highlighted.

The signal selection is defined in the configuration menu, see below.

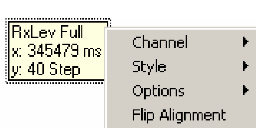
Events and Title

The two fields above the diagram and the legend show the displayed events and the signal and current value of the selected curve, respectively.

Marker

If the marker symbol in the toolbar is clicked, a marker line and a info field is displayed. The marker line and the info field can be shifted horizontally and vertically using a drag and drop mechanism.

Info Field

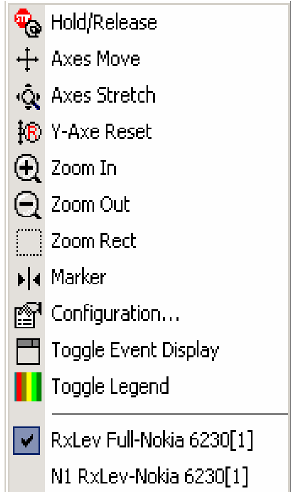


In the default configuration the info field shows the plotted signal of the selected curve, the marker position, and the signal value. The contents and position of the info field can be changed in the associated context menu (right-click):

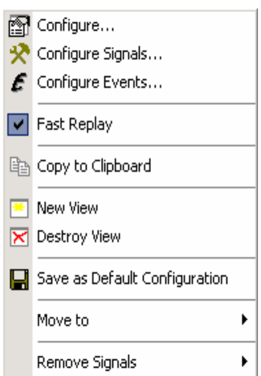
- *Channel* selects one of the displayed signals for evaluation.
- *Style* selects the marker style (single line for absolute marker values, two lines for ranges) and the displayed values (x, y, distances, frequencies within an interval).
- *Options* configures the display options (color, visibility only while the marker line is clicked).
- *Flip Alignment* changes the relative position of marker line and info field.
-

Tool Bar

The tool bar to the right of the diagram provides scaling tools for the diagram, displays or hides the marker line, opens the configuration menu, and displays or hides the headings and the legend. The right arrow symbol on top of the tool bar opens a context menu with a short description of each icon.



Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, move to another worksheet, or remove signals; see *Context menu* description on p. 4.2.

Phone Mode of a GSM or UMTS mobile in a 2D-chart view

The *Phone Mode* signal shows the GSM RR (Radio Resource) modes and the UMTS RRC (Radio Resource Control) states of a mobile phone. It is convenient to view the phone mode in a 2D-chart view, e.g. to monitor the periodic attempts to set up a connection while the test mobile operates in *Autodial* mode. The phone mode can be selected from the *GSM – <device> – Server Report* branch of the signal tree. The *CELL DCH* RRC state corresponds to the GSM *Dedicated* state.

The phone mode is also displayed in the *UMTS/GSM NQA State View* described on p. 4.249.

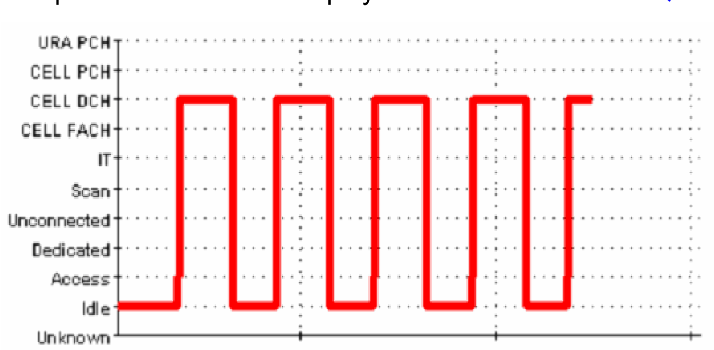


Fig. 4-9 UMTS phone mode during autodial

2D Chart View Configuration: Values Tab

The *2D Chart View* configuration menu defines the signals to be viewed and shows information on the current view version. It is opened via a right mouse click on a point inside *2D Chart View* or via the *Configuration – Settings* command (see chapter 3).

The *Values* tab selects the signals to be displayed. *Fig. 4-10 below* shows some of the signals provided by a GPRS mobile phone.

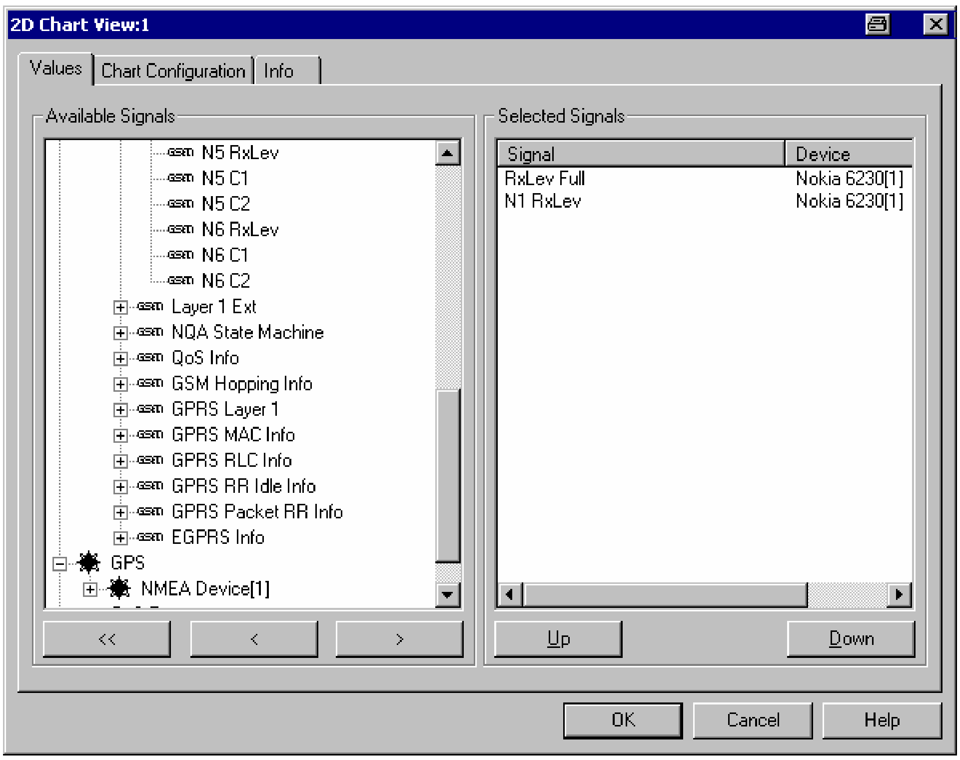


Fig. 4-10 2D Chart View: Parameter selection

Available Signals Data tree (see chapter 1) showing all available signals (hierarchy level 4 of the data tree).

- To select a single signal for display, left-click this signal (which will be highlighted in inverse video) and click the > button. Alternatively, double-click the signal.
- Select a parent node of higher hierarchy level (level 1, 2, or 3) and click > if you wish to select all signals below the node.

Selected Signals List of all signals selected for display.

- To remove a single signal from the list, left-click this signal (which will be highlighted in inverse video) and click the < button. Alternatively, double-click the signal or use the *Remove Signal* command in the view context menu.
- To remove all signals at once, click the << button.

The order of the list can be changed using the two buttons below. This order is relevant especially if the list contains more signals than can be displayed in the 2D Chart View, see *2D Chart View* tab below.

2D Chart View Configuration: Chart Configuration

The *Chart Configuration* tab scales the axes of the chart and defines its contents and its appearance.

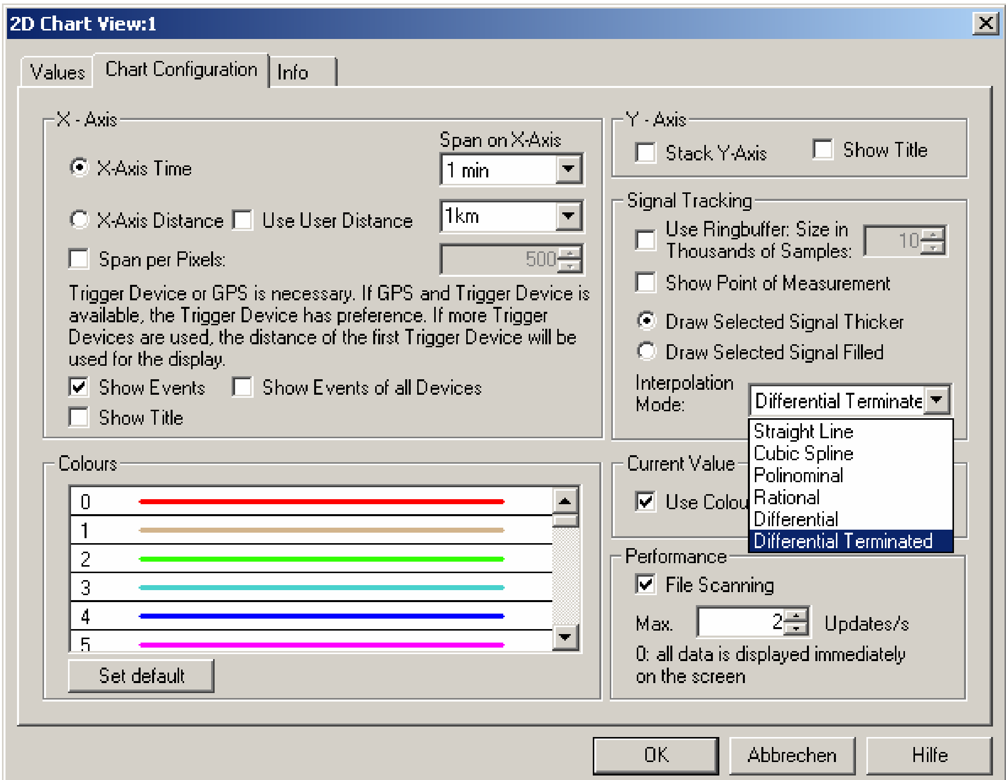


Fig. 4-11 2D Chart View: configuration

X-Axis: Time/Distance/ Pixels

The *X-Axis* panel contains two alternative option buttons to scale the x-axis by the time or distance information stored with the measurement data. A distance information is available only if the measurement data is recorded with a trigger device (see section *Test Receiver Drivers* in chapter 6). If *X-Axis Distance* is selected but no trigger is available, ROMES will not generate the *2D Chart View* but display the message:

as soon as the measurement or replay is started.

The *User Distance* is a generalized distance signal with a finite number of marker points where the distance values may jump and/or change their direction. Unlike the real distance the *User Distance* is a composite signal that globally does not have to be continuous and monotonically increasing or decreasing. For test receivers, user distance signals can be generated using the options in the driver configuration menus (see chapter 6).

The time interval or distance corresponding to the full x-axis scale of the *2D Chart View* can be selected from the two pull-down lists *Span on X-Axis* located in the right half of the *X-Axis* panel.

Span per Pixels sets the diagram width to a fixed number of pixels.

Event and title display

- *Show Events* and *Show Events of all Devices* display or hide the events above the diagram (equivalent to the *Toggle Events* icon in the toolbar).
- *Show Title* shows or hides the x-axis title (only visible if the view is high enough).
-

Colors

The colors of up to 699 signal curves can be defined in the *Colors* menu opened on double-clicking a field in the *Colors* panel (see p. 4.322). The *Set default* button resets all colors to their default values.

Y-Axis

- *Stack Y-Axis* displays the y-axis scales for all selected signals. This setting is effective only if more than one signal is selected.
- *Show Title* shows or hides the y-axis title (only visible if the view is high enough).
-

Signal Tracking

The *Signal Tracking* settings modify the display of the measurement curve:

- The *Ring Buffer* can be used to limit the number of samples to be displayed in the view. The ring buffer size defines a moving window with a definit number of values. Clear the check box to display the entire set of measurement data.
- *Show Point of Measurement* displays a dot at the position of each measurement point on the curve.
- *Draw Selected Signal Thicker* increases the line width of the selected curve.
- *Draw Selected Signal Filled* fills the area below the selected curve with the color of the curve.

The *Interpolation Mode* for the selected signal can be specified using the listbox with supported interpolation modes. Possible modes are *Straight Line*, *Cubic Spline*, *Polynomial*, *Rational*, *Differential*, and *Differential Terminated* (default).

Current Value

If the check box is on, the current value of the selected curve above the diagram is displayed with the colors of the color scale. If the check box is cleared the current value is black.

Performance

Limits the maximum update rate of the view results. An update rate of 0 means that every new result causes an immediate update of the view (not recommended for performance reasons).

OK

Apply all *2D Chart View* settings and close the configuration menu.

Cancel

Discard all *2D Chart View* settings and close the configuration menu.

Statistic Histogram View

A *Statistic Histogram View* provides several diagrams to show a statistical evaluation of a signal. If an invalid signal is selected (e.g. RxQual while the mobile is in *Scan(ning)* mode), the diagrams remain empty. ROMES allows to open several independent *Statistic Histogram Views* simultaneously.

The *Statistic Histogram View* is a complement to the *2D Chart View* (see p. 4.11*)* where the actual values of different signals are displayed.

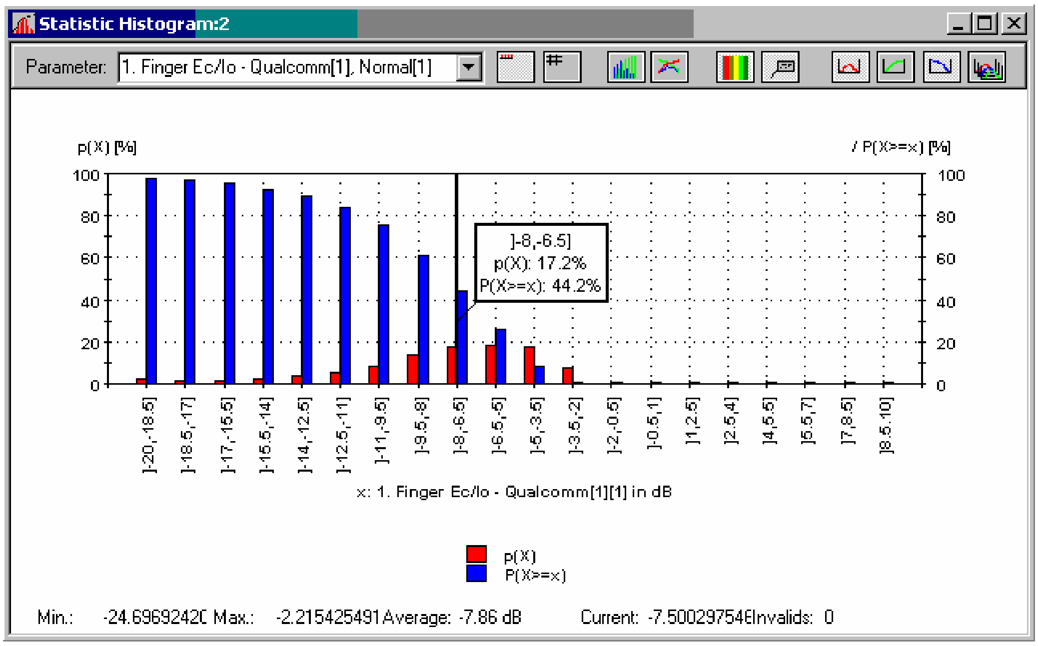
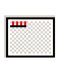
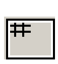


Fig. 4-12 Statistic Histogram View

Diagram / Table

The diagram or table shows the distribution of the signal values. The available signals appear in the *Parameter* pull-down list after they have been selected in the configuration menu. The two icons to the right of the *Parameter* list choose between a diagram or a table:

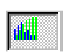
 The values are displayed in a diagram

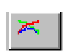
 The values are displayed in a table. The following table corresponds to the bars in Fig. 4-12:

	Qualcomm[1]	
1. Finger Ec/Io in dB	%	#
]-20,-18.5]	1.9%	55
]-18.5,-17]	2.6%	74
]-17,-15.5]	3.6%	102
]-15.5,-14]	2.5%	70
]-14,-12.5]	3.4%	95
]-12.5,-11]	4.9%	138
]-11,-9.5]	8.1%	229
]-9.5,-8]	17.9%	506
]-8,-6.5]	15.5%	440
]-6.5,-5]	16.2%	458
]-5,-3.5]	15.9%	449
]-3.5,-2]	6.8%	193
]-2,-0.5]	0.0%	0
]-0.5,1]	0.0%	0
]1,2.5]	0.0%	0
]2.5,4]	0.0%	0
]4,5.5]	0.0%	0
]5.5,7]	0.0%	0

Diagram types

The remaining icons are enabled only if a diagram is selected. The next two icons select the diagram types:

 The values are displayed in a bar chart

 The values are displayed in a 2D-chart with a continuous (polygonal) curve

Legend and marker

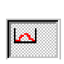
The next two icons show or hide the legend and marker:

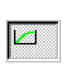
 Displays or hides the legend on the right side of the diagram

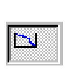
 Displays or hides the marker line and a info field. The info field shows the x-axis variable and the value of the relative and accumulated bars/curves (if activated) at the marker line. The marker line can be shifted to the left and to the right by means of the corresponding cursor keys. Besides a double click places the marker to the desired position.

Accumulated bars

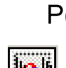
The following icons display or hide the bars or curves for the relative or accumulated frequency of each value. Several types of bars/curves may be active at the same time:

 Displays the relative frequency of all values in percent (p(X) in *Fig. 4-12 above*).

 Displays the accumulated frequency in ascending order, i.e. the sum of the frequencies of all signal values below the current value (P(X<x) in *Fig. 4-12 above*).

 Displays the accumulated frequency in descending order, i.e. the sum of the frequencies of all signal values above and including the current value (P(X>=x) in *Fig. 4-12 above*). The first bar/first value of the curve always starts at 100%. The sum of the accumulated frequencies equals to 100% for all signal values:

$$P(X<x) + P(X>=x) = 100\% \quad \text{for all } X$$

 Shows or hides the device name in the legend and the marker.

The colors of the bars or curves and the scale of the y-axis are set in the *Settings* tab of the configuration menu.

Scaling

The x-axis is scaled by the expected value range of the analyzed signal. The expected range is set automatically for each signal but can be changed in the *Available Signals* tab of the *ROMES Configuration* menu (opened via *Configuration – Preferences*; see chapter 3). In this tab, *Exp. Min.,* and *Exp. Max.* define the first and last value of the x-axis.

The intermediate x-axis values depend on the nature of the analyzed signal:

Many signals are defined on a step scale with a fixed number of discrete values, e.g. the RxLev of a GSM mobile is an integer number between 0 and 63. For those signals, *Step* is displayed in the legend below the diagram; the x-axis is labeled by all values between the minimum and the maximum expected value. Each step represents a class for the statistical evaluation, i.e. it is represented by a single bar or point on the view curve.

For continuous signals, classes are defined by dividing the expected value range by an integer number *(Number of Classes)* set in the *Settings* tab of the configuration menu. The classes are thus intervals of equal width; the center values of each interval labels the x-axis.

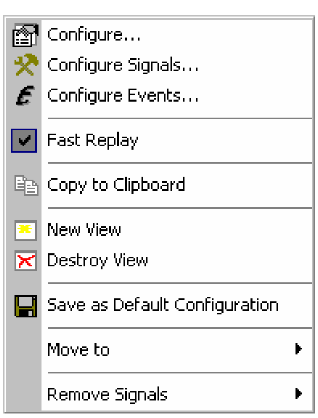
Legends

The diagram displays two types of legends:

On the right side, the types of bars/curves are indicated together with their colors.

Across the bottom of the diagram, the statistical parameters of the current signal are displayed: Minimum and maximum value ever measured or replayed *(Min. / Max.),* arithmetic mean value of all values ever measured *(Average); Current* value, and number of invalid values in the signal *(Invalid)*. The invalid values are excluded from the diagram; the sum of all individual frequencies p(X) always amounts to 100%.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, move to another worksheet, or remove signals; see *Context menu* description on p. 4.2.

Statistic Histogram View Configuration

The *Statistic Histogram View* configuration menu defines the signals to be viewed, configures the diagram and shows information on the current view version. It is opened via a right mouse click on a point inside *Statistic Histogram View* or via the *Configuration – Settings* command (see chapter 3).

The *Values* tab selects the signals to be displayed. *Fig. 4-13 below* shows the signals provided by a GSM mobile phone. For an explanation of the signals refer to section *GSM Abbreviations* in chapter 8.

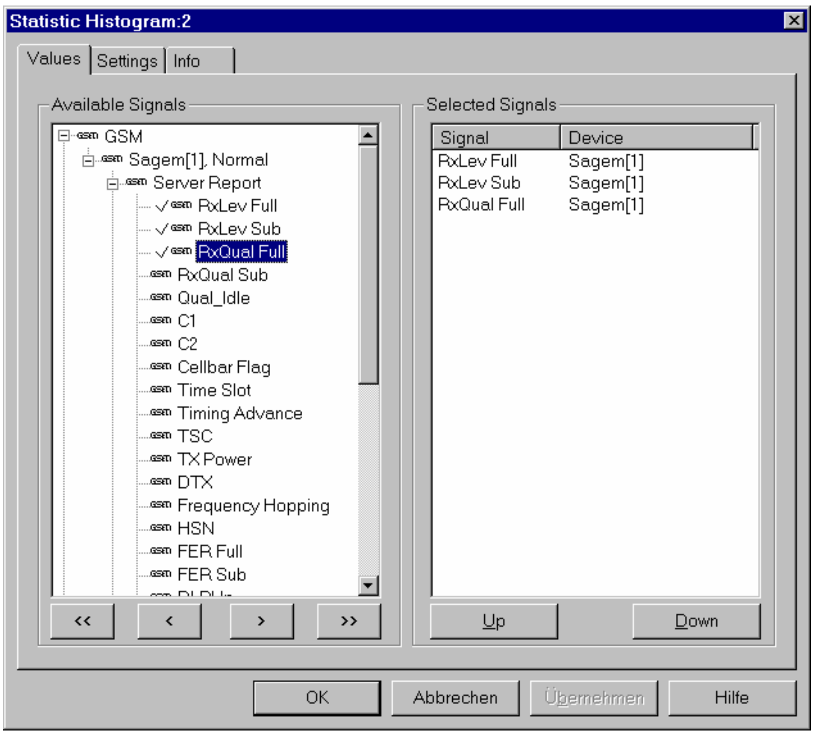


Fig. 4-13 Statistic Histogram View: parameter selection

The *Values* tab is analogous to the *Values* tab of the 2D Chart View configuration menu, see Fig. 4-10 on p 4.14.

Available Signals Data tree (see chapter 1) showing all available signals (hierarchy level 4 of the data tree).

- ➢ To select a single signal for display, left-click this signal (which will be highlighted in inverse video) and click the > button. Alternatively, double-click the signal.
- ➢ Select a parent node of higher hierarchy level (level 1, 2, or 3) and click > if you wish to select all signals below the node.

Selected Signals List of all signals selected for display.

- ➢ To remove a single signal from the list, left-click this signal (which will be highlighted in inverse video) and click the < button. Alternatively, double-click the signal or use the *Remove Signal* command in the view context menu.
- ➢ To remove all signals at once, click the << button.

The order of the list can be changed using the two buttons below. This order is relevant especially if the list contains more signals than can be displayed in the *Static Histogram View*.

The *Settings* tab defines how many classes are created to evaluate a continuous signal and selects the bar types/curves to be displayed, the display colors and the y-axis scale.

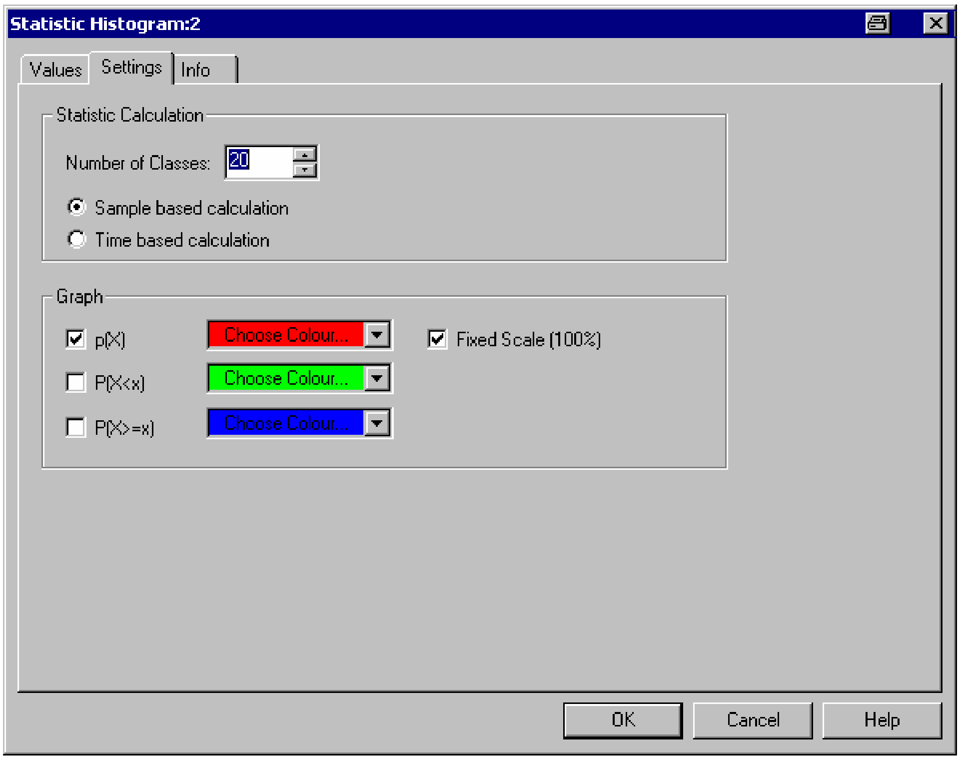


Fig. 4-14 Statistic Histogram View: configuration

Statistical Calculation

Selects a number of 2 to 256 classes for the statistical evaluation of a continuous signal. The classes are obtained by dividing the expected total value range of the signal by the *Number of Classes;* they correspond to intervals of the signal value of equal width. The intervals label the x-axis. The height of the bars can be calculated in two alternative ways:

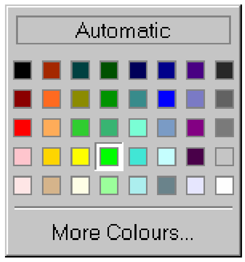
If *Sample based calculation* is selected the height of each bar is proportional to the number of samples in the class.

If *Time based calculation* is selected the height of each bar is proportional to the amount of time that the signal values fall inside the class.

Number of Classes is ignored for step parameters.

Graph

Selects the bar types/curves to be displayed, the display colors and the y-axis scale. The three checkboxes *p(X), P(X<x) and P(X>=x)* show (if checked) or hide the bar graphs or curves for the relative frequency of the values per class and the accumulated frequencies; they are equivalent to the corresponding icons in the *Statistic Histogram View* (see above). The *Choose Color* pull-down lists select the display color for each bar graph or curve:



The *More Colors* button calls up the *Colors* menu described on p. 4.322.

The *Fixed Scale* checkbox fixes (if checked) the y-axis scale of the diagram to the range between 0% and 100%, irrespective of the range of displayed values. Otherwise the p(X) scale is adapted to the largest displayed value. The value range and thus the scale for the accumulated frequencies P(X<x) and P(X>=x) is always fixed to the range between 0% and 100%.

OK Apply all *Statistic Histogram View* settings and close the configuration menu.

Cancel Discard all *Statistic Histogram View* settings and close the configuration menu.

Event View

The *Event View* displays a chronological record of all events that occurred during the measurement. What represents an event is defined in the *Available Events* tab of the *ROMES Configuration* menu, see chapter 3.

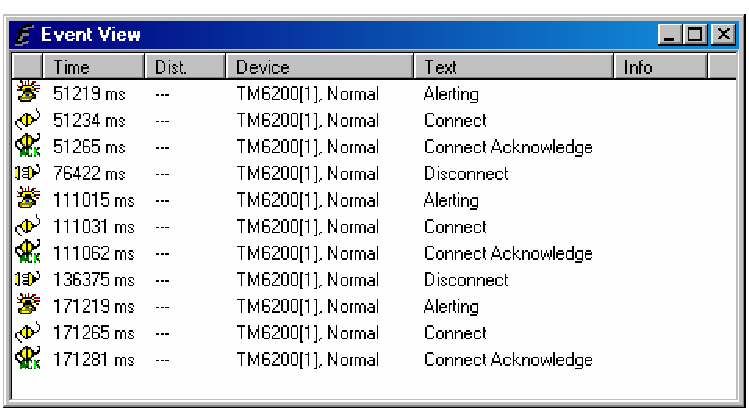
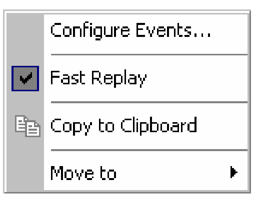


Fig. 4-15 Event View

View table The events are displayed in tabular form:

Event symbol	Graphical symbol for the event, also used in the *Available Events* tab to configure event selection
Time	Time of the event, the scale is relative to the start time of the measurement
Device	Device (mobile phone type, fax terminal, test receiver etc.) that triggered the event
Text	Event type

Context menu



A right mouse click on any point in the view opens the context menu to access the *Configure Events* dialog (see chapter 3), (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see *Context menu* description on p. 4.2.

The *Event View* has no configuration menu. The *Info* tab can be accessed via the *Configuration – Settings* command.

Message View

The *Message View* displays a detailed chronological record of the system messages generated during the measurement.

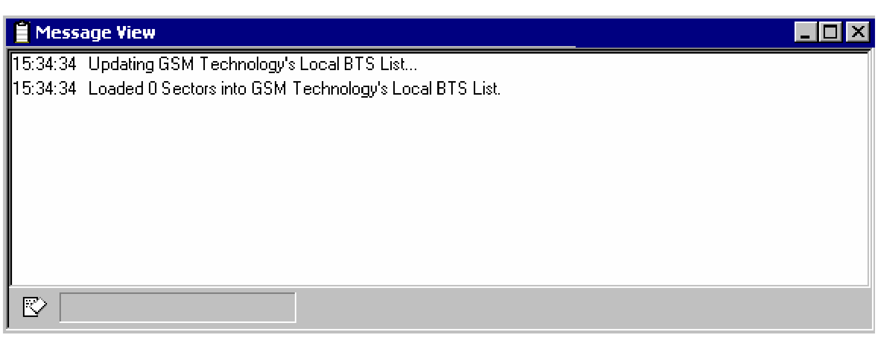


Fig. 4-16 Message View

View contents The messages are displayed in consecutive lines together with the time when they were recorded. In general all messages are self-explanatory.

The messages generated during a Carrier-to-Interference analysis (with option PCSD-K6/-K7) deserve some particular attention and are explained below.

Clicking the icon in the lower left corner of the view deletes all messages in the view and clears a space for new messages.

Context menu

A right mouse click on any point in the view opens the context menu to (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see *Context menu* description on p. 4.2.

The *Message View* has no configuration menu. The *Info* tab can be accessed via the *Configuration – Settings* command.

C/I messages

The messages generated during a Carrier-to-Interference analysis are stored in the file *CtoI_Message.txt* in the *TestFiles* subdirectory. They are used for monitoring the actions of the measurement system and for error diagnosis. Information messages are in black color, warning messages in blue color and errors in red color. The following messages can be generated (the list may be extended by further self-explanatory messages):

C:\RuS\ROMES\D1026T17.58 created

A new Transmitter Scan file with the given name was created.

... SC sectors available for C/I measurements

Denotes the number of sectors available for interference measurement. These are the base stations within a radius of 50 km from the actual measurement location. This list is updated every 20 km.

C/I measurements started

It is possible to start a new interference measurement during the post process of the first measurement. If such a situation occurs, this message is displayed. Equivalently, an arbitrary large number of measurements is possible.

All C/I measurements finished

All interference measurements are stopped now and the system continues with Transmitter Scan.

BTS appended

A BTS was appended successfully to the database. This message occurs only when the BTS was appended via the BTS edit function.

BTS deleted

Indicates that a BTS was deleted successfully from the database.

BTS time offset evaluation started

Starts the update of the database.

C/I measurement started

The trigger module has given a command to the channel sounder card PCS2 to start the interference measurement.

C/I IF sampling started

The channel sounder card PCS2 has started the sampling of the interference measurement data.

C/I measurement stopped

The trigger module has given a command to the channel sounder card PCS2 to stop the interference measurement.

C/I IF sampling stopped

The channel sounder card PCS2 has stopped the sampling of the interference measurement data.

COX export finished

The GSM NWS measurement data export to a *.cox file is completed successfully.

Database updated

This message shows the update of the database, which usually occurs every two minutes.

Frequency correction started

In regular time intervals, corresponding to the values chosen in the C/I driver dialog window, the system performs a frequency correction to the ESVD. Especially, if the ESVD was cold at the beginning of the measurement, this correction is very important and can take larger values.

Frequency correction = ... Hz

The result of this frequency correction.

Frequency correction stopped

The frequency correction is calculated with help of at least 4 sectors. If less than 4 sectors are available, the frequency correction could not be performed and this message appears.

Just ... MB memory left

In order to be able to run the software there must be at least 80 MByte of free disk space available. If this message occurs, check your free disk space and verify that the disk is not fragmented.

K6 C/I-GSS created successfully

The graphical subsystem (GSS), represented by the *C/I Map Display* window, was created. This module is responsible for the complete interaction of the user with the interference measurement system during the measurement and analysis, apart from the manually triggered interferences.

One C/I finished but still one C/I measurement in process

This message appears if two interference measurements have been started (see above), and one of them has terminated.

Post Process [4] :: K6_C0CX
Post Process [3] :: K6_CXCX

This message appears only if traffic channel interferences are measured, too. It indicates the analysis of an interference. The number in brackets shows the number of interference data that has yet to be processed. *K6_C0CX* denotes a traffic channel interference on the BCCH and *K6_CXCX* a traffic channel interference on a traffic channel of the serving cell, respectively.

Problems with Transmitter Scan

This message appears if there are problems during the assignment of a Transmitter Scan (TS), e.g. due to unusual propagation conditions at the measurement location.

If this message appears in regular intervals, e.g. every two minutes, synchronization of the TS was not possible. To be synchronized, a TS must contain common BTS sectors with the database that can be compared to obtain a common reference time. In practice, this means that the areas of a new TS must overlap with one of the areas measured before (see section *Measurement Process* in chapter 1). PCSD-K6 tries to overlap a new TS with the existing database for 15 minutes. If the synchronization fails, the TS is stopped and a new one is initiated. The message *Problems with Transmitter Scan* is displayed every two minutes as long as the overlap is attempted.

To make sure that an overlap is possible, start your measurement from a point inside an area that was already measured.

- If the message disappears after 15 minutes, the new TS could be synchronized. Nothing else must be done.
- If the message continues to be displayed, drive back to an area that was already measured.
- If the synchronization still fails, create a new database.

SC not measured yet

This message appears if there is a trigger to an interference measurement but the serving cell has not been measured by a Transmitter Scan in the last two minutes.

> SC [CI = 1234, C0 = 56, BCC = 7, FH = On] is interfered,
> but SC not found in database

If the serving cell of the test mobile supports frequency hopping, the measurement system PCSD-K6 measures on all channels of this sector. The corresponding information is obtained from the base station list. As a consequence, it is only possible to switch to an interference measurement in this case if the channel occupation of this sector has not changed since the last database update. If the serving cell supports frequency hopping and the base station list is too old this message appears.

Sector skipped: (Reason)

After reading a sector from the base station text file, the program checks, whether all entries have consistent values. E.g. if there is a sector in the GSM band with channel 1283, the sector is not taken into the database.

Skip sector

During reading a base station text file, a sector did not have all mandatory entries. The corresponding sector is skipped and the program continues with reading the next sector.

Start COX export of file ...

The GSM Network Scanner measurement data is capable to export the measurement data to a GSM NWS *.cox export file. Detailed export-related messages are available in the Message View, which show more details than the usual logfiles.

Stop Module: ...
Module stopped: ...

When the interference measurement is stopped, the following modules must be terminated explicitly:

C/I Trigger

Graphical Display

Time Delay Measurement

PCS2

Interference Measurement

Interference Assignment

While terminating the Time Delay Measurement, an update of the database is performed and monitored in the *K6 Message View* window.

System nonlinear to network

One or more BTS have a drift beyond the allowed range. In this case, a new Transmitter Scan file is created.

Transmitter Scan Overlap: m Sectors, n Identified Sectors

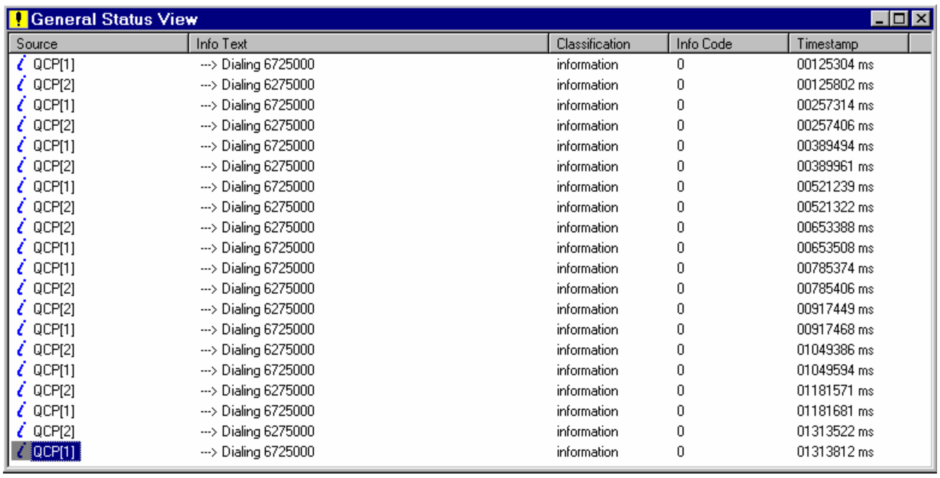
When a new Transmitter Scan file is opened, m recently measured BTS are also taken in the new file in order to avoid a loss of overlap. On n of these sectors the CI could be identified.

TS File ... added to database

Every Transmitter Scan file which is manually added to the database is shown.

General Status View

The *General Status View* displays text messages of general interest, e.g. application events reported during the measurement. NQA messages can be displayed in the *General Status View* if the *NQA monitoring active* option in the *NQA* tab of the GSM driver configuration menu is enabled (see chapter 6).



General Status View

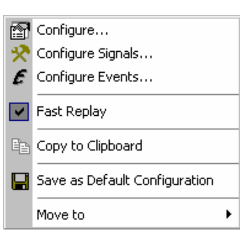
Source	Info Text	Classification	Info Code	Timestamp
QCP[1]	---> Dialing 6725000	information	0	00125304 ms
QCP[2]	---> Dialing 6275000	information	0	00125802 ms
QCP[1]	---> Dialing 6725000	information	0	00257314 ms
QCP[2]	---> Dialing 6275000	information	0	00257406 ms
QCP[1]	---> Dialing 6725000	information	0	00389494 ms
QCP[2]	---> Dialing 6275000	information	0	00389961 ms
QCP[1]	---> Dialing 6725000	information	0	00521239 ms
QCP[2]	---> Dialing 6275000	information	0	00521322 ms
QCP[2]	---> Dialing 6275000	information	0	00653388 ms
QCP[1]	---> Dialing 6725000	information	0	00653508 ms
QCP[1]	---> Dialing 6725000	information	0	00785374 ms
QCP[2]	---> Dialing 6275000	information	0	00785406 ms
QCP[2]	---> Dialing 6275000	information	0	00917449 ms
QCP[1]	---> Dialing 6725000	information	0	00917468 ms
QCP[2]	---> Dialing 6275000	information	0	01049386 ms
QCP[1]	---> Dialing 6725000	information	0	01049594 ms
QCP[2]	---> Dialing 6275000	information	0	01181571 ms
QCP[1]	---> Dialing 6725000	information	0	01181681 ms
QCP[2]	---> Dialing 6275000	information	0	01313522 ms
QCP[1]	---> Dialing 6725000	information	0	01313812 ms

Fig. 4-17 General Status View

Note:

Events will show in the General Status window during recording and replay only, not during the measurement. If the measurement runs without problems, no messages might appear for an extended period.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

General Status View Configuration

The *General Status View* configuration activates the remote display and shows information on the current view version. It is opened via a right mouse click on a point inside the *General Status* or via the *Configuration – Settings* command (see chapter 3).

The remote display TS95-RD makes it easier to monitor the process of data recording. It can be ordered from Rohde & Schwarz with stock no. 1122.9350.02 and is simply connected to the measurement system via a printer connector. During the measurement tour, the LEDs of the remote display inform the driver whether the measurement yields valid data, a warning, or an error.

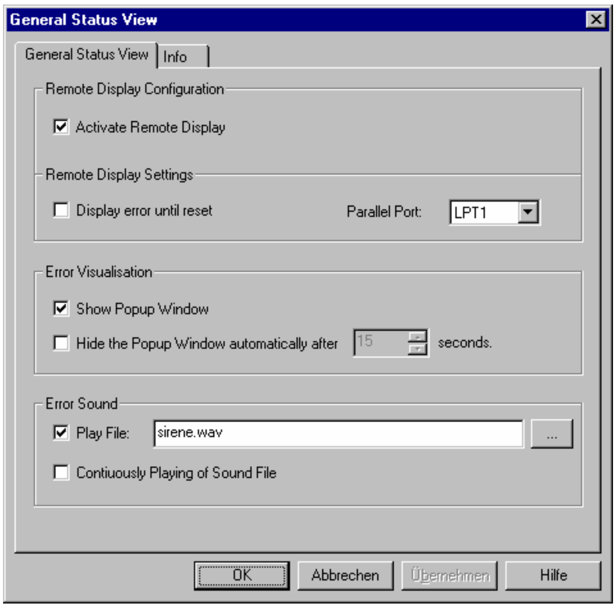


Fig. 4-18 General Status View: Configuration

Activate Remote Display

The *Activate Remote Display* switch activates (box checked) or deactivates the remote display. If the box is checked the *Remote Display Settings* are enabled.

Remote Display Settings

The *Remote Display Settings* panel configures the remote display and assigns it to a printer connector.

Display error... — If this box is checked and an error is detected, the error LED lights and an acoustic signal sounds until an explicit reset via the *Acknowledge* key of the remote display. Otherwise, the error LED goes out as the measurement continues.

Parallel port — Parallel port used to connect the remote display

Error Visualization

For each error detected, an error message can be displayed in a popup window that will either remain on screen or be automatically closed after a definite time (option *Hide the Popup...* checked). The display time of the popup is set in the *after...seconds* field.

Error Sound For each error detected, an error sound is played if the *Play File* box is checked. A wave file (*.wav) can be selected by means of the "..." button If the *Continuously Playing...* option is checked the sound is continuously repeated.

Polar View

The *Polar View* provides a circular diagram to display a signal as a function of the geographic orientation of the receiving directional antenna *(Mast Position* in degrees). The calculation of the *Mast Position* requires the following input:

- The geographic orientation of the test vehicle carrying the compass and the directional antenna *(True Heading)*.
- The direction of the antenna relative to the *True Heading.*

This implies that the measurement data to be viewed in the *Polar View* must be recorded using both the *Compass* driver and the *Mast* driver (see chapter 6).

The *Polar View* is complemented by the *Compass Info* view (see p. 4.372*)* where the *True Heading* is visualized. ROMES allows to open several independent *Polar Views* simultaneously.

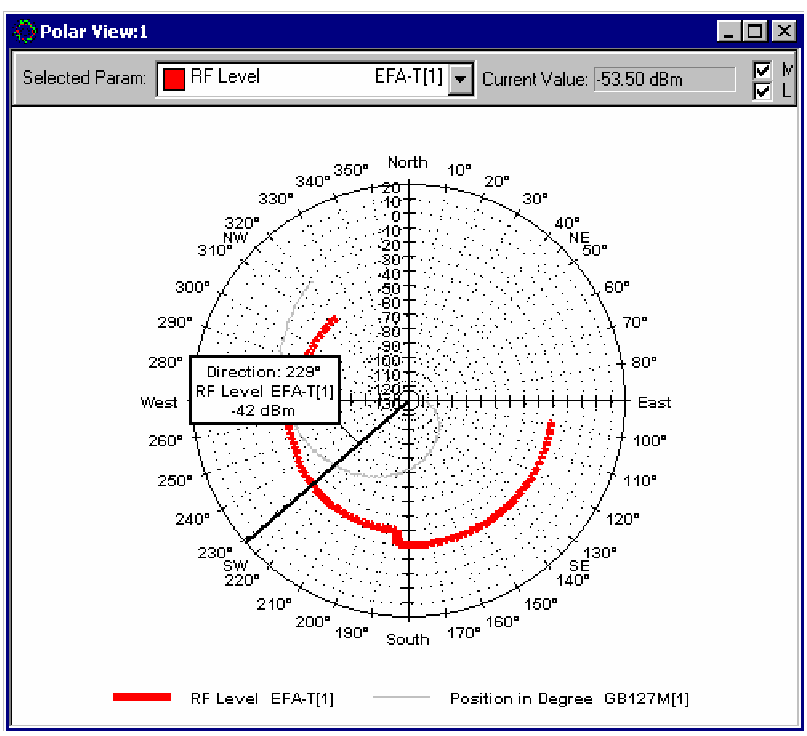


Fig. 4-19 Polar View

Diagram The diagram may contain a selected curve (the signal, the mobile type, and the current value is shown in the *Selected Param.* field above the diagram) and several additional curves. The curves are distinguished by their colors; the selected curve is distinguished by its line width. In addition to the curves, events (represented by the icons shown in the *Available Events* tab of the ROMES configuration menu, see chapter 3) can be displayed.

In the circular diagram, the signal values are plotted as a function of the geographical orientation (direction) of the antenna stored in the measurement file. The radial distance from the origin corresponds to the signal value; the angular coordinate of the diagram indicates the direction. The angular orientation of the diagram is fixed.

Scaling

The radial axis is scaled by the expected value range of the analyzed signal. The expected range is set automatically for each signal but can be changed in the *Available Signals* tab of the *ROMES Configuration* menu (opened via *Configuration – Preferences*; see chapter 3). In this tab, *Exp. Min.,* and *Exp. Max.* correspond to the center of the diagram and the value of the outer circumference.

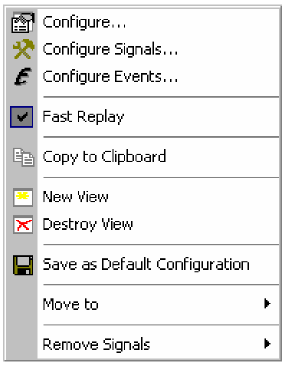
Marker

If *Marker* is selected, a radial marker line and a info field is displayed. The info field shows the direction, the plotted signal, device type, and signal value at the direction. The marker line can be shifted to the left and to the right by means of the corresponding cursor keys. Besides a double click places the marker to the desired position.

Legend

If the box is checked, a legend showing the signals of all displayed curves together with their line color and width is displayed below the diagram.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, move to another worksheet, or remove signals; see *Context menu* description on p. 4.2.

Polar View Configuration

The *Polar View* configuration menu defines the signals to be viewed and shows information on the current view version. It is opened via a right mouse click on a point inside *Polar View* or via the *Configuration – Settings* command (see chapter 3).

The *Values* tab selects the signals to be displayed.

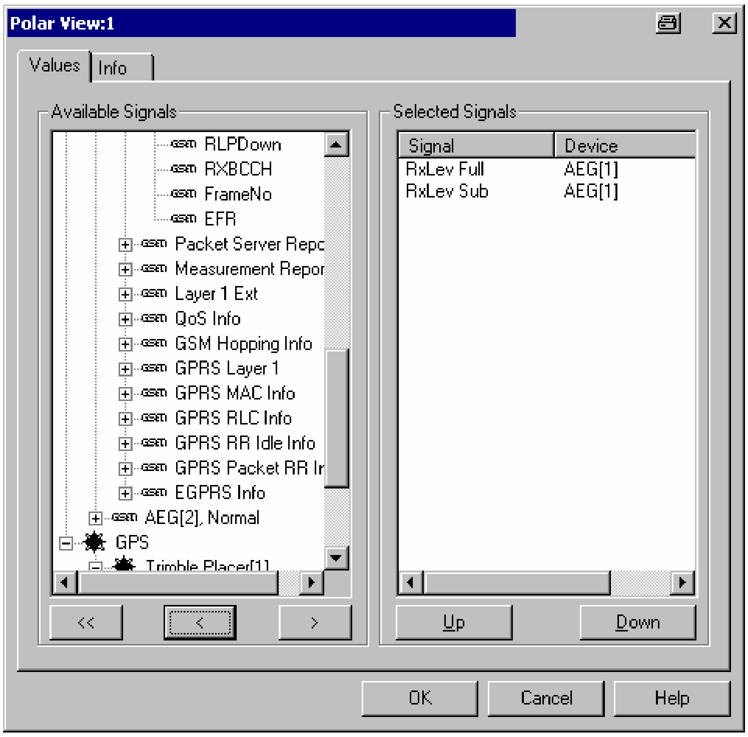


Fig. 4-20 Polar View: parameter selection

The *Values* tab is analogous to the *Values* tab of the 2D Chart View configuration menu, see Fig. 4-10 on p 4.14.

Available Signals Data tree (see chapter 1) showing all available signals (hierarchy level 4 of the data tree).

- To select a single signal for display, left-click this signal (which will be highlighted in inverse video) and click the > button. Alternatively, double-click the signal.
- Select a parent node of higher hierarchy level (level 1, 2, or 3) and click > if you wish to select all signals below the node.

Selected Signals List of all signals selected for display.

- To remove a single signal from the list, left-click this signal (which will be highlighted in inverse video) and click the < button. Alternatively, double-click the signal or use the *Remove Signal* command in the view context menu.
- To remove all signals at once, click the << button.

The order of the list can be changed using the two buttons below. This order is relevant especially if the list contains more signals than can be displayed in the Polar View.

Navigation Views

The *Navigation Views* can be used to visualize measured quantities with valid geographic coordinates and to retrieve the geographic coordinates of an individual measured value.

Click the icon *in the measurement bar and use the* Available Signals Drag & Drop... *dialog to display signals in the* Navigation Views*.*

The navigation views can be selected from a submenu displayed to the right of the *View* menu when the mouse pauses over *Navigation Views*.

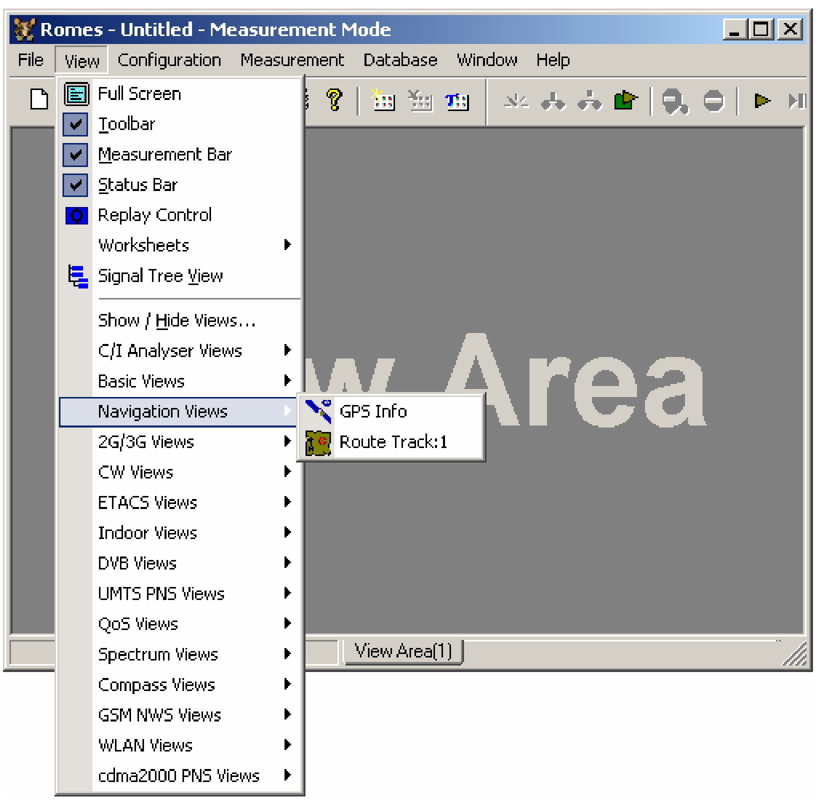


Fig. 4-21 Navigation Views

GPS Info

The *GPS Info* window shows the recorded GPS information and the calculated direction and speed of the test vehicle. Compass heading and speed are displayed in a compass and speedometer if the GPS receiver provides these quantities.

The detected GPS satellites are shown with their IDs. The bar graphs show the relative quality of the received GPS signals.

If the Romes measurement setup is eqipped with a U-BLOX GPS receiver, additional car sensor information is shown in the *GPS Info* window, if available.

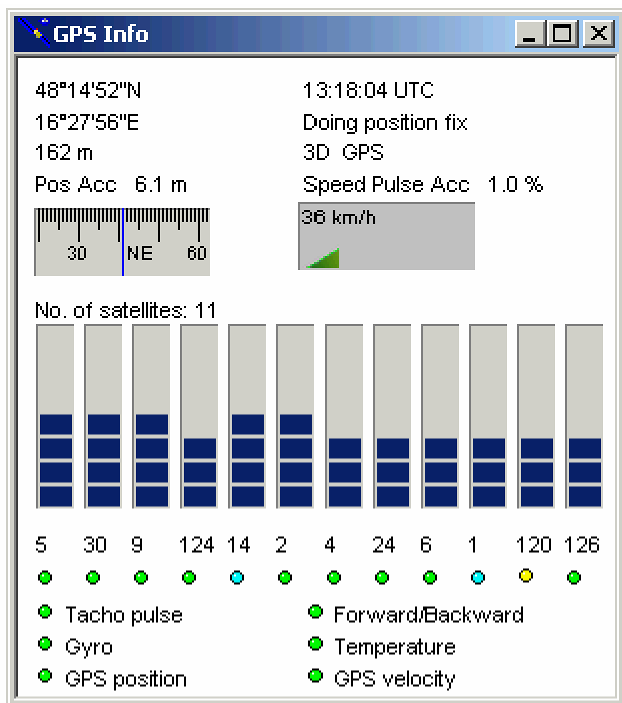


Fig. 4-22 GPS Info view

Latitude/Longitude/ Altitude
The left column of the view shows the geographic coordinates of the current measurement point.

Time
The first entry in the right column represents the Universal Time Coordinated (UTC) of the current measurement point.

Health
The second entry in the right column describes the operating conditions of the GPS receiver. The *GPS Info* view displays messages such as *Doing position fix, No usable satellite, Only 1 satellite*, ...

Validity

The third entry in the right column describes the validity of the current results. The following status messages are possible:

2D GPS	Data with valid longitude and latitude coordinates
3D GPS	Data with valid longitude and latitude and altitude coordinates
2D DGPS	Data with valid longitude and latitude coordinates, only with DGPS (differential GPS) receiver
3D DGPS	Data with valid longitude and latitude and altitude coordinates, only with DGPS (differential GPS) receiver
DR	Dead Reckoning, only Trimble Placer or GINA by Rohde & Schwarz.

Compass and Speedometer

Display of the compass and speedometer is optional; see configuration menu below. Only GPS receivers supporting the RMC protocol ($GPRMC) provide the direction and speed of the test vehicle.

Satellite Information

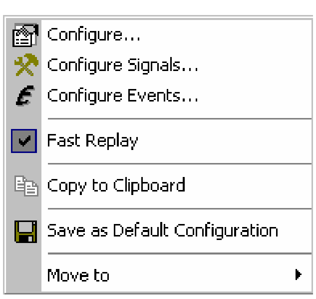
These bar graphs show the relative signal quality of up to 11 satellites within range of the GPS receiver. The satellite ID numbers are displayed below the associated bar graph.

Note that this information is only available if this is supported by the used GPS receiver.

Car Sensor Info

The Car Sensor Info is only available with an installed U-BLOX GPS receiver unit. This unit is supported, but it is not available from Rohde & Schwarz.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see *Context menu* description on p. 4.2.

GPS Info Configuration

The *GPS Info* configuration menu shows or hides the compass and speedometer, the satellite information, and the car sensor info described in the *GPS Info* menu. It is opened via a right mouse click on a point inside the *GPS Info* or via the *Configuration – Settings* command (see chapter 3).

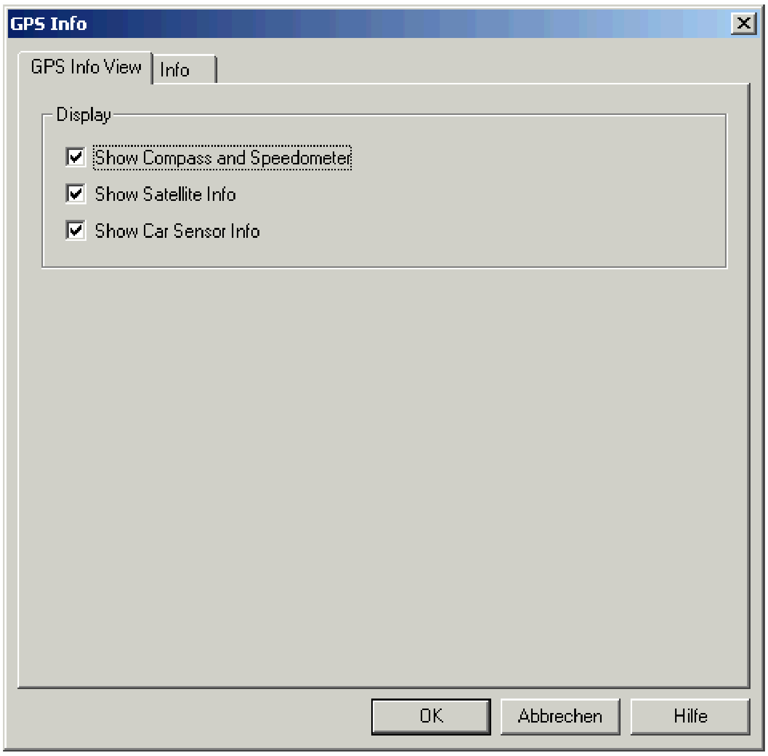


Fig. 4-23 GPS Info configuration

Route Track

The *Route Track* diagram visualizes a measurement tour and the behavior of the measured signals using a projection onto a background map that can be loaded and positioned into the view.

In addition to the signal, the events recorded along the route and the base station located in the vicinity can be displayed.

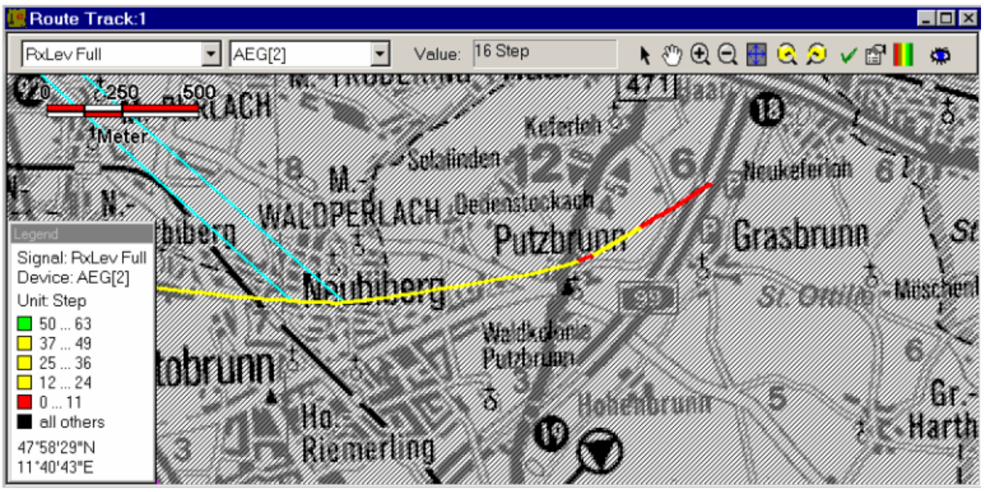


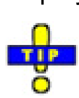
Fig. 4-24 Route Track

Diagram

By default, the diagram shows a (vector) background map of the whole world together with a length scale. The signals along a measurement tour, event symbols, base stations, and arbitrary bitmaps of the explored area can be projected onto the background map.

Measurement curve

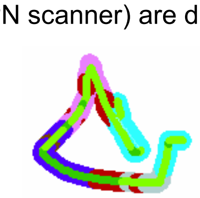
Polygonal curve connecting the individual measurement points projected onto the background map. The color of the curve indicates the signal value as explained in the legend. The signal plotted, the device type and number, and the signal value of the current measurement point is indicated above the diagram. In the legend, the geographic coordinates of the current measurement point are displayed.



You can display the entire measurement route stored in a measurement (CMD) file immediately when opening the file, provided that CMD file scanning is enabled in the *General* tab of the *ROMES Configuration* menu.

Scrambling Code indication

Curves obtained by means of UMTS equipment (UMTS test mobiles or UMTS PN scanner) are displayed with a colored frame.



The frame color indicates the primary scrambling code(s) connected with the signal:

- A measurement curve obtained in a PN scan shows the primary SC of the 1st top N element (the strongest signal measured). The color scheme is defined in the configuration menus of the *PNS* views. If the measurement contains also UMTS test mobile data, a second frame shows the SC of the serving cell.

- A measurement curve of a UMTS test mobile parameter shows the primary SC of the serving cell. The color scheme is defined in the configuration menus of the *UMTS* views. If the measurement contains also PNS data, a second frame shows the SC of the 1st top N element.

In areas where the serving cell does not provide the strongest signal, the PNS and UMTS SCs are different. Display of the SC frames can be switched off in the *PNS Settings* and *Mobile Settings* tabs of the *UMTS Layer* configuration menu. Moreover, it is possible to qualify which of the frames laid over the other (see *General Settings* tab of the *UMTS Layer* configuration menu).

Bitmap Map of the explored area loaded as a file in one of the standard bitmap formats. Several overlapping or non-overlapping bitmaps can be collected in an archive and loaded simultaneously, see *Archive* tab in the configuration menu, *Fig. 4-27*. When loaded for the first time, a bitmap must be positioned onto the world map using one of the methods described below (see section *Bitmap Handling and Positioning (Calibration)* on page 4.46).

Toolbar The toolbar offers the selected signal and device list, shows the signal value at the current measurement point, and provides the map tools.

Parameters Pull-down list of all signals selected in the configuration menu, see p. 4.41. The current signal is visualized in the diagram.

Devices Pull-down list of all devices measured or contained in the measurement file replayed. The measurement curve in the diagram shows the signal for the current device.

Signal value Value of the current signal and device at the current measurement point.

Icons

1 2 3 4 5 6 7 8 9 10 11

1 – 4 The icons set the view tools are described in section *Bitmap Handling and Positioning (Calibration)* on page 4.46 ff.

5 *Show/Hide Layer Mover* opens or closes the *Layer Mover* dialog as described on p. 4.39.

6,7 *Restore/Redo last bounds* resets or repeats the last zoom or move actions.

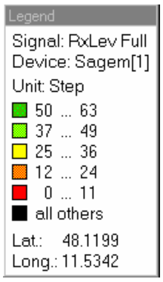
8 Enables or suppresses the display of the measurement curve.

9 Calls up the configuration menu (see section *Route Track Configuration* on p. 4.41)

10 Shows the legend of the measurement curve (see below)

11 If this icon is enabled (as shown above), the view follows the geographical measurement position so that the current location is always visible.

Legend

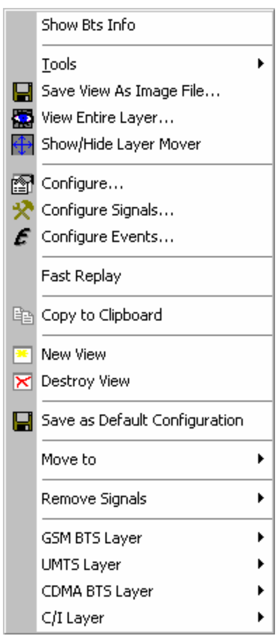


The legend window explains the signal ranges symbolized by the different colors of the measurement curve. Up to seven colors can be defined via the *Route Tracking* tab of the configuration menu, see section Route Track Configuration on p. 4.41.

The current signal and device is indicated above the color legend.

Below the color legend, the geographic coordinates of the current measurement point are indicated. More detailed information on this point can be retrieved via the *GPS Info* menu, see p. 4.34.

Context menu

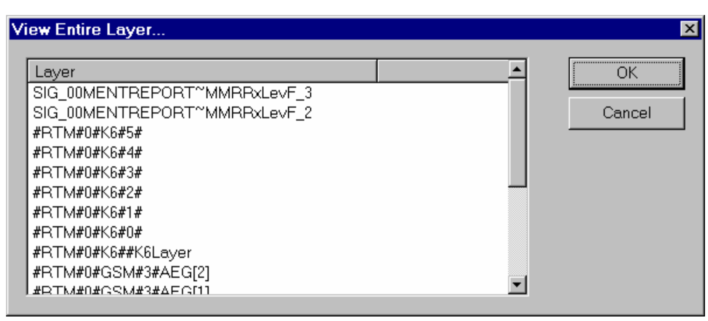


A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, move to another worksheet, or remove a signal; see Context menu description on p. 4.2. In addition the context menu provides the following commands:

Tools Opens a submenu providing tools for customizing the current view. The map tools are also accessible via the *Calibration* menu, see section Bitmap Handling and Positioning (Calibration) on page 4.46.

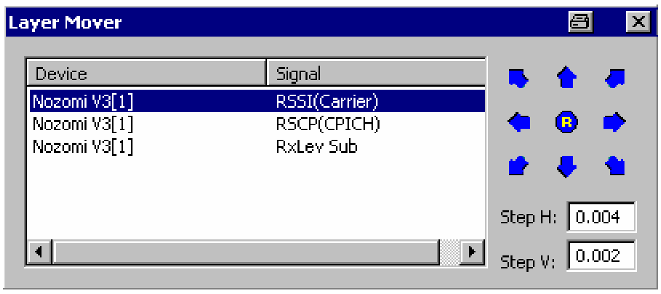
Save View As... Opens a standard dialog to save the current view to an image file. The dialog defines the file name and directory and selects a standard bitmap format (*.tif, *.bmp, *.pcx, *.png, *.gif) for the file. A *.tab file defining the geographic coordinates of the image is created together with the bitmap file; see Raster image map on p. 4.47. This means that the image can be re-used as a background map in later sessions; see section Bitmap Handling and Positioning (Calibration) on p. 4.46.

View Entire Layer Zooms the *Route Track* view to a size where one of the layers is displayed entirely. The layer to be viewed must be selected in a dialog:

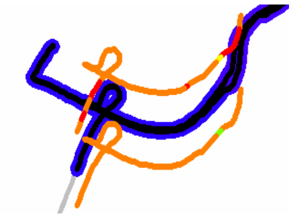


Show/Hide Layer

Mover Opens or closes the *Layer Mover* dialog. This dialog contains all signals selected in the *Values* tab of the *RouteTrack* configuration dialog.



This dialog can be used to display different signals along a route with a relative offset so that the sinal values can be "read" simultaneously. Simply select a signal in the list and click the arrow buttons. Click to reset (superimpose) the signals.



GSM BTS Layer Opens a submenu used to select the GSM base stations located in the vicinity of the measurement route and set their display options; see section *GSM BTS Layer Configuration* on page 4.51.

UMTS Layer Opens a submenu used to select the UMTS Node Bs located in the vicinity of the measurement route, select UMTS mobile and PNS scanner data, and set display options; see section *UMTS Layer Configuration* on p. 4.56.

C/I Layer Provides the configuration tools for performing a Carrier-to-Interference analysis (with ROMES-GS); see section *Graphical C/I Analysis in the Route Track View* in chapter 5.

Route Track Configuration

The *Route Track* configuration menu defines the signals to be viewed and shows information on the current view version. It is opened via a right mouse click on a point inside *Route Track* or via the *Configuration – Settings* command (see chapter 3).

Route Track Configuration: Values Tab

The *Values* tab selects the signals to be displayed.

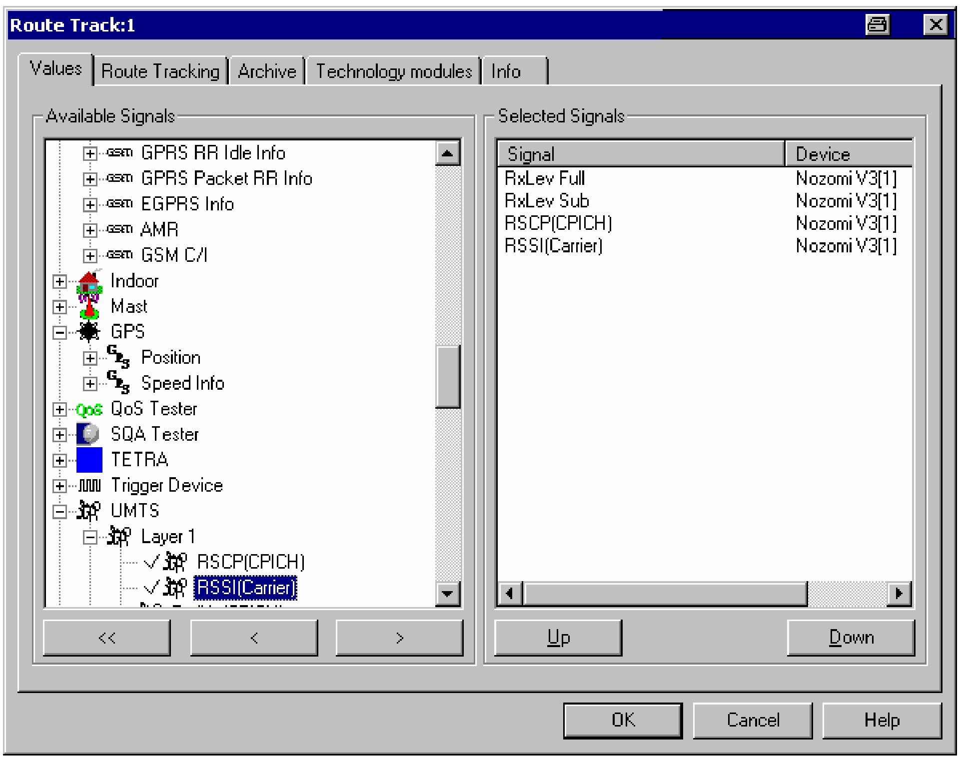


Fig. 4-25 Route Track configuration: Values

The *Values* tab is analogous to the *Values* tab of the *2D Chart View* configuration menu, see Fig. 4-10 on p 4.14.

Route Track Configuration: Route Tracking Tab

The *Route Tracking* tab configures the map and opens the menu for loading and positioning raster images (e.g. background maps).

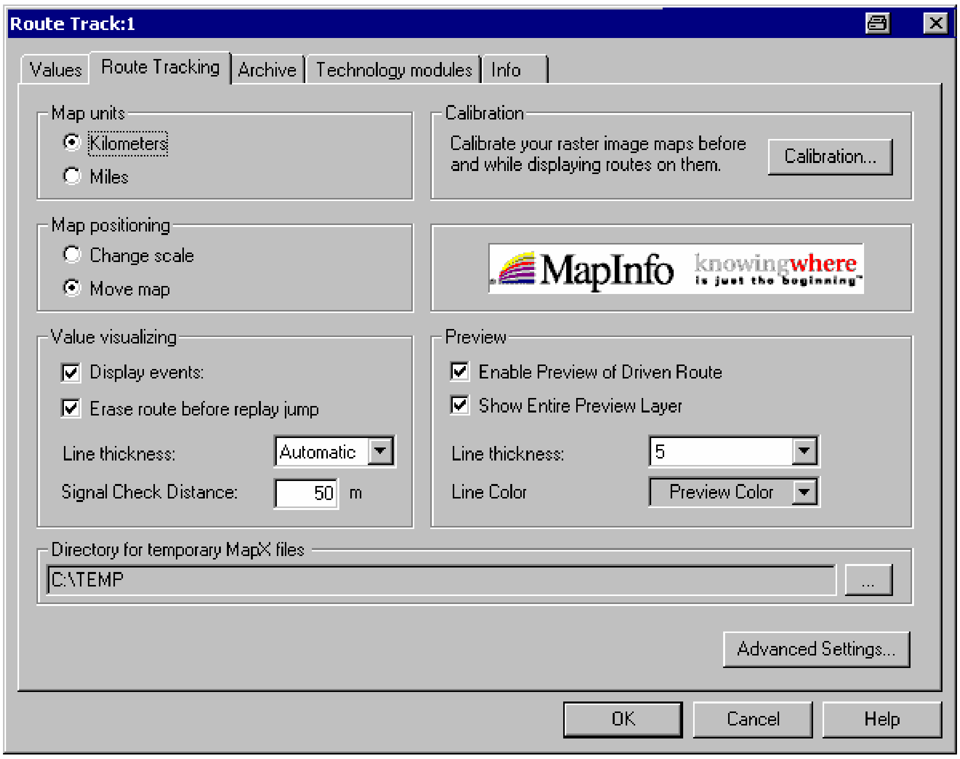


Fig. 4-26 Route Track configuration: Route Tracking

Map units

In the *Map units* panel, the length units for the *distance tool* (see section *Bitmap Handling and Positioning (Calibration)* on page 4.46) can be selected (kilometers or miles).

Map positioning

The *Map positioning* panel defines how the *Route Track* view is updated when a measurement point falls outside the viewed area. Both settings are valid only while the measurement/replay is running. In this case, they replace the map tools *Zoom In, Zoom Out,* and *Pan:*

Change scale
: The scale of the diagram is reduced such that the whole measurement tour can be viewed.

Move map
: The map is shifted at constant scale such that the area currently measured/replayed can be viewed.

Value visualizing

The *Value visualizing* panel determines in which way events and signals are visualized in the *Route Track* view. The settings must be defined before a diagram is generated:

Display events
: If the box is checked, the events selected in the *Available Events* tab of the *Configuration – Preferences* menu (see chapter 3) are displayed along the measurement tour.

Erase route…
: Clears the lines for the displayed signals before the replay restarts at a new position. The view shows the signal values between two consecutive jumps only. If *Erase route…* is cleared, the view always shows the signal values from the beginning of the measurement.

Line thickness
: Sets the line thickness of the polygonal curve along the measurement

tour on a scale between 1 (thin line) and 7 (thick line). With *Automatic* setting, the line width is adapted to the shape of the curve.

Signal Check Distance

GPS distance after which a position point is drawn in the *Route Track* view, even if no valid result is available for the current parameter (e.g. if no UMTS signal from a particular cell/with a particular scrambling code can be detected in an area that is far away from the transmitting Node B). Invalid results are indicated with black color.

Calibration

The *Enter Calibration Mode* button opens the menu for bitmap handling and positioning, see p. 4.46.

Preview

The *Preview* panel configures the appearance of the preview of the driven route in the *Route Track* view. The preview is a curve with configurable thickness and color which is opened at the beginning of the replay.

Enable Preview…

Must be selected in order to obtain a preview

Show Entire Preview…

Rescales the view when a measurement file is opened so that the view area can show the complete measurement route.

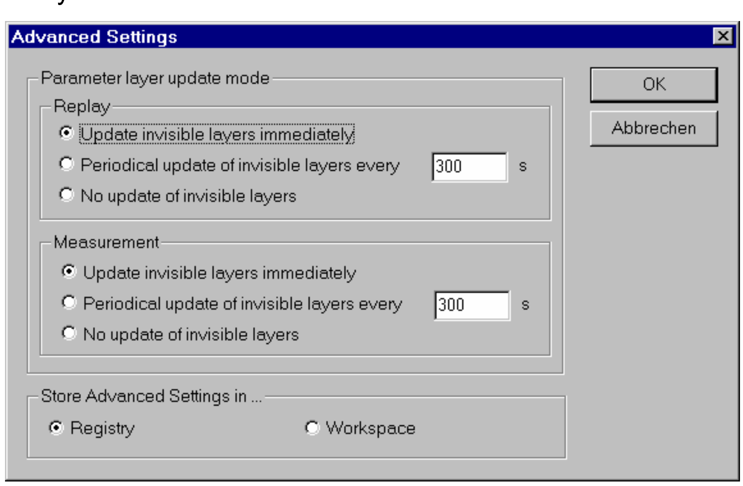
The color scale for the individual signals can be modified in the *Color Scale* menu which is opened via the *Preferences – Available Signals* tab; see chapter 3.

Directory for temporary MapX files

The *Directory for temporary MapX files* panel indicates the directory used to store temporary MapX files. Another directory can be selected by pressing the "..." button. This is particularly important if the MapX files are stored to a RAM disk in order to improve the system performance; see section *RAMDisk* in chapter 8.

Advanced Settings

The *Advanced Settings* button opens a menu to control the display of the invisible layers, i.e. the signals that have been selected in the *Values* tab but are not currently viewed.



The invisible layers are controlled separately for replay and measurement sessions:

Update immediately

All layers are permanently updated, so switchover between the layers by means of the signal or device pull-down lists in the toolbar of the *Route Track* view is possible any time without delay.

Periodical update

The invisible layers are updated after a fixed period of time set in the input field (in s).

Periodical update

The invisible layers are not updated unless they are selected as current layers. This implies a delay time on switchover to an invisible layer but saves system resources if only a single layer is viewed.

Store ... settings in

The advanced settings can be stored in the system registry (in the *General* subdirectory of your ROMES directory) or in the current workspace. Settings stored in the registry represent default settings for all ROMES workspaces; they are superseded by explicit settings stored in a given workspace.

Route Track Configuration: Archive Tab

The *Archive* tab configures a bitmap archive containing an arbitrary number of bitmap files with valid information on their geographic position.

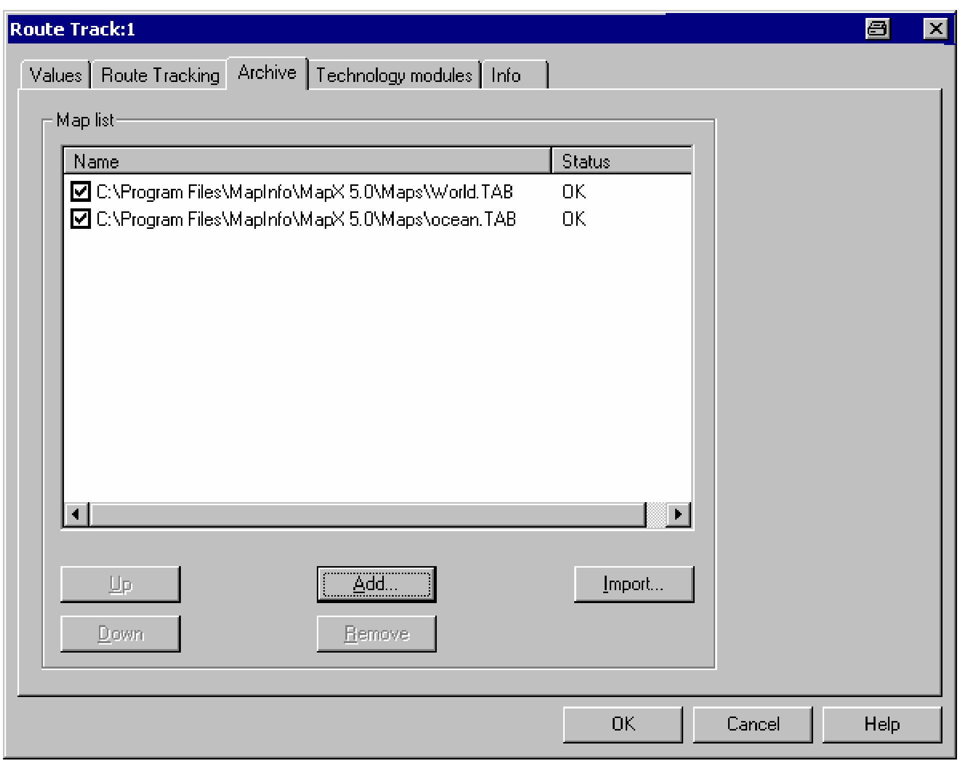


Fig. 4-27 Route Track configuration: Archive

Map list

The *Map list* shows all files belonging to the archive together with their display and status information. An archive map is shown in the *Route Track* view if the corresponding box is checked. The position and scale of an archive file can not be changed. The map list is part of the workspace configuration.

Up

Interchanges the selected (clicked) archive bitmap with the previous one in the list. In the *Route Track* view, bitmaps are superimposed to all bitmaps with a lower position in the list.

Down

Interchanges the selected (clicked) archive bitmap with the next one in the list.

Add

Add a new bitmap file (a *.tab file or one of the standard bitmap formats) to the archive using an *Open file* dialog.

Remove

Remove the selected (clicked and highlighted) bitmap file from the archive.

Import

Import a bitmap archive (*.arc) created in an earlier version of ROMES to the current application.

Route Track Configuration: Technology Modules Tab

The *Technology modules* tab provides a list of the technology modules loaded and information on each module.

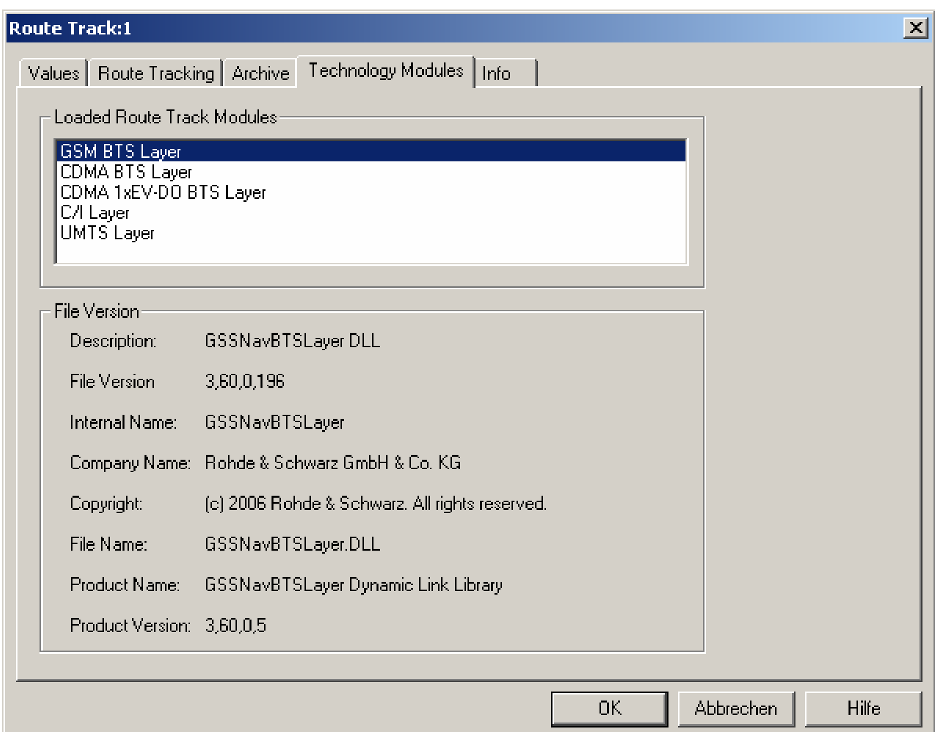


Fig. 4-28 Route Track configuration: Technology modules

To use the *GSM* or *CDMA BTS Layer*, a valid base station list must be imported and a BTS data base created. This is done in the *TEC for GSM/CDMA* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3.

- GSM BTS layer configuration is described in section *GSM BTS Layer Configuration* on p. 4.51.
- UMTS layer configuration is described in section *UMTS Layer Configuration* on p. 4.56.
- CDMA BTS layer configuration is described in section *CDMA BTS Layer Configuration* on p. 4.63.
- C/I Layer configuration is described in section *C/I Layer Configuration* on p. 4.74.

Bitmap Handling and Positioning (Calibration)

The *Calibration* submenu offers the functions for loading, positioning, saving, and closing a bitmap file. Besides, it selects the map tools that are also accessible via the context menu in the *Route Track* view.

The *Calibration* menu is opened via the *Enter calibration mode* button in the *Route Tracking* tab of the *Route Track* calibration menu. Control elements used to interact with the current image map (cursor modes, tools for bitmap positioning) are active only after the calibration menu is closed.

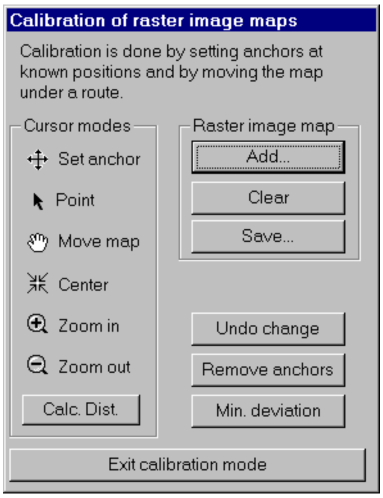


Fig. 4-29 Route Track configuration: Calibration of raster image maps

Cursor modes

The *Cursor modes* panels offers tools used to customize the map view. By clicking one of the symbols, the cursor takes the corresponding shape; at the same time, the following actions can be carried out:

Set anchor
Shift a loaded bitmap relative to the world map and the measurement curve. This tool is also used to re-scale the map using its position frame.

Point
Select a single object on the map. The pointer coordinates are indicated in the legend.

Move map
Shift the entire map, i.e. the world map including loaded bitmaps and measurement curves. When moved, a loaded bitmap appears with a shaded pattern which is removed when the *Set anchor* tool is set.

Center
Shift the entire map to place the selected point to the center of the view. When centered, a loaded bitmap appears with a shaded pattern which is removed when the *Set anchor* tool is set.

Zoom in
Magnify the entire map. When zoomed, a loaded bitmap appears with a shaded pattern which is removed when the *Set anchor* tool is set. The following two options are available:

a. Put the *Zoom in* icon to the center of the area you want to magnify. The map will be magnified by a factor of 2, the position of the icon becoming the center of the magnified map window.

b. Left-click a point on the map, keep the mouse button pressed and move to another point to draw a rectangle. On releasing the mouse button, the border of the rectangle becomes the border of the magnified map window.

Zoom out

Scale down the entire map. When zoomed, a loaded bitmap appears with a shaded pattern which is removed when the *Set anchor* tool is set. Proceed as follows:

Put the *Zoom in* icon to the center of the area you want to make smaller. The map will be scaled down by a factor of 2, the position of the icon becoming the center of the scaled down map window.

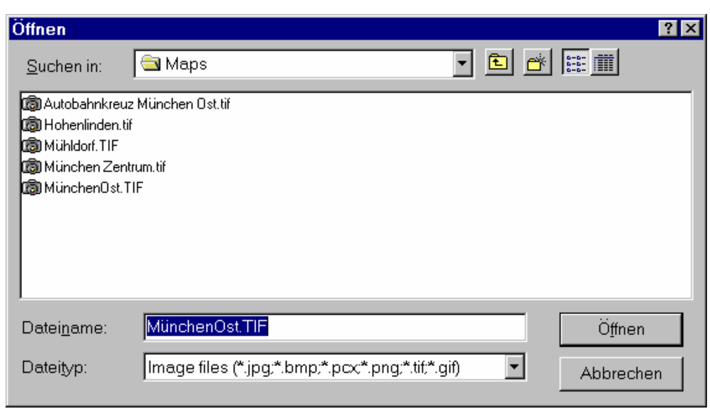
Calc. Dist.

Set the distance tool. This tool calculates the distance along a polygonal curve to be marked on the map by repeated left-click. The distance is indicated in the view legend; the length unit (km or miles) can be set in *the Route Tracking* tab of the configuration menu.

Raster image map

The three buttons in the *Raster image map* panel are used to load, save, and close (clear) a bitmap file:

Add Calls up an *Open* file dialog to load a bitmap file. Valid bitmaps are in a standard bitmap format (see figure below). The geographic positioning information assigned to a bitmap is stored in a TAB file, i.e. a text file with the same name but with the extension (*.tab). Instead of being added individually, several TAB files and the corresponding bitmaps can be stored in an archive and loaded together (see *Archive* tab in the configuration menu, *Fig. 4-27*).



Clear Removes the current bitmap file from the *Route Track* view. Archive files must be cleared in the *Archive* tab of the configuration menu.

Save Saves the positioning information of the current bitmap in a TAB file.

Example of a TAB file defining four anchor positions:

```
!table
!version 300
!charset WindowsLatin1
Definition Table
  File "München Zentrum.tif"
  Type "RASTER"
  (11.612009,48.125907) (414,518) Label "Anchor1",
  (11.615401,48.136615) (434,443) Label "Anchor2",
  (11.615547,48.128851) (440,468) Label "Anchor3",
  (11.678717,48.137394) (705,446) Label "Anchor4"
  CoordSys Earth Projection 1, 0
  Units "degree"
```

Positioning softkeys

The three remaining buttons on the right side of the *Calibration* menu are used to position the bitmap file:

Undo change
: Undoes the last change made to the current bitmap. The *Undo* function may be used several times in a row to undo several changes made.

Remove anchors
: Remove all anchors set to project the bitmap onto the background map, see below.

Deviation min.
: Shifts and re-scales the bitmap such that the sum of the deviations of all anchor points is minimized, see below.

Bitmap positioning

The position and scale of a bitmap which is not an archive file can be adjusted in three different ways:

- Shift and scale the bitmap manually using its position frame
- Enter the known geographic coordinates of several objects marked in the bitmap
- Place the bitmap onto a known measurement tour

For each of these methods, the *Set anchor* cursor mode must be selected.

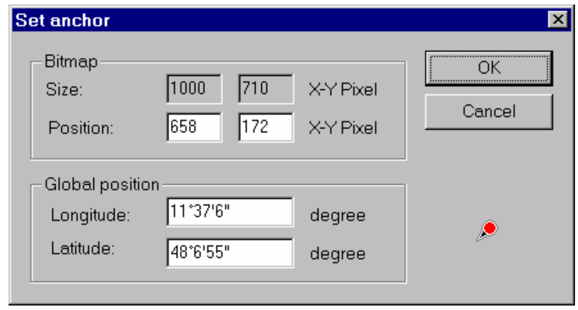
Entry of coordinates

One or several objects with known geographic position can be used to anchor the bitmap onto the background map. An anchor links one point on the bitmap to one point of the background map.

➢ Select the *Set anchor* cursor mode.

➢ To set an anchor for a known object, double-click the desired position on the bitmap.

The *Set Anchor* dialog indicating the bitmap coordinates and the geographic (global) coordinates of the anchor is opened.



Bitmap

Size of the whole bitmap in pixel units and current position of the anchor on the bitmap. The current position can be adjusted by overwriting the two *Position* input fields.

Global position

Current geographic coordinates of the anchor (according to the position of the bitmap relative to the background map). The actual geographic coordinates of the anchor must be entered here. Double-clicking the coordinate input fields toggles between decimal and degree/minute/second format display of the coordinate.

Cancel

Discard the entries and close the *Set Anchor* dialog. No anchor point is created.

OK

Link the anchor point to its global position and close the *Set Anchor* dialog.

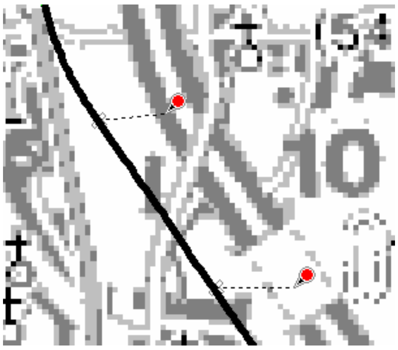
The anchor displayed in the Route Track view consists of a pin linked to a cross. The pin marks the position on the bitmap, the cross marks the corresponding global position.

An arbitrary number of anchors can be set. Ideally, if the bitmap is correctly positioned and all anchors are accurately defined, the deviation of the anchors should be zero, i.e. the pins and the crosses should coincide. The *Deviation min.* command in the *Map* submenu (see above) sets the scale and position of the bitmap such that the sum of the deviations of all anchors is minimized.

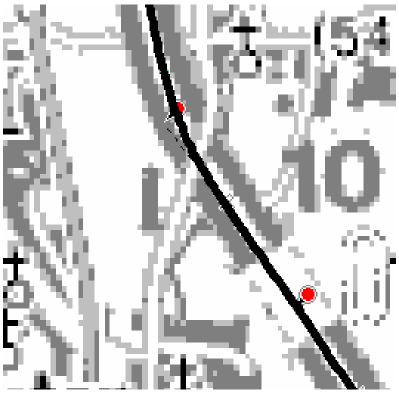
Identifying a measurement tour

A known measurement tour can be used to anchor the bitmap onto the background map. The role of the anchors is as in the previous method of bitmap positioning:

- Select the *Set anchor* cursor mode.
- To set an anchor for a measurement tour, press the *Ctrl* key and double-click a point on the measurement curve.
- Move to the corresponding point on the bitmap and click to set the anchor.
- Repeat the procedure for the next point.



Again, an arbitrary number of anchors can be set. The *Deviation min.* command in the *Map* submenu (see above) sets the scale and position of the bitmap such that the sum of the deviations of all anchors is minimized. In the example above using 2 anchors the following result is obtained:



The map is positioned with an offset which makes it easier to identify the streets and the position of areas with equal signal values.

Minimization of the deviation

To position the bitmap, ROMES varies the overall position and a scaling factor which is the same in x and y direction (see *Deviation min.* command in the *Map* submenu). This means that three coordinates are varied at maximum; the mathematical problem to solve depends on the number of anchors used:

- If only one anchor is defined, the scaling factor of the bitmap is preserved, the bitmap is shifted such that the anchor point coincides with its geographic position. The deviation is zero.
- If two or more anchors are used, the scaling factor of the bitmap is varied as well, however, it is generally not possible to achieve zero deviation of all anchors.

GSM BTS Layer Configuration

The submenu of the *GSM BTS Layer* command in the *Route Track* context menu provides display settings for the GSM base stations in the view.

Fig. 4-30 GSM BTS Layer submenu

Note:

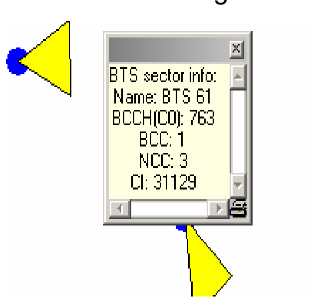
Before any configurations can be made, a valid base station list must be imported and a BTS data base created. For GSM base stations, this is done in the TEC for GSM tab of the Configuration of Software Modules menu; refer to section Configuration Menu in chapter 3.

BTS display

In the *Route Track view*, the position and transmission characteristics of the base stations in the view area is indicated with colored symbols. A BTS with an omnidirectional antenna is symbolized by a circle; a BTS with directed antennas is symbolized by a dot with up to three triangles indicating the sectors with their maximum transmission directions. The color and size of the BTS symbols can be modified in the *GSM BTS Layer* dialog, see *GSM BTS Layer* on page 4.51.

Info field

A click with the left mouse button into the hot zone around a sector symbol (triangle) opens an info field. For GSM base stations, this field indicates the sector name, the BCCH channel number, the BTS color code (BCC), the network color code (NCC), and the cell identity (CI). The radius of the hot zone can be configured in the *GSM BTS Layer* dialog.



TIP The detailed information window is totally independent of the view, so you can move, resize and scroll it as you like. Click the printer symbol in the lower right corner to generate a hardcopy of the detailed information.

Configuration

Opens the *GSM BTS Layer* dialog to set the BTS display options.

The ***Settings*** tab of the *GSM BTS Layer* dialog selects the serving cell lines to be drawn and defines their display options.

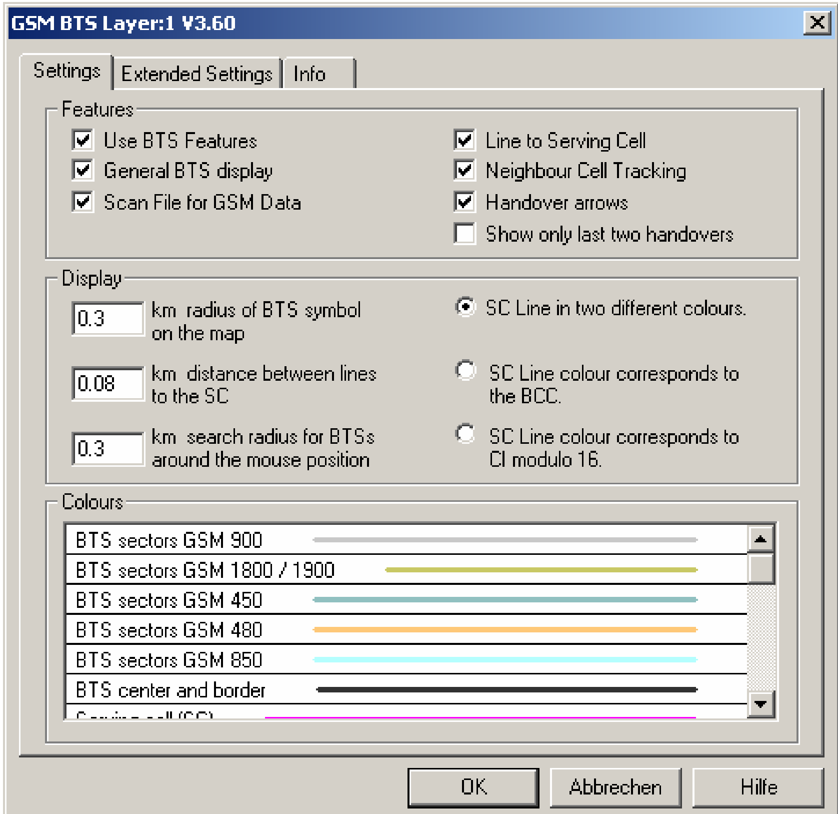
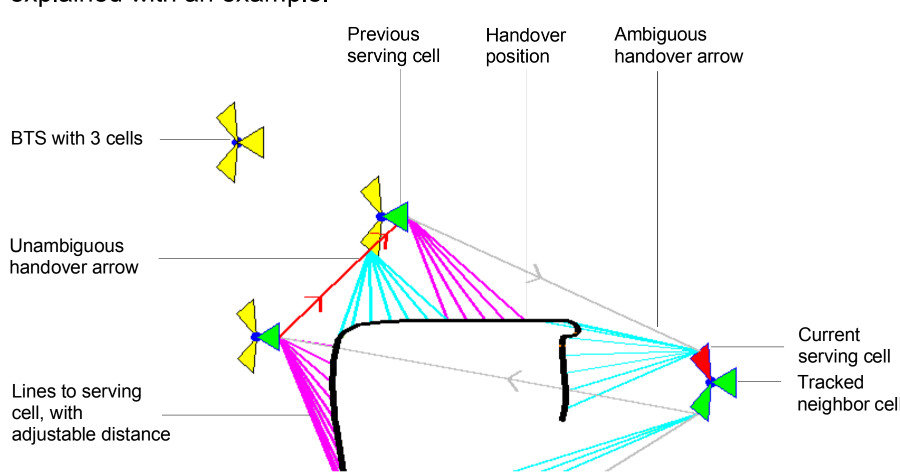


Fig. 4-31 GSM BTS Layer dialog: Settings

Example for BTS display

The dialog provides different display options for GSM networks. They are best explained with an example.



Features (GSM)

In the *Features* panel the following display elements can be switched off individually or altogether *(Use BTS Features* cleared):

- General display of the BTS symbols, leaving only the symbols for the serving cells and for the cells being tracked
- Enables or disables the automatic scan for GSM-related data in the active CMD file.

- All lines to the serving cells
- The indication of cells being tracked
- All handover arrows
- All handover arrows except for the last two

Display and Colors (GSM)

In the *Display* panel the size of the BTS symbols, the distance between the serving cell lines, the radius of the hot zone that can be clicked to open an info field can be adjusted. The option buttons in the right half of the panel provide three alternative options for drawing the Serving Cell (SC) lines.

The *Colors* panel changes the colors of all display elements. Double-clicking an element of the list opens the *Colors* dialog (see p. 4.322) to modify the current display color.

Note:
A distinction is made between unambiguous and ambiguous handovers. A handover is classified ambiguous if the change of two signals characterizing the serving cell is reported with a time delay exceeding a fixed limit.

The ***Extended Settings*** tab of the *GSM BTS Layer* dialog selects the serving cell lines to be drawn and defines their display options.

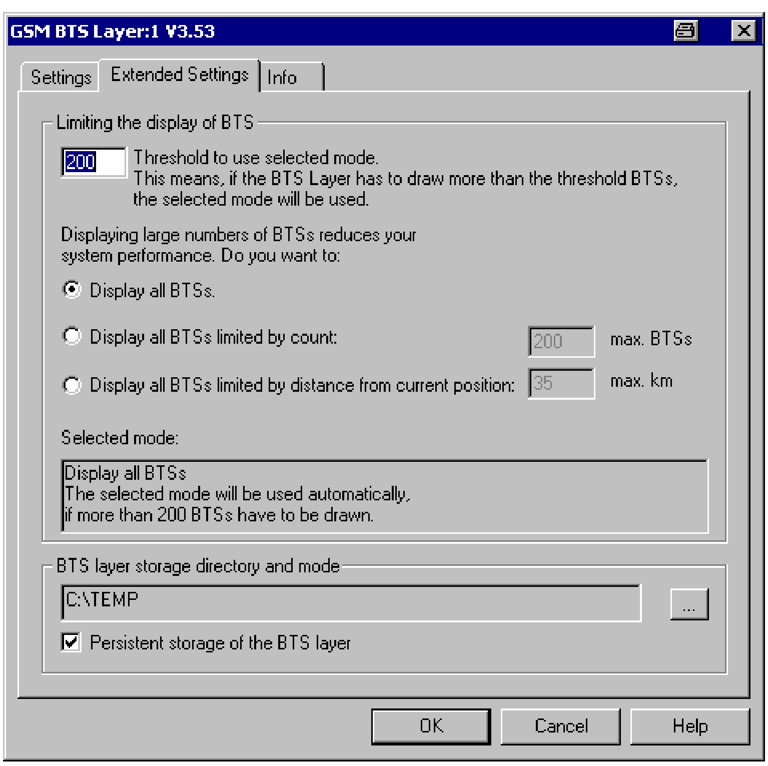


Fig. 4-32 GSM BTS Layer dialog: Extended Settings

BTS display limit

The *Limiting the display of BTS* panel contains an input field to limit the number of BTS symbols displayed in the *Route Track* view. A small number of BTS symbols improves the system performance.

ROMES counts the number of BTS symbols to be drawn. A limiting condition is imposed as soon as this number exceeds the threshold set in the input field. Below the threshold, all symbols all drawn.

Display all BTSs
All BTS symbols displayed, i.e. no limiting condition set

Display ... limited by count
Only a fixed number of BTS symbols around the current position are displayed. The fixed number is equal to the threshold value for the limiting condition.

Display ... limited by distance
Only the BTS symbols within a given radius (between 1 km and 1000 km) around the current position are displayed.

The limit settings are valid after an update of the BTS layer. ROMES indicates the limiting condition set when updating the BTS layer.

BTS layer storage directory and mode

If the *Persistent storage of the BTS layer* box is checked, ROMES stores the current BTS layer (containing all information on the BTS symbols to be displayed in the current view) to the directory indicated in the (unavailable) input field. This avoids reloading of the BTS list and recalculating of the layer when the workspace with the current *Route Track* view is opened for the next time.

The directory can be changed using the "..." button. This is particularly important if the BTS layer is stored to a RAM disk in order to improve the system performance; see section *RAMDisk* in chapter 8.

Attach Configuration Settings

Includes the current GSM BTS layer configuration in the measurement file.

The attached configuration settings can be re-used in a later replay session.

BTS Selection

Opens the *BTS Selection* dialog to select BTSs with particular properties.

The *BTS Selection* dialog offers a variety of options to select a subset of base stations in the BTS list with particular properties or position.

BTS Sectors: GSM

For GSM networks *BTS Selection* opens the following dialog:

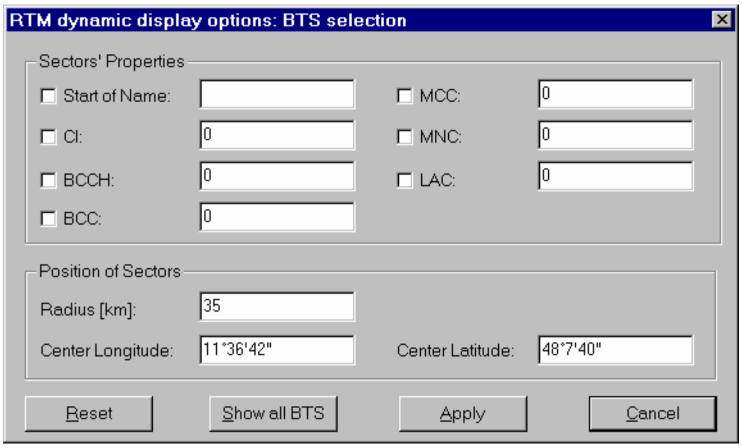


Fig. 4-33 BTS Selection dialog (GSM networks)

Sectors' Properties

In the *Sectors' Properties* panel one or several of the following conditions can be set (click one of the option buttons and enter the desired value (name or integer number) in the input field on the right side):

Start of Name	Select BTS with a particular name or with a name starting with a particular combination of characters
CI	Select BTS with a particular Cell Identity
BCCH	Select BTS transmitting on a particular Broadcast Control Channel
BCC	BTS Color Code
MNC	Mobile Network Code
MCC	Mobile Country Code
LAC	Location Area Code

Position of Sectors

The *Position of Sectors* panel defines a circle of variable size and position to limit the number of BTS symbols displayed in the *Route Track* view. BTSs outside the circle are not displayed. A small number of BTS symbols improves the system performance.

The size of the circle is defined by the Radius [km]. Its position is defined by the longitude and latitude coordinates of the center *(Center Longitude, Center Latitude)*. The default *Center Longitude* and *Center Latitude* are the coordinates of the pointer on the *Route Track* view when the context menu and the *BTS Selection* dialog was called up. The default radius corresponds to the maximum GSM cell radius.

Reset

Reset the current display in the *Route Track* view; delete all BTS displayed (disabled during a measurement or replay).

Show all BTS in this area

Show all BTS from the BTS list in the *Route Track* view. With this button, the BTS can be viewed without starting a measurement or a replay session (disabled during a measurement or replay).

Apply selection

Apply the current condition.

Remove all BTS from map

Removes all BTS symbols currently displayed.

A warning message must be confirmed before this command is executed. The function is disabled during a measurement or replay.

GSM Layers Invisible

Temporarily hide the entire BTS layer currently displayed.

A checkmark before the command indicates that a GSM BTS layer is currently available, but hidden. The layer reappears if the command is clicked for the second time.

GSM Layers Invisible is disabled if the current view contains no GSM BTS layer.

UMTS Layer Configuration

The submenu of the *UMTS Layer* command in the *Route Track* context menu provides display settings for base stations and UMTS or PNS signals.

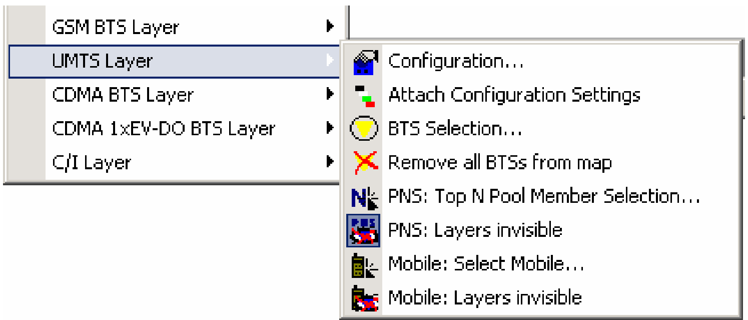


Fig. 4-34 UMTS Layer submenu

Note:
Before any configurations can be made, a valid base station list must be imported and a BTS data base created. For UMTS base stations, this is done in the TEC for UMTS tab of the Configuration of Software Modules menu; refer to section Configuration Menu in chapter 3.

BTS display UMTS BTSs are displayed in analogy to GSM or CMDA base stations; see section *GSM BTS Layer Configuration* on p. 4.51.

Configuration Opens the *UMTS Layer* dialog to set the display options.

The *PNS Settings* tab of the *UMTS Layer* dialog selects the display options for PN scanner data.

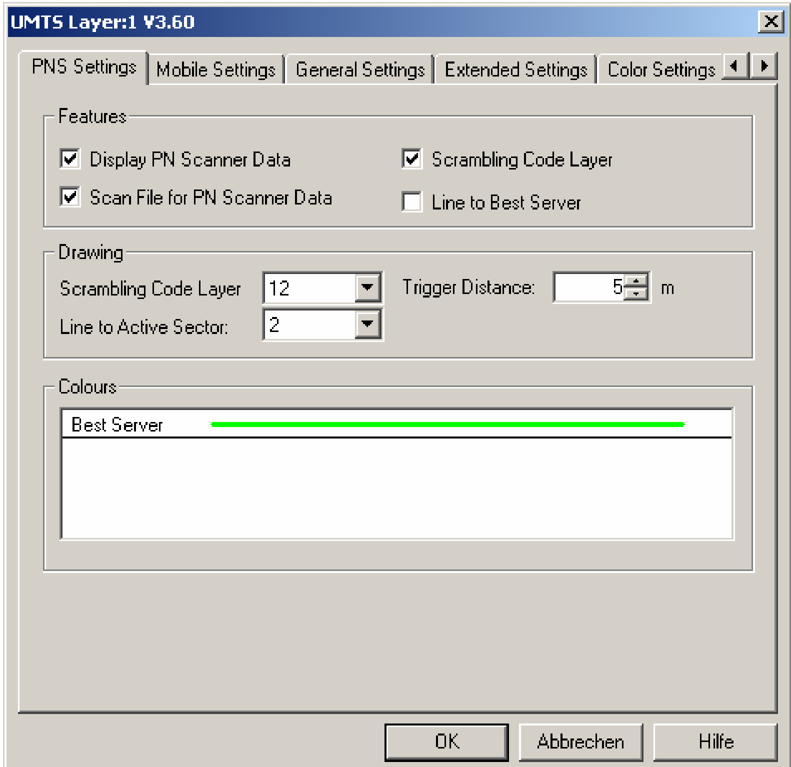


Fig. 4-35 UMTS Layer dialog: PNS Settings

The *PNS Settings* are analogous to the BTS layer configurations for GSM, see *Example for BTS display* on p. 4.52.

Features The following checkboxes select the displayed PN scanner information:

Display PN Scanner Data
Show the best server, i.e. the 1st top N element, using the color selected below. The following display options are only effective if the PN scanner data is displayed.

Scan File for PN Scanner Data
Enable or disable the automatic scan for UMTS PNS data in the active CMD file.

SC Layer
Show the scrambling codes of the serving cell using the color codes of the *Color Settings* tab. The scrambling codes are visualized by means of a colored frame around the measurement curve; see Scrambling Code indication on p. 4.37.

Line to Best Server
Draw lines between the measurement position and the active sector (best server).

Drawing Line thickness of the signal route and of the lines between the signal route and the active sector. *Trigger Distance* is the distance between two consecutive drawn results on the signal route.

Colors Color of the best server in the active sector.

The *Mobile Settings* tab of the *UMTS Layer* dialog selects the display options for UMTS mobile data.

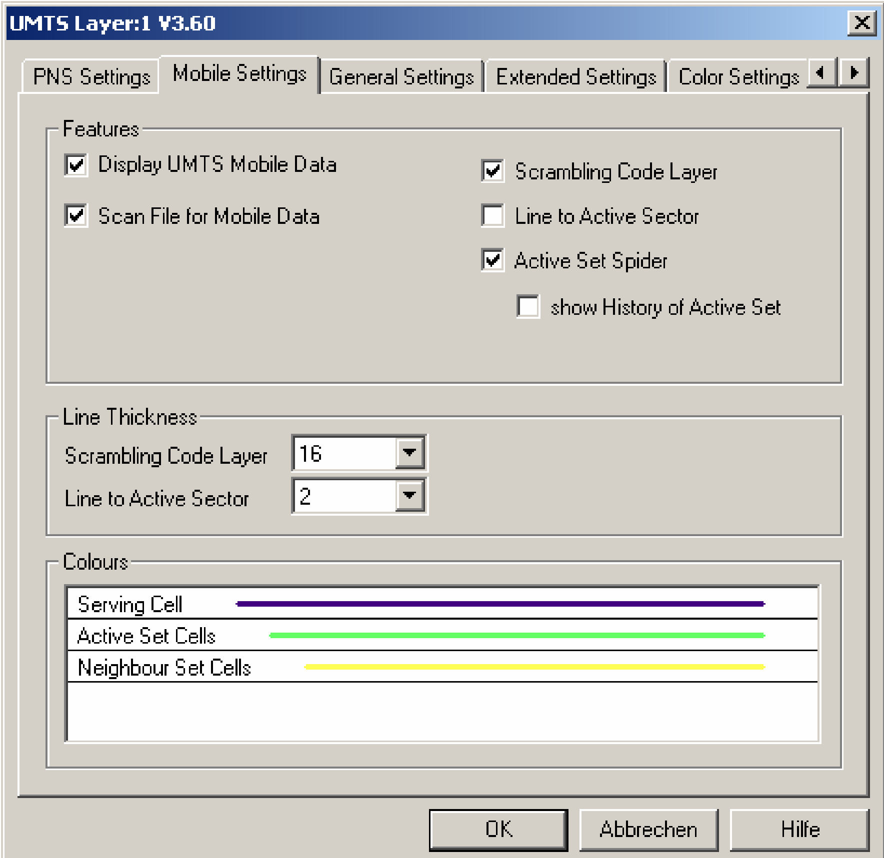


Fig. 4-36 UMTS Layer dialog: Mobile Settings

The ***Mobile Settings*** are analogous to the BTS layer configurations for GSM, see *Example for BTS display* on p. 4.52.

Features The following checkboxes select the displayed mobile information:

Display UMTS Mobile Data
Show the serving cell, the active cell set and the neighbor cell set reported by the mobile using the colors selected below for the Node B sectors. The following display options are only effective if the mobile data is displayed.

Scan File for Mobile Data
Enables or disables the automatic scan for UMTS mobile data in the active CMD file.

Line to Active Sector
Draw lines between the mobile position and the active Node B sectors.

SC Layer
Show the scrambling codes of the serving cell using the color codes of the *Color Settings* tab. The scrambling codes are visualized by means of a colored frame around the measurement curve; see Scrambling Code indication on p. 4.37.

Active Set Spider
Draw temporary lines between the mobile position and the cell sectors in the active set. If *Show History of Active Set* is active, the lines are no longer removed as the active set changes.

Line Thickness Line thickness of the SC layer around the signal route and of the lines between the signal route and the active sector.

Colors Color of the serving cell, the cells in the active cell set and the cells in the neighbor cell set.

The ***General Settings*** tab of the *UMTS Layer* dialog selects display options that are either independent of the test device data or concern both the PNS and the mobile data.

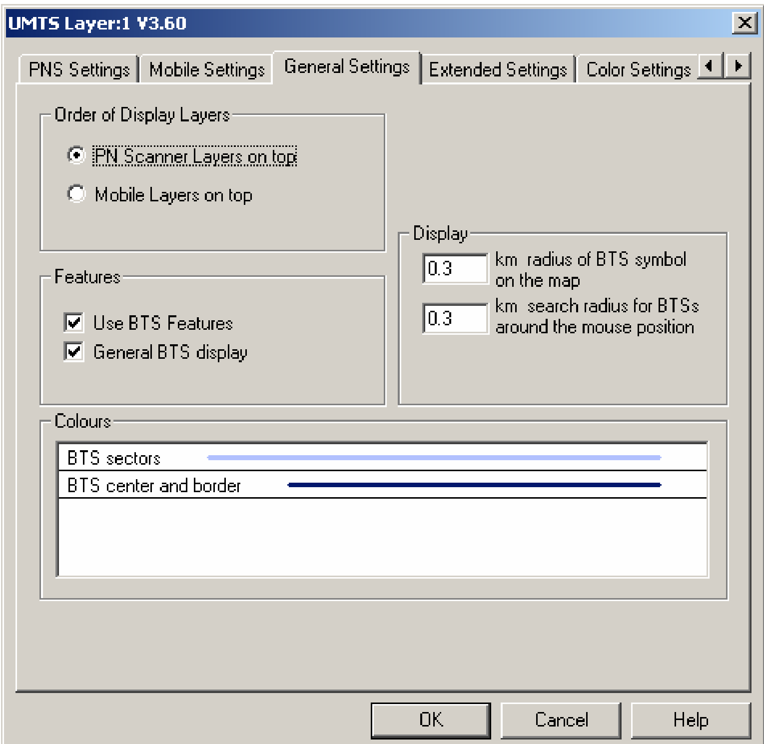


Fig. 4-37 UMTS Layer dialog: General Settings

Most of the *General Settings* are also provided for GSM layers; see Fig. 4-31 on p. 4.52. The following settings are UMTS-specific:

Order of Display Layers Defines which one of the frames indicating the PNS and UMTS scrambling codes is laid over the other; see description of SC indication on p. 4.37.

The *Extended Settings* tab of the *UMTS Layer* dialog selects the serving cell lines to be drawn and defines their display options. It is identical to the *Extended Settings* tab of the *GSM BTS Layer* configuration menu; see Fig. 4-32 on p. 4.53. If *Display BTS Labels* is checked, every cell sector is labeled with its scrambling code (use e.g. *Attach Configuration Settings* to update the screen display).

The *Color Settings* tab of the *UMTS Layer* dialog is analogous to the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310. The dialog defines the colors of the SC frame around the measurement curve; see Scrambling Code indication on p. 4.37.

Attach Configuration Settings Includes the current UMTS layer configuration in the measurement file.

The attached configuration settings can be re-used in a later replay session.

BTS Selection

Opens the *BTS Selection* dialog to select BTSs with particular properties.

The *BTS Selection* dialog offers a variety of options to select a subset of base stations in the BTS list with particular properties or position.

BTS Sectors: UMTS

For UMTS networks *BTS Selection* opens the following dialog:

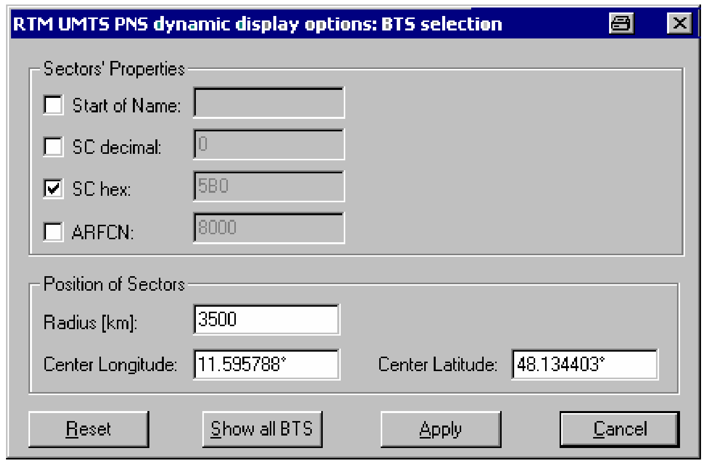


Fig. 4-38 BTS Selection dialog (UMTS networks)

Sectors' Properties

In the *Sectors' Properties* panel one or several of the following conditions can be set (click one of the option buttons and enter the desired value (name or integer number) in the input field on the right side):

Start of Name
: Select BTS with a particular name or with a name starting with a particular combination of characters

SC decimal
: Select BTS sectors using a particular Primary Scrambling code (to be entered in decimal notation)

SC hex
: Select BTS sectors using a particular Primary Scrambling code (to be entered in hexadecimal notation)

ARFCN
: Absolute Radio Frequency Channel Number of the received DL signal. The carrier frequency is equal to *f = 0.2 MHz * ARFCN.*

Note:
SC decimal and SC hex are alternative options and should not be activated at the same time.

Position of Sectors

The *Position of Sectors* panel defines a circle of variable size and position to limit the number of BTS symbols displayed in the *Route Track* view. BTSs outside the circle are not displayed. A small number of BTS symbols improves the system performance.

The size of the circle is defined by the Radius [km]. Its position is defined by the longitude and latitude coordinates of the center *(Center Longitude, Center Latitude)*. The default *Center Longitude* and *Center Latitude* are the coordinates of the pointer on the *Route Track* view when the context menu and the *BTS Selection* dialog was called up. The default radius corresponds to the maximum UMTS cell radius.

Reset

Reset the current display in the *Route Track* view; delete all BTS displayed (disabled during a measurement or replay).

Show all BTS in this area

Show all BTS from the BTS list in the *Route Track* view. With this button, the BTS can be viewed without starting a measurement or a replay session (disabled during a measurement or replay).

Apply selection

Apply the current condition.

Remove all BTS from map

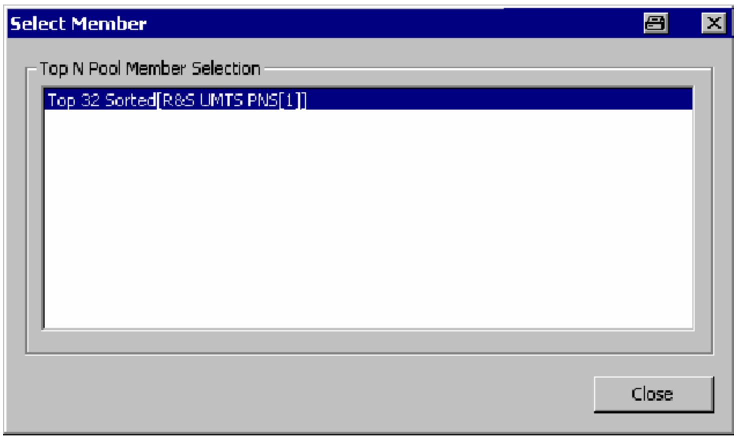
Removes all BTS symbols currently displayed.

A warning message must be confirmed before this command is executed. The function is disabled during a measurement or replay.

PNS: Top N Pool Member Selection

Selects a member of the top N pool defined in the driver configuration menu.

The command opens a dialog with a list of all top N pool members available. The selected member is activated on closing the dialog. The scrambling code displayed in the PNS layer is the SC of the first element in the selected top N member.



PNS: Layers Invisible

Temporarily hide the entire PNS layer.

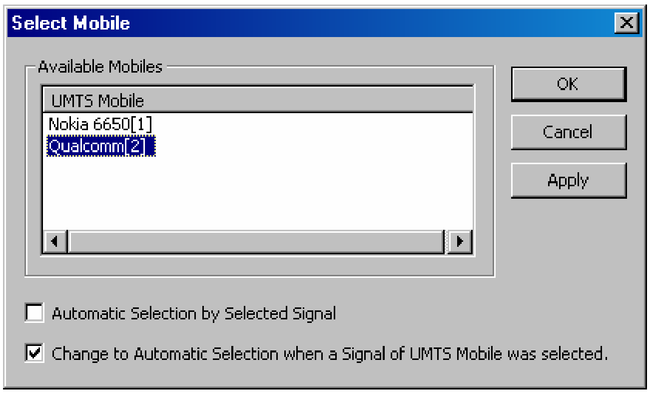
A checkmark before the command indicates that a PNS layer is currently available, but hidden. The layer reappears if the command is clicked for the second time.

Definition:
The PNS layer contains the frames around the signal tour for SC indication and the lines to the active sector but not the signal tour itself. The Node Bs are only displayed if either the PNS layer or the mobile layer (or both) are visible.
PNS Layers Invisible is disabled if the current view contains no PNS layer.

Mobile: Select Mobile

Select the mobile for which the mobile layer is displayed.

The *Select Mobile* dialog contains a list of all mobiles available in the current measurement.



The mobile layer indicates the serving cell for a mobile along the measurement tour; see *Mobile: Layers invisible* below. The checkmarks below the mobile list can be used to select one of the following alternative modes:

- *Automatic mobile layer selection* (upper box checked, lower box unavailable): The mobile layer always corresponds to the mobile that provided the selected signal. While a PNS signal is selected, the mobile layer is invisible so that the PNS layer can be displayed.
- *Automatic mobile layer selection while mobile signals are viewed* (upper box cleared, lower box checked): The mobile layer of the mobile selected in the list of *Available Mobiles* is displayed. This mobile layer is maintained if a PNS signal is selected. Selecting a signal from a UMTS mobile switches back to automatic mobile selection, so there can be no mismatch between a UMTS mobile signal an the mobile layer displayed in the *Route Track* view.
- *Fixed mobile layer* (upper and lower box cleared): The mobile layer of the mobile selected in the list of *Available Mobiles* is displayed, irrespective of the PNS or UMTS mobile signal selection.

Mobile: Layers Invisible

Temporarily hide the entire mobile layer.

A checkmark before the command indicates that a mobile layer is currently available, but hidden. The layer reappears if the command is clicked for the second time.

Definition:

The mobile layer contains the frames around the signal tour for scrambling code indication and the lines to the active sector but not the signal tour itself. The Node Bs are only displayed if either the PNS layer or the mobile layer (or both) are visible.
Mobile Layers Invisible is disabled if the current view contains no mobile layer.

CDMA BTS Layer Configuration

The submenu of the *CDMA BTS Layer* command in the *Route Track* context menu provides display settings for the CDMA base stations in the view.

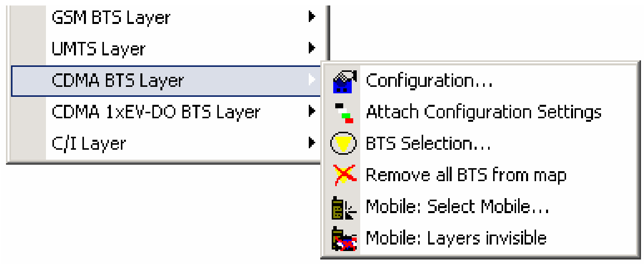


Fig. 4-39 CDMA BTS Layer submenu

Note:
Before any configurations can be made, a valid base station list must be imported and a BTS data base created. For CDMA base stations, this is done in the TEC for CDMA tab of the Configuration of Software Modules menu; refer to section Configuration Menu in chapter 3.

BTS display CDMA base stations are displayed in analogy to GSM or UMTS base stations; see section *GSM BTS Layer Configuration* on p. 4.51.

Configuration Opens the *CDMA BTS Layer* dialog to set the BTS display options.

The *cdma Settings* tab of the *CDMA BTS Layer* dialog defines the display options for cdma and 1xEV-DO scanner data.

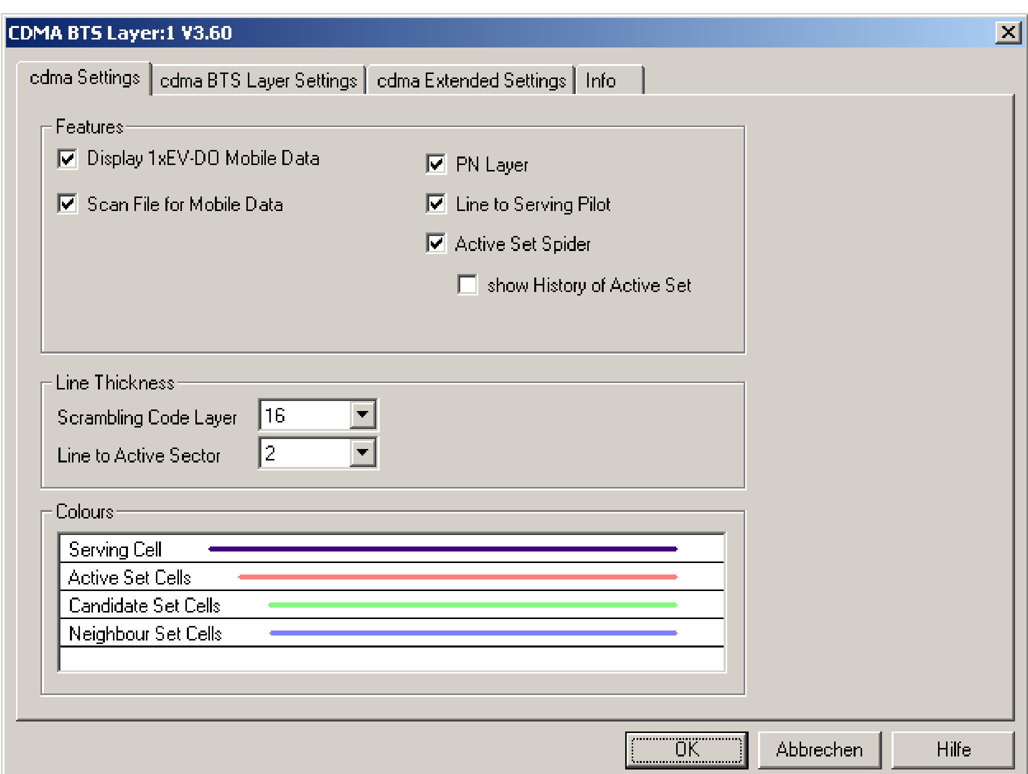
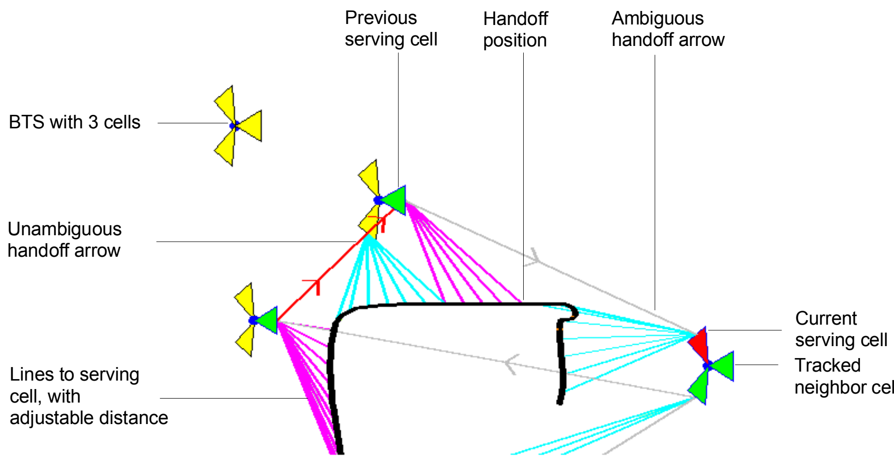


Fig. 4-40 CDMA BTS Layer dialog: cdma Settings

Example for BTS display

The dialog provides different display options for CDMA networks. They are best explained with an example.



The *cdma Settings* are analogous to the BTS layer configurations for GSM, see *Example for BTS display* on p. 4.52.

Features

To improve the stability of the radio connection and the handoff procedures, a CDMA mobile may be connected to several base stations or BTS sectors at the same time (soft handoff). However, only the connecting lines to the current (i.e. the most recently connected) BTS sector are drawn. Due to this simplification, the visualization of a CDMA route track is similar to GSM.

The following display elements can be switched off individually or altogether:

Display 1xEV-DO Mobile Data
General display of the 1xEV-DO symbols, leaving only the symbols for the serving cells and for the cells being tracked.

Scan File for Mobile Data
Enable or disable the automatic scan for mobile data in the active CMD file.

PN Layer
Hide or show the PN layer.

Line to Serving Pilot
Draw lines to the current cell (serving pilot cells)

Active Set Spider
Draw temporary lines between the mobile position and the cell sectors in the active set. If *Show History of Active Set* is active, the lines are no longer removed as the active set changes.

Line Thickness

Line thickness of the scrambling code layer and of the lines between the signal route and the active sector.

Colors

Color of the active sector.

The ***cdma BTS Layer Settings*** tab of the *CDMA BTS Layer* dialog defines the general options for the BTS layer data.

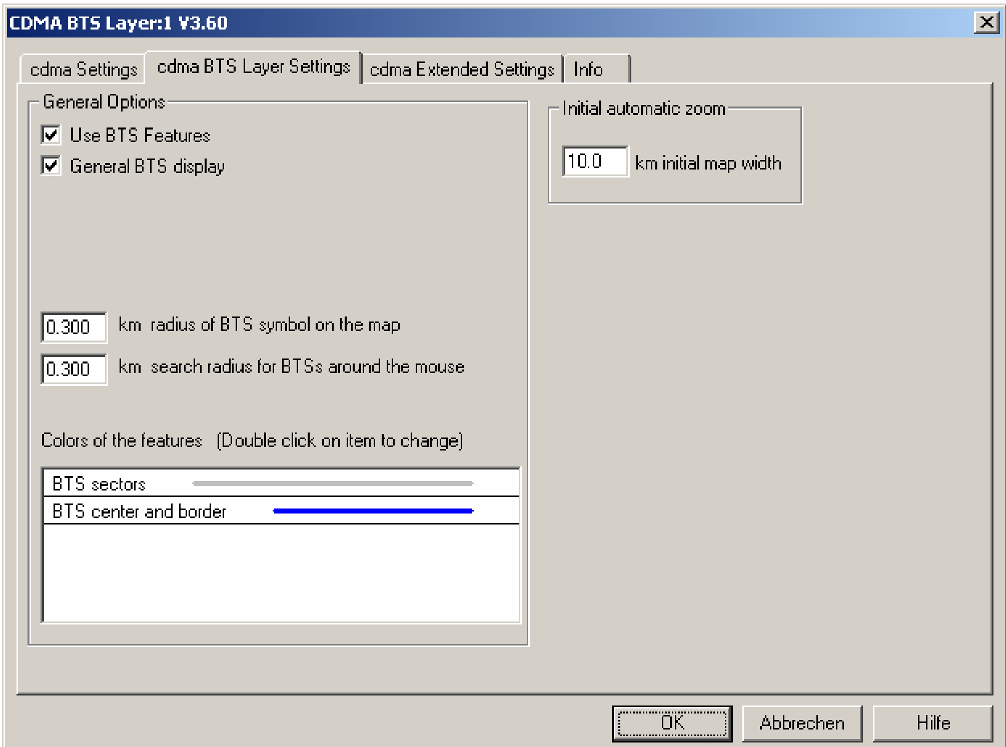


Fig. 4-41 CDMA BTS Layer dialog: cdma BTS Layer Settings

General Options

In the *Features* panel the following display elements can be switched off individually or altogether *(Use BTS Features* cleared):

General BTS display
: Enables or disables the general display of the BTS symbols, leaving only the symbols for the serving cells and for the cells being tracked

Radius of BTS symbol on the map
: The size of the BTS symbol on the displayed map can be adjusted by entering a proportional symbol radius here. This is useful in measurement areas with a high BTS density to avoid symbol overlapping.

Search radius for BTSs around the mouse
: The radius of the hot zone that can be clicked to open an info field can be adjusted.

Colors of the features

The *Colors* panel changes the colors of the display elements. Double-clicking an element of the list opens the *Colors* dialog (see p. 4.322) to modify the current display color.

Initial automatic zoom

The *Initial automatic zoom* panel contains an input field for the width of the *Route Track* view window. This setting is applied in a measurement session as soon as ROMES receives the first position coordinates. The first measurement point also marks the center of the map.

The *cdma Extended Settings* tab of the *CDMA BTS Layer* dialog selects the cell lines to be drawn and defines their display options.

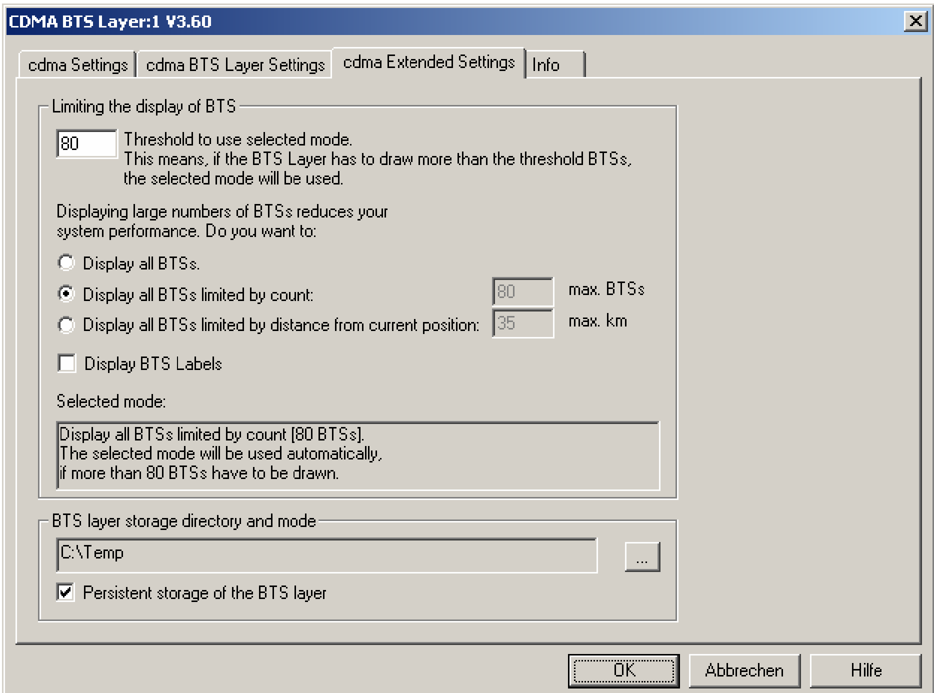


Fig. 4-42 CDMA BTS Layer dialog: cdma Extended Settings

BTS display limit

The *Limiting the display of BTS* panel contains an input field to limit the number of BTS symbols displayed in the *Route Track* view. A small number of BTS symbols improves the system performance.

ROMES counts the number of BTS symbols to be drawn. A limiting condition is imposed as soon as this number exceeds the threshold set in the input field. Below the threshold, all symbols all drawn.

Display all BTSs
All BTS symbols displayed, i.e. no limiting condition set

Display ... limited by count
Only a fixed number of BTS symbols around the current position are displayed. The fixed number is equal to the threshold value for the limiting condition.

Display ... limited by distance
Only the BTS symbols within a given radius (between 1 km and 1000 km) around the current position are displayed.

The limit settings are valid after an update of the BTS layer. ROMES indicates the limiting condition set when updating the BTS layer.

BTS layer storage directory and mode

If the *Persistent storage of the BTS layer* box is checked, ROMES stores the current BTS layer (containing all information on the BTS symbols to be displayed in the current view) to the directory indicated in the (unavailable) input field. This avoids reloading of the BTS list and recalculating of the layer when the workspace with the current *Route Track* view is opened for the next time.

The directory can be changed using the "..." button. This is particularly important if the BTS layer is stored to a RAM disk in order to improve the system performance; see section *RAMDisk* in chapter 8.

Attach Configuration Settings

Includes the current CDMA BTS layer configuration in the measurement file.

The attached configuration settings can be re-used in a later replay session.

BTS Selection

Opens the *BTS Selection* dialog to select BTSs with particular properties or position.

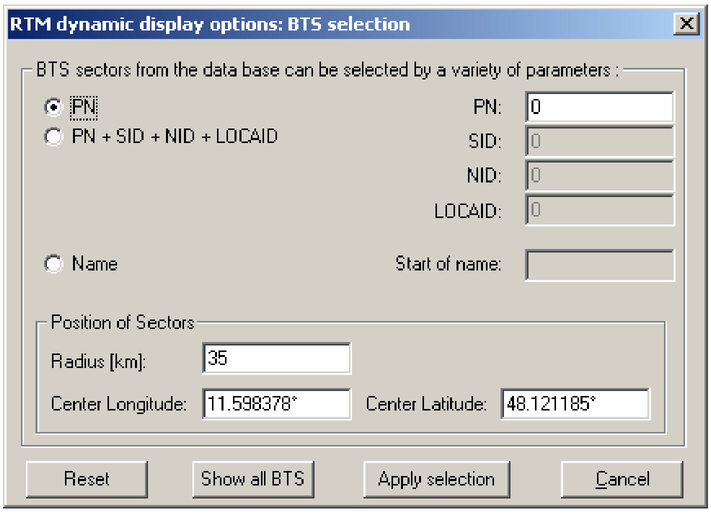


Fig. 4-43 BTS Selection dialog (CDMA networks)

Sectors' Properties

In the upper part of the dialog one or several of the following conditions can be set (click one of the option buttons and enter the desired value (name or integer number) in the input field on the right side):

PN

Select BTS with a particular pilot number

PN+SID+NID+LOCAID

Pilot number plus system identity plus network identity plus location area identity

Name

Select BTS with a particular name or with a name starting with a particular combination of characters

Position of Sectors

The *Position of Sectors* panel defines a circle of variable size and position to limit the number of BTS symbols displayed in the *Route Track* view. BTSs outside the circle are not displayed. A small number of BTS symbols improves the system performance.

The size of the circle is defined by the *Radius [km]*. Its position is defined by the longitude and latitude coordinates of the center *(Center Longitude, Center Latitude)*. The default *Center Longitude* and *Center Latitude* are the coordinates of the pointer on the *Route Track* view when the context menu and the *BTS Selection* dialog was called.

Reset

Reset the current display in the *Route Track* view; delete all BTS displayed (disabled during a measurement or replay).

Show all BTS

Show all BTS from the BTS list in the *Route Track* view. With this button, the BTS can be viewed without starting a measurement or a replay session (disabled during a measurement or replay).

Apply Selection

Apply the current condition.

Remove all BTS from map

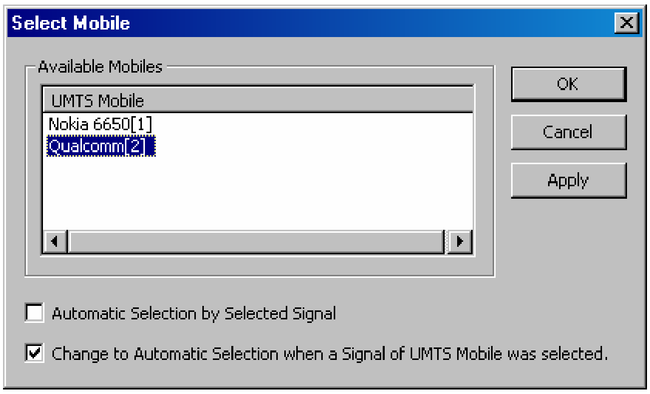
Removes all BTS symbols currently displayed.

A warning message must be confirmed before this command is executed. The function is disabled during a measurement or replay.

Mobile: Select Mobile...

Select the mobile for which the mobile layer is displayed.

The *Select Mobile* dialog contains a list of all mobiles available in the current measurement.



The mobile layer indicates the serving cell for a mobile along the measurement tour; see *Mobile: Layers invisible* below. The checkmarks below the mobile list can be used to select one of the following alternative modes:

Automatic Selection by Selected Signal
(upper box checked, lower box unavailable): The mobile layer always corresponds to the mobile that provided the selected signal. While a PNS signal is selected, the mobile layer is invisible so that the PNS layer can be displayed.

Change to Automatic Selection when a Signal of UMTS Mobile was selected
(upper box cleared, lower box checked): The mobile layer of the mobile selected in the list of *Available Mobiles* is displayed. This mobile layer is maintained if a PNS signal is selected. Selecting a signal from a UMTS mobile switches back to automatic mobile selection, so there can be no mismatch between a UMTS mobile signal an the mobile layer displayed in the *Route Track* view.

Fixed Mobile Layer
(upper and lower box cleared): The mobile layer of the mobile selected in the list of *Available Mobiles* is displayed, irrespective of the mobile signal selection.

Mobile: Layers invisible

Temporarily hide the entire BTS layer currently displayed.

A checkmark before the command indicates that a CDMA BTS layer is currently available, but hidden. The layer reappears if the command is clicked for the second time.

Layers Invisible is disabled if the current view contains no CDMA BTS layer.

CDMA 1xEV-DO BTS Layer Configuration

The submenu of the *CDMA 1xEV-DO BTS Layer* command in the *Route Track* context menu provides display settings for the *1xEV-DO* base stations in the view.

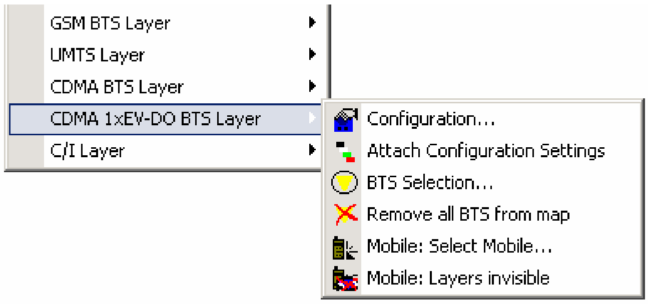


Fig. 4-44 CDMA 1xEV-DO BTS Layer submenu

Note:
Before any configurations can be made, a valid base station list must be imported and a BTS data base created. For CDMA base stations, this is done in the TEC for CDMA tab of the Configuration of Software Modules menu; refer to section Configuration Menu in chapter 3.

Configuration Opens the *CDMA 1xEV-DO BTS Layer* dialog to set the BTS display options.

The *cdma/1xEV-DO Settings* tab of the *CDMA BTS Layer* dialog defines the display options for 1xEV-DO scanner data.

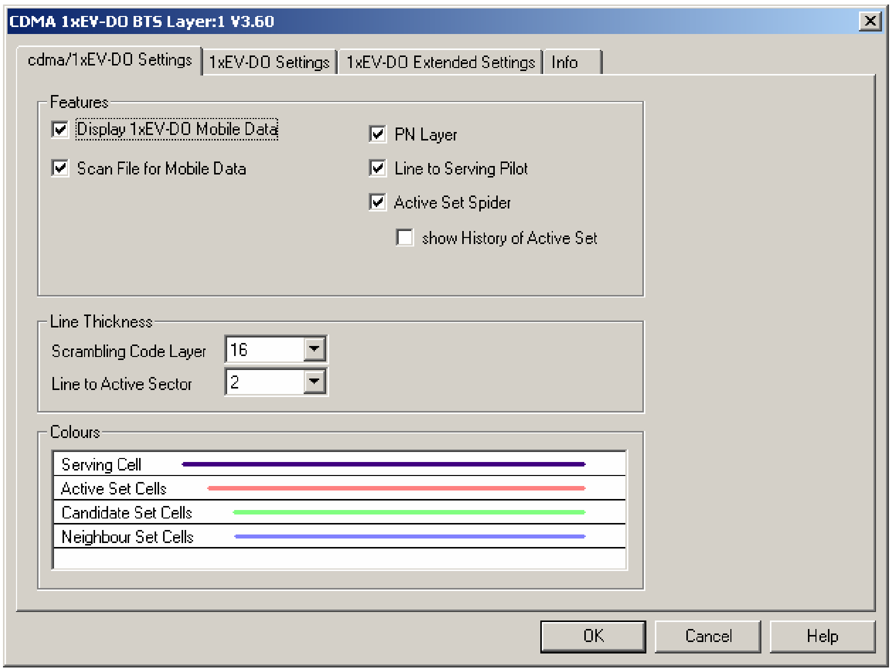


Fig. 4-45 CDMA 1xEV-DO BTS Layer dialog: cdma/1xEV-DO Settings

The *cdma/1xEV-DO Settings* are analogous to the BTS layer configurations for cdma BTS as described above:

Features To improve the stability of the radio connection and the handoff procedures, a 1xEV-DO mobile may be connected to several base stations or BTS sectors at the same time (soft handoff). However, only the connecting lines to the current (i.e. the most recently connected) BTS sector are drawn. Due to this simplification, the visualization of a CDMA/1xEV-DO route track is similar to GSM.

The following display elements can be switched off individually or altogether:

Display 1xEV-DO Mobile Data
General display of the 1xEV-DO symbols, leaving only the symbols for the serving cells and for the cells being tracked.

Scan File for Mobile Data
Enables or disables the automatic scan for mobile data in the active CMD file.

PN Layer
Hide or show the PN layer.*Line to Serving Pilot*
Draw lines to the current cell (serving cells)

Active Set Spider
Draw temporary lines between the mobile position and the cell sectors in the active set. If *Show History of Active Set* is active, the lines are no longer removed as the active set changes.

Line Thickness Line thickness of the scrambling code layer and of the lines between the signal route and the active sector.

Colors Color of the active sector.

The *1xEV-DO Settings* tab of the *CDMA 1xEV-DO BTS Layer* dialog defines the general options for the BTS layer data.

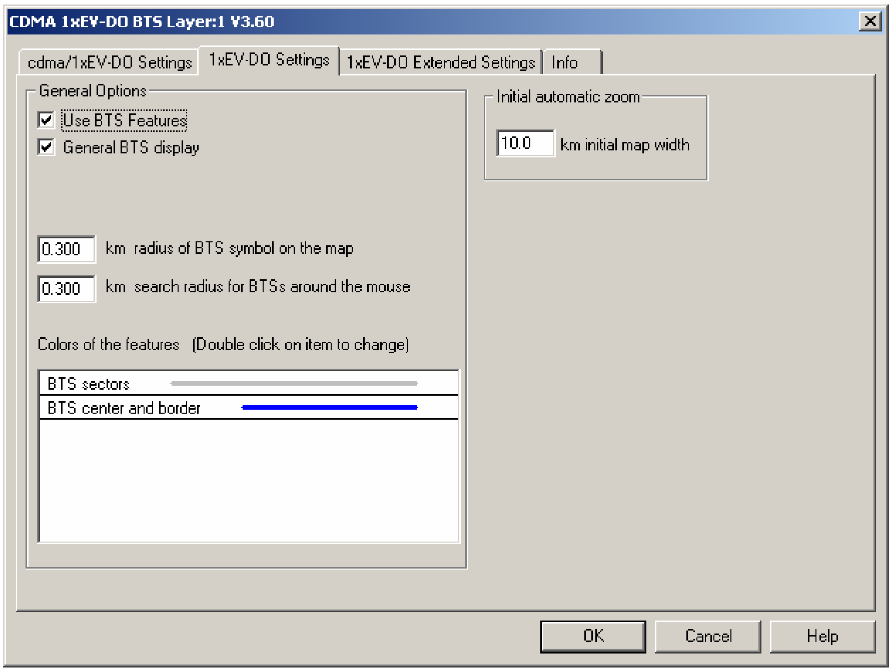


Fig. 4-46 CDMA 1xEV-DO BTS Layer dialog: 1xEV-DO Settings

General Options

In the *Features* panel the following display elements can be switched off individually or altogether *(Use BTS Features* cleared):

General BTS display
: Enables or disables the general display of the BTS symbols, leaving only the symbols for the serving cells and for the cells being tracked

Radius of BTS symbol on the map
: The size of the BTS symbol on the displayed map can be adjusted by entering a proportional symbol radius here. This is useful in measurement areas with a high BTS density to avoid symbol overlapping.

Search radius for BTSs around the mouse
: The radius of the hot zone that can be clicked to open an info field can be adjusted.

Colors of the features

The *Colors* panel changes the colors of the display elements. Double-clicking an element of the list opens the *Colors* dialog (see p. 4.322) to modify the current display color.

Initial automatic zoom

The *Initial automatic zoom* panel contains an input field for the width of the *Route Track* view window. This setting is applied in a measurement session as soon as ROMES receives the first position coordinates. The first measurement point also marks the center of the map.

The *1xEV-DO Extended Settings* tab of the *CDMA 1xEV-DO BTS Layer* dialog selects the cell lines to be drawn and defines their display options.

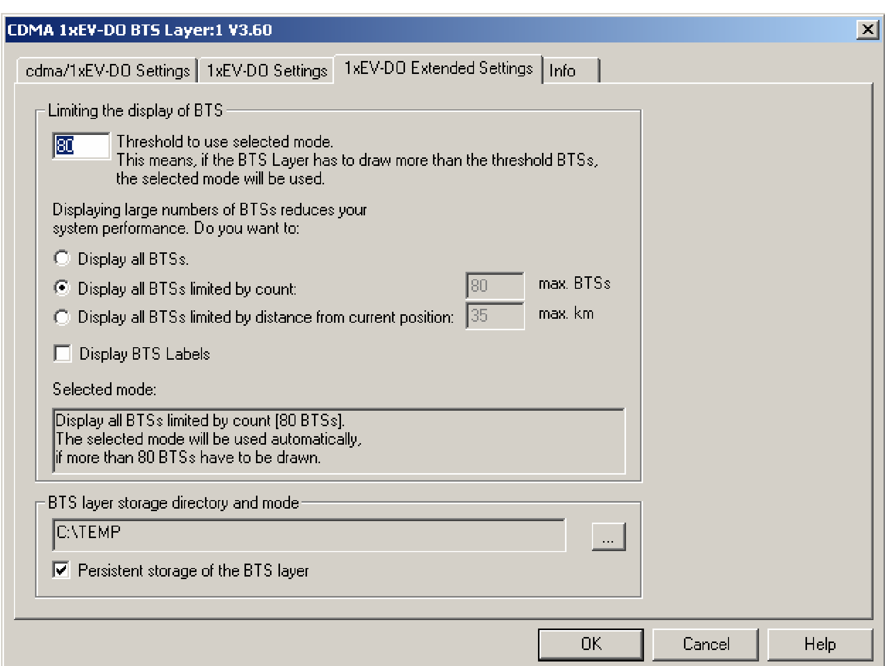


Fig. 4-47 CDMA 1xEV-DO BTS Layer dialog: 1xEV-DO Extended Settings

BTS display limit

The *Limiting the display of BTS* panel contains an input field to limit the number of BTS symbols displayed in the *Route Track* view. A small number of BTS symbols improves the system performance.

ROMES counts the number of BTS symbols to be drawn. A limiting condition is imposed as soon as this number exceeds the threshold set in the input field. Below the threshold, all symbols all drawn.

Display all BTSs
All BTS symbols displayed, i.e. no limiting condition set

Display ... limited by count
Only a fixed number of BTS symbols around the current position are displayed. The fixed number is equal to the threshold value for the limiting condition.

Display ... limited by distance
Only the BTS symbols within a given radius (between 1 km and 1000 km) around the current position are displayed.

The limit settings are valid after an update of the BTS layer. ROMES indicates the limiting condition set when updating the BTS layer.

BTS layer storage directory and mode

If the *Persistent storage of the BTS layer* box is checked, ROMES stores the current BTS layer (containing all information on the BTS symbols to be displayed in the current view) to the directory indicated in the (unavailable) input field. This avoids reloading of the BTS list and recalculating of the layer when the workspace with the current *Route Track* view is opened for the next time.

The directory can be changed using the "..." button. This is particularly important if the BTS layer is stored to a RAM disk in order to improve the system performance; see section *RAMDisk* in chapter 8.

Attach Configuration Settings

Includes the current CDMA 1xEV-DO BTS layer configuration in the measurement file.

The attached configuration settings can be re-used in a later replay session.

BTS Selection

Opens the *BTS Selection* dialog to select BTSs with particular properties or position.

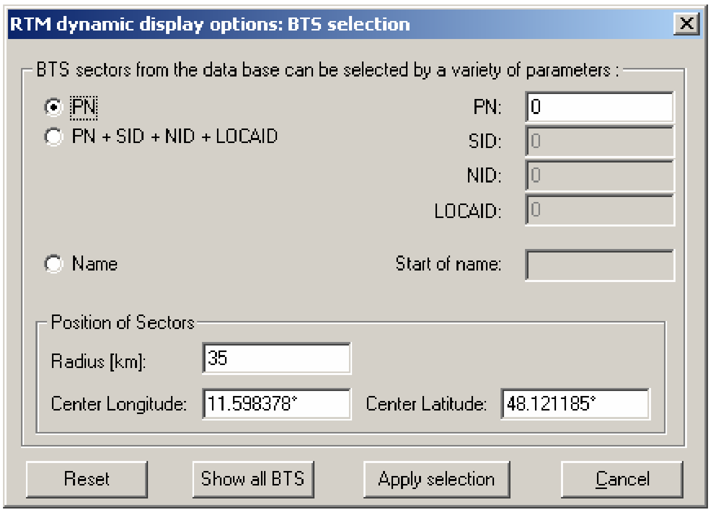


Fig. 4-48 BTS Selection dialog (CDMA 1xEV-DO networks)

Sector Properties

In the upper part of the dialog one or several of the following conditions can be set (click one of the option buttons and enter the desired value (name or integer number) in the input field on the right side):

PN

Select BTS with a particular pilot number

PN+SID+NID+LOCAID

Pilot number plus system identity plus network identity plus location area identity

Name

Select BTS with a particular name or with a name starting with a particular combination of characters

Position of Sectors

The *Position of Sectors* panel defines a circle of variable size and position to limit the number of BTS symbols displayed in the *Route Track* view. BTSs outside the circle are not displayed. A small number of BTS symbols improves the system performance.

The size of the circle is defined by the Radius [km]. Its position is defined by the longitude and latitude coordinates of the center *(Center Longitude, Center Latitude)*. The default *Center Longitude* and *Center Latitude* are the coordinates of the pointer on the *Route Track* view when the context menu and the *BTS Selection* dialog was called up.

Reset

Reset the current display in the *Route Track* view; delete all BTS displayed (disabled during a measurement or replay).

Show all BTS

Show all BTS from the BTS list in the *Route Track* view. With this button, the BTS can be viewed without starting a measurement or a replay session (disabled during a measurement or replay).

Apply Selection

Apply the current condition.

Remove all BTS from map

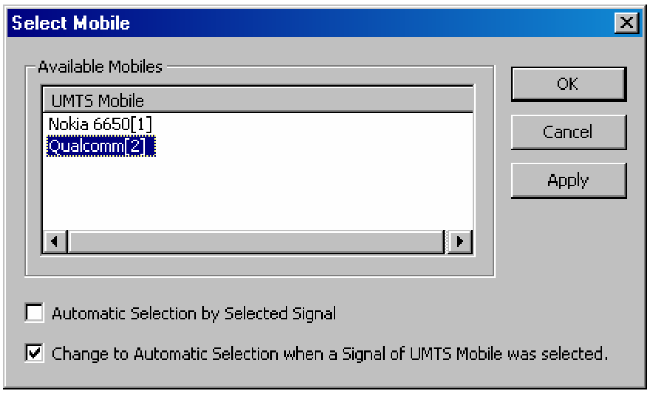
Removes all BTS symbols currently displayed.

A warning message must be confirmed before this command is executed. The function is disabled during a measurement or replay.

Mobile: Select Mobile...

Select the mobile for which the mobile layer is displayed.

The *Select Mobile* dialog contains a list of all mobiles available in the current measurement.



The mobile layer indicates the serving cell for a mobile along the measurement tour; see *Mobile: Layers invisible* below. The checkmarks below the mobile list can be used to select one of the following alternative modes:

Automatic Selection by Selected Signal
(upper box checked, lower box unavailable): The mobile layer always corresponds to the mobile that provided the selected signal. While a PNS signal is selected, the mobile layer is invisible so that the PNS layer can be displayed.

Change to Automatic Selection when a Signal of UMTS Mobile was selected
(upper box cleared, lower box checked): The mobile layer of the mobile selected in the list of *Available Mobiles* is displayed. This mobile layer is maintained if a PNS signal is selected. Selecting a signal from a UMTS mobile switches back to automatic mobile selection, so there can be no mismatch between a UMTS mobile signal an the mobile layer displayed in the *Route Track* view.

Fixed Mobile Layer
(upper and lower box cleared): The mobile layer of the mobile selected in the list of *Available Mobiles* is displayed, irrespective of the mobile signal selection.

Mobile: Layers invisible Temporarily hide the entire BTS layer currently displayed.

A checkmark before the command indicates that a CDMA 1xEV-DO BTS layer is currently available, but hidden. The layer reappears if the command is clicked for the second time.

Layers Invisible is disabled if the current view contains no CDMA 1xEV-DO BTS layer.

C/I Layer Configuration

The *C/I Layer* command in the *Route Track* context menu provides sub-commands and menus to configure a C/I layer. A C/I layer displays the results of Carrier-to-Interference analysis performed with options PCSD-K6/-K7.

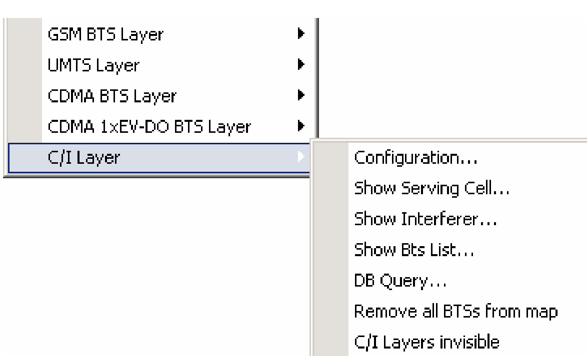


Fig. 4-49 C/I Layer submenu

For detailed information about the use and configuration of C/I layers in the *Route Track View* see chapter 2 (practical example) and chapter 5 (reference and background information on C/I analysis).

2G/3G Views

2G/3G views can be used to view 2G (GSM) as well as 3G (UMTS) data. Some of the views evaluate processes that are independent of the technology (e.g. the NQA call statistics), others show information that is exchanged between the 3G and 2G systems to ensure interoperability (e.g. the layer 3 messages).

The 2G/3G *Views* can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over 2G/3G *Views*.

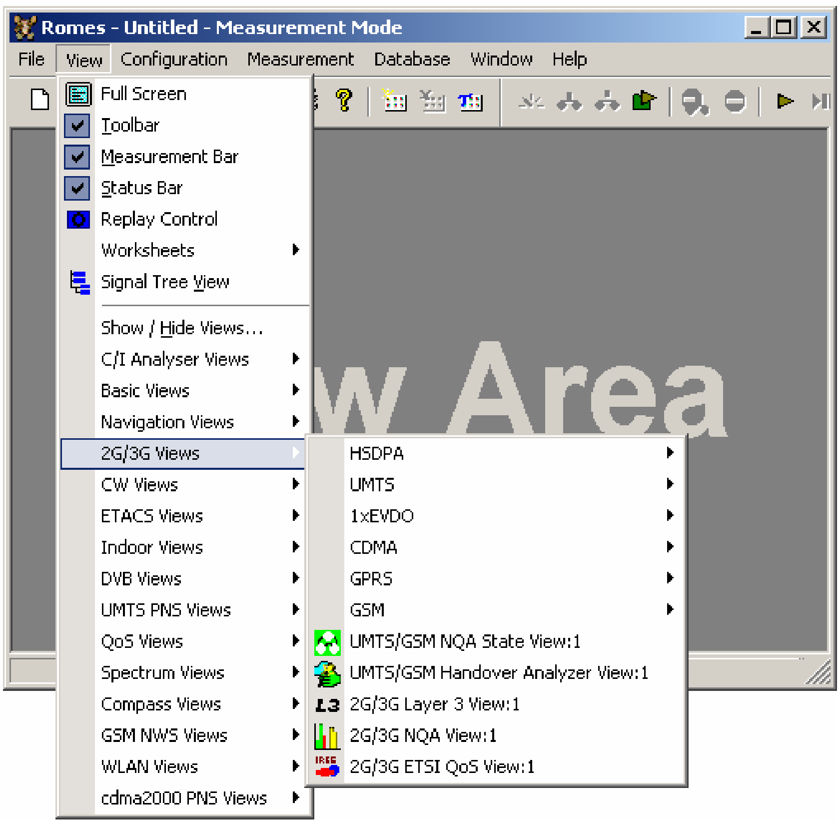


Fig. 4-50 2G/3G Views

UMTS HSDPA Views

The *UMTS HSDPA Views* display HSDPA-specific information acquired with an UMTS test mobile supporting HSDPA and using the UMTS driver. HSDPA measurements require option ROMES-UM4. In general, recording of the different message types shown in the *UMTS Views* must be explicitly activated in the driver configuration menu:

- Enable UMTS HSDPA in the Configuration tab.
- Select the HSDPA node in the Expert Mode tab.

ROMES supports HSDPA test mobiles based on the Qualcomm 6275 chipset.

The HSDPA views can be selected from a submenu displayed on the right side of the *View* menu when the mouse cursor hovers over *HSDPA*.

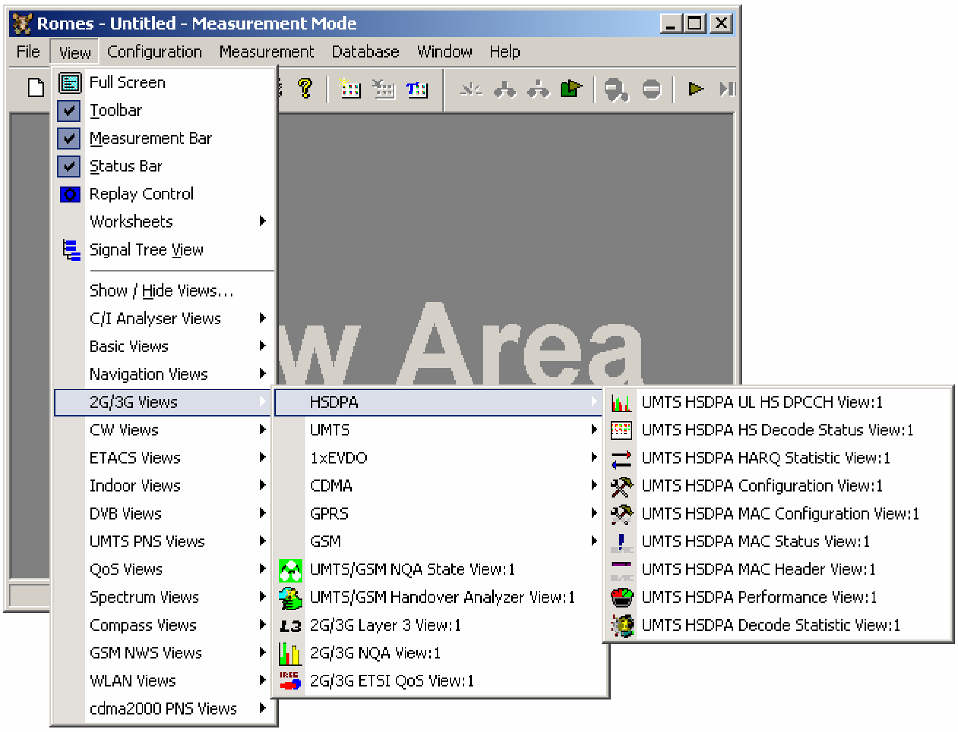
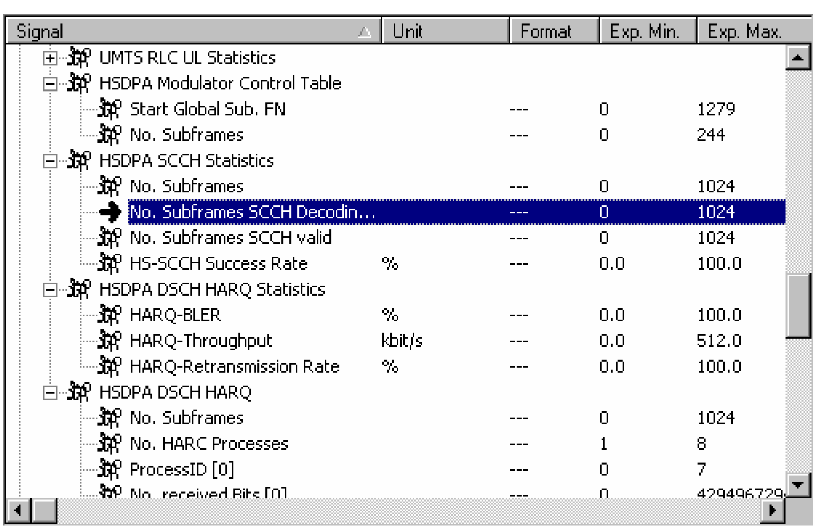


Fig. 4-51 UMTS HSDPA views

In addition to the *HSDPA Views* described in this section, ROMES provides an extensive selection of HSDPA signals. These signals appear below the *UMTS* node of the data tree *(Configuration – Preferences – Available Signals)* and can be analyzed in the appropriate *Basic Views* (see p. 4.7) and exported to ASCII files (see chapter 7). Many signals are also displayed in the *HSDPA Views.*



Signal	Unit	Format	Exp. Min.	Exp. Max.
UMTS RLC UL Statistics				
HSDPA Modulator Control Table				
Start Global Sub. FN		---	0	1279
No. Subframes		---	0	244
HSDPA SCCH Statistics				
No. Subframes		---	0	1024
No. Subframes SCCH Decodin...		---	0	1024
No. Subframes SCCH valid		---	0	1024
HS-SCCH Success Rate	%	---	0.0	100.0
HSDPA DSCH HARQ Statistics				
HARQ-BLER	%	---	0.0	100.0
HARQ-Throughput	kbit/s	---	0.0	512.0
HARQ-Retransmission Rate	%	---	0.0	100.0
HSDPA DSCH HARQ				
No. Subframes		---	0	1024
No. HARC Processes		---	1	8
ProcessID [0]		---	0	7
No. received Bits [0]		---	0	429496729

Fig. 4-52 HSDPA signals

TIP

In addition to the HSDPA views described in this section the following views can display HSDPA data: UMTS/GSM Handover Analyzer View, UMTS Finger Data View. *HSDPA-related information in these views is only available with option ROMES-UM4.*

UMTS HSDPA UL HS-DPCCH View

The *UMTS HSDPA UL HS-DPCCH View* shows the CQI values reported by the test mobile in the last 100 HSDPA subframes. In the network, the Channel Quality Indicator (CQI) is transmitted on the UL High Speed Dedicated Physical Control Channel (HS-DPCCH), which is a fixed rate channel with a spreading factor of 256. The first slot of each UL HS-DPCCH subframe contains the ACK/NACK messages, the following two slots carry the CQI. The frame structure of the uplink HS-DPCCH is shown in the figure below.

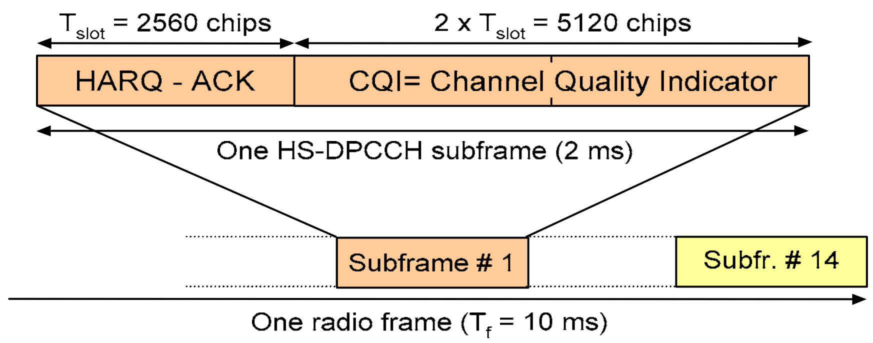


Fig. 4-53 HS-DPCCH frame structure

The CQI values are integer numbers between 0 and 30; see CQI mapping tables in standard 3GPP TS 25.214. Large CQI numbers denote a good channel quality and a high potential DL data throughput.

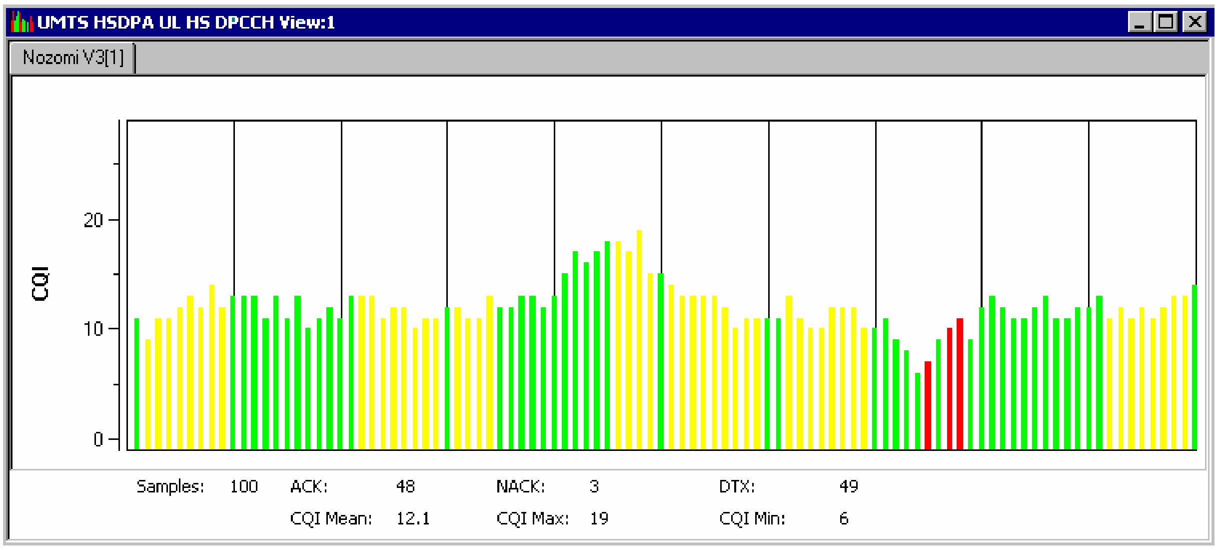


Fig. 4-54 UMTS HSDPA UL HS-DPCCH View

Diagram

The view shows a bar graph with fixed scale. Each bar corresponds to a CQI value reported by the mobile. The colors of the bars distinguish between the messages transmitted in the first (HARQ-ACK) slot of the HS-DPCCH subframe that carried the CQI value:

- A green bar denotes an acknowledged subframe: The mobile sends an *ACK* message after a successful CRC check of a received HS-DSCH packet.
- A red bar denotes an unacknowledged subframe: The mobile sends a *NACK* message after a failed CRC check.
- A yellow bar denotes a subframe that was neither acknowledged nor unacknowledged: no answer was received from the mobile. This is most likely because the mobile could not correctly demodulate the downlink HS-SCCH. Note that the mobile can use DTX independently in the ACK/NACK and CQI slots.

NOTE

With a CQI Feedback Cycle *of more than 1 subframe, the CQI information is no longer available in all subframes. ACK/NACK messages can still be transmitted. In the HS-DPCCH view, small colored bars of length 0 are used to visualize the ACK/NACK message content of subframes without CQI information.*

TIP

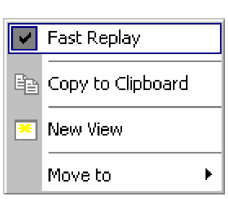
Use the UMTS HSDPA HS Decode Status View (see p. 4.78) to analyze the cause for an unacknowledged or DTX frame.

Statistical Results

Below the diagram the view shows the total number of CQI bars *(Samples)* in the diagram and the number of *ACK, NACK,* and *DTX* subframes (see above; *ACK + NACK + DTX = Samples).*

The arithmetic mean value of the displayed CQI values, the maximum, and the minimum CQI values are displayed below.

Context menu



A right mouse click on any point in the view opens the context menu to activate the fast replay mode, copy the view contents to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *UMTS HSDPA UL HS-DPCCH View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

UMTS HSDPA HS Decode Status View

The *UMTS HSDPA HS Decode Status View* shows the status of the HS-SCCH demodulation and the decoded HS-SCCH information. The view contains a table with up to 100 of the newest samples (sets of results) provided by the test mobile.

The HS-SCCH is a downlink physical channel used to carry downlink signalling information related to HS-DSCH transmission. This includes the channelization code set, the modulation scheme, the transport block size and HARQ related information (see standard 3GPP TS 25.212).

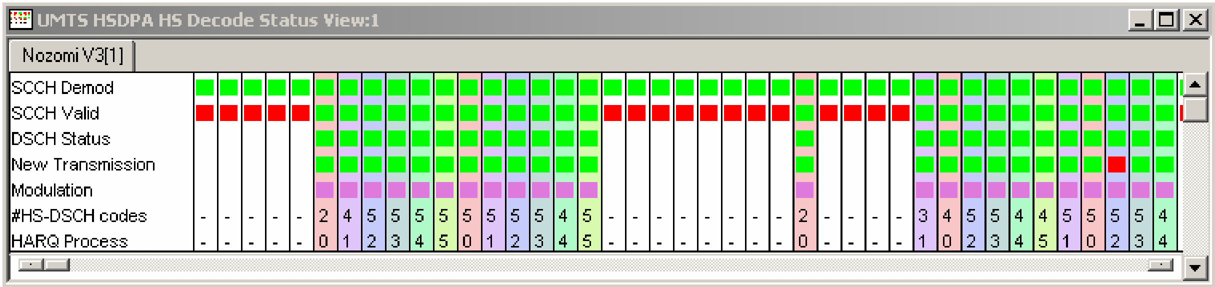


Fig. 4-55 UMTS HSDPA HS Decode Status View

Diagram

The view shows a table with fixed scale. Each column corresponds to a HS-SCCH sample comprising the following information:

SCCH Demod

Indicates whether the mobile attempted to demodulate the HS-SCCH

SCCH Valid

Indicates whether the mobile was able to decode consistent signaling information from the demodulated HS-SCCH

DSCH Status

Status of the CRC check for the transmitted and decoded HS-DSCH packet: *CRC pass* (successful transmission) causes an ACK message in the UL HS-DPCCH, *CRC fail* causes a NACK message, no CRC check (because no valid HS-SCCH information could be obtained) causes DTX. See also *UMTS HSDPA UL HS-DPCCH View* on p. 4.77.

New Transmission

Transmission of a new HS-DSCH packet or retransmission of a packet transmitted earlier.

Modulation

Modulation scheme *(QPSK* or *16QAM)*

#HS-DSCH Codes

Number of HS-(P)DSCH channelization codes in the range between 1 and 15. The HS-PDSCH is a fixed rate (SF = 16) physical channel with channelization code numbers ranging from 1 to 15 (ch. code $C_{16,0}$ is barred because the channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively). The HS-PDSCH channelization codes are allocated contiguously starting from the first code.

HARQ Process

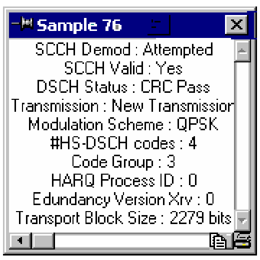
HARQ Process ID, number of the HARQ process that the transmission belongs to (range 0 to 7). The HARQ process ID defines the background color of the column.

The meaning of the colors in the diagram is listed in Table 1 below. Note that a red square will often cause red or white squares in the cells below (e.g. a failed SCCH demodulation means that the mobile cannot start receiving the HS-DSCH, so all the following cells are white).

Table 1 Color codes in the UMTS HSDPA HS Decode Status View

Decoding Stage	Green	Red	White
SCCH Demod	Attempted	Not attempted (because the SCCH did not carry the proper UE ID)	n/a
SCCH Valid	Yes	No	n/a
DSCH Status	CRC Pass	CRC Fail	n/a
New Transmission	New Transmission	Retransmission	n/a
Modulation	16QAM	QPSK (violet)	n/a

Details Window



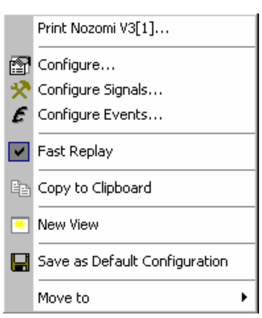
A double-click on any of the table columns opens a details window for the corresponding sample. The window repeats the information in the table and contains the following additional entries :

HARQ Process ID
Value of the HARQ process identifier (0 to 7)

Redundancy Version
Value X_{rv} in the range 0 to 7. X_{rv} jointly codes the redundancy version (RV) parameters r, s and the constellation version parameter b.

Transport Block Size
Size of the HS-DSCH transport blocks in bit, calculated from the 6-bit transport block size index; see 3GPP TS 25.321.

Context menu



A right mouse click on any point in the view opens the context menu to print the view, access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The *UMTS HSDPA HS Decode Status View* configuration menu contains a single *Info* tab; see p. 4.4.

UMTS HSDPA HARQ Statistic View

The *UMTS HSDPA HARQ Statistic View* shows the characteristics of all HARQ processes of the test mobile. HARQ processes control the transmission and (possibly) retransmission of data blocks. Up to 8 parallel HARQ processes can be active per mobile.

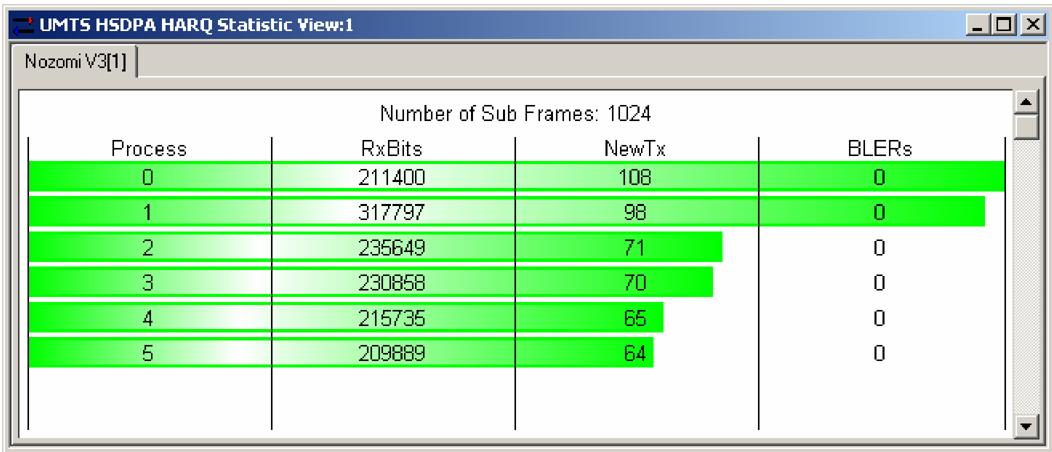


Fig. 4-56 UMTS HSDPA HARQ Statistic View

Diagram

The view shows a list of the different HARQ processes of the test mobile. The following information is displayed:

Number of Sub Frames

Averaging length for the statistical results, mobile-specific parameter.

Process

HARQ process identifier. The list is sorted so that the identifiers are in the range 0 to n ($n \leq 7$).

RX Bits

Number of received bits per process.

New Tx

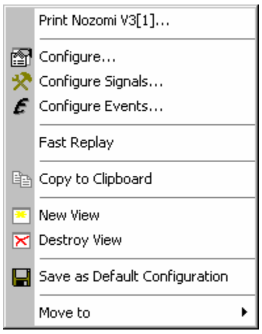
New data indicator; the number of new data blocks transmitted within the HARQ process (not counting retransmissions, i.e. data blocks received in error).

BLERs

Block Errors, the number of blocks received in error.

Either the *BLERs* (red) or the *New TX* (green) can be visualized with horizontal, colored bars. The selection of bars and the scales are defined in the configuration menu.

Context menu



A right mouse click on any point in the view opens the context menu to print the view, access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS HSDPA HARQ Statistic View Configuration

The *UMTS HSDPA HARQ Statistic View* configuration menu selects and scales the colored *BLER* or *New Tx* bars in the diagram.

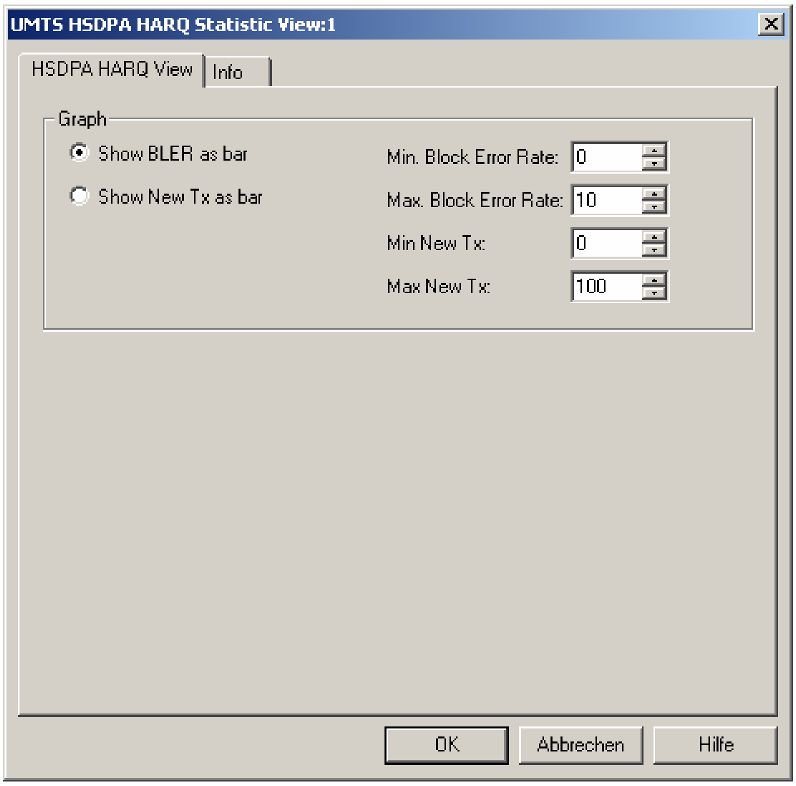


Fig. 4-57 UMTS HSDPA HARQ Statistic View Configuration

Graph *Show BLER as bar* or *Show New TX as bar* select the visualized quantity. The input fields on the right side set the scale of the bars.

UMTS HSDPA Configuration View

The *UMTS HSDPA Configuration View* shows the configuration of the DL HSDPA channels received by the test mobile, the UL HS-DPCCH, and information related to the finger configuration command, the DL HS-SCCHs, and the active HARQ processes. This configuration data is generated whenever there is a L1 reconfiguration related to HSDPA.

Most of the displayed information is mobile-specific and primarily intended for monitoring the status of the test mobile.

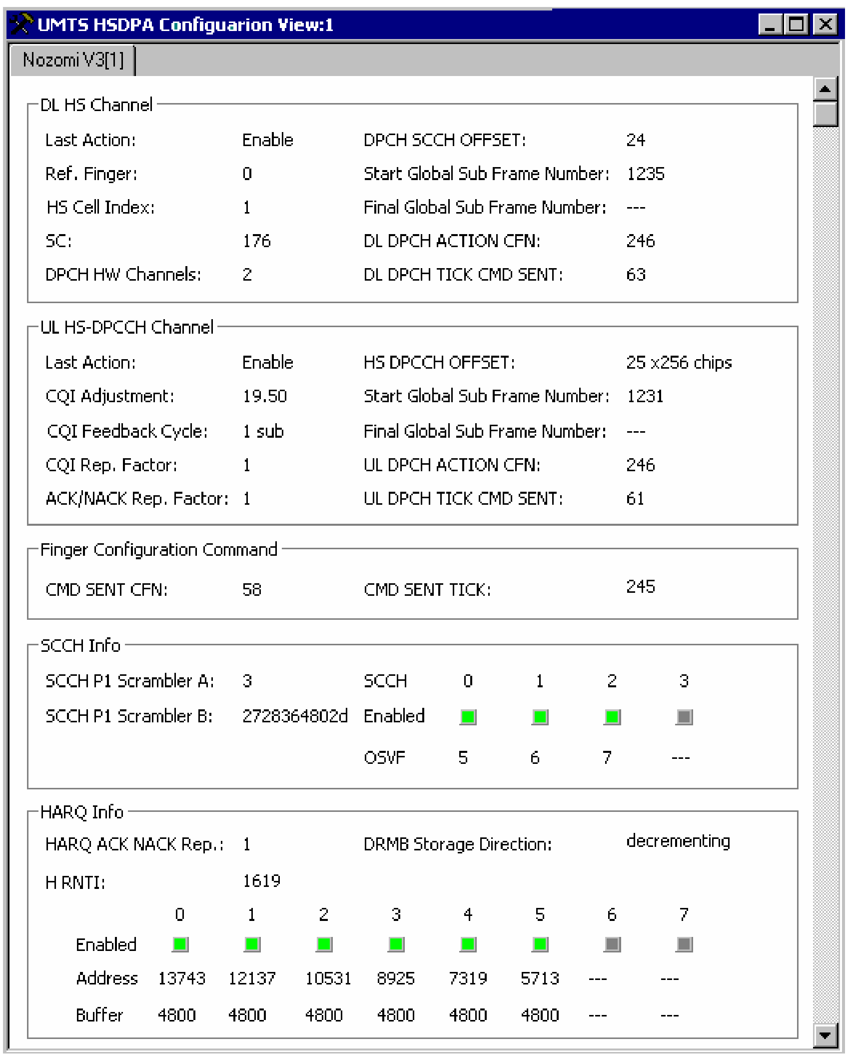


Fig. 4-58 UMTS HSDPA Configuration View

The configuration data is displayed in different panels.

DL HS Channel

The following information is related the DL High Speed Channels (HS-DPCH and HS-SCCH):

Last Action
Status of the DL transmission. *Enable, Disable,* or *Reslam*.

Ref. Finger
Reference finger (values 0 to 11).

HS Cell Index
High speed cell index in the range 0 to 7.

SC
Common scrambling code for all DL HSDPA channels.

Use the UMTS Finger Data View (see p. 4.101*) to view the preceding parameters together with the time offset and Ec/Io of all signals captured by the different fingers of the mobile receiver.*

DPCH HW Channels
Values 0 to 3.

DPCH SCCH Offset
Corresponds to starting global sub frame number, values 0 to 149 (256 chip periods).

Start Global Sub Frame Number
Mobile-specific subframe no. in the range 0 to 1279.

Final Global Sub Frame Number
Mobile-specific subframe no. in the range 0 to 1279, only relevant for *Last Action: Reslam*.

DL DPCH ACTION CFN
Mobile-specific parameter, 0 to 255.

DL DPCH TICK CMD SENT
Mobile-specific parameter, 0 to 149.

UL HS-DPCCH Channel

The following information is related the UL HS-DPCCH. This channel carries the ACK/NACK and CQI messages that the mobile reports to the network; see *UMTS HSDPA UL HS-DPCCH View* on p. 4.77:

Last Action
Status of the UL transmission. *Enable, Disable,* or *Reslam*.

CQI Adjustment
Adjustment applied to SIR measurement before quantization. CQI Adjustment = [12.04 + DSCH to CPICH offset (signaled to the mobile) + SNR to CQI offset (constant for a software build, e.g. 4.0].

CQI Feedback Cycle
Time (in multiples of HSDPA subframes with a length of 2 ms) after which the mobile repeats the transmission of CQI symbols on the HS-DPCCH. Possible values are 0, 1, 2, 4, 5, 10, 20, 40, 80.

CQI Rep. Factor
Number of repeated CQI transmissions (1 to 4).

ACK/NACK Rep.
Factor Number of repeated ACK/NACK transmissions (1 to 4).

HS-DPCCH Offset
Corresponds to starting global sub frame number, values 0 to 149 (256 chip periods).

Start Global Sub Frame Number
Mobile-specific subframe no. in the range 0 to 1279.

Final Global Sub Frame Number
Mobile-specific subframe no. in the range 0 to 1279, only relevant for *Last Action: Reslam*.

UL DPCH ACTION CFN
Mobile-specific parameter, 0 to 255.

UL DPCH TICK CMD SENT
Mobile-specific parameter, 0 to 149.

Finger Configuration Command

The following information is mobile-specific.

CMD SENT CFN
Counter in the range 0 to 255.

CMD SENT TICK
Counter in the range 0 to 149.

SCCH Info

The *SCCH Info* field provides information about the channels in the HS-SCCH set which is allocated to the mobile. A HS-SCCH set is a set of 1 to 4 HS-SCCHs. The mobile continuously monitors all the HS-SCCHs in the allocated set.

The panel shows the number of enabled SCCHs together with their channelization codes *(OSVF)*. The SCCHs are fixed rate channels (SF = 128) with code numbers ranging from 1 to 127.

The remaining information mobile-specific.

HARQ Info

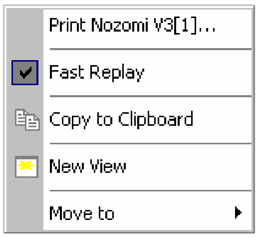
The *HARQ Info* field provides information about the active HARQ processes together with the internal address and the size of the physical buffer associated with each process. In addition the following information is displayed:

HARQ ACK/NACK Rep.
Mobile-specific parameter.

DRMB Storage Direction
Mobile-specific parameter.

H RNTI
HS-DSCH RNTI, 16-bit identity, identifies the mobile for which data is transmitted in the corresponding HS-DSCH TTI.

Context menu



A right mouse click on any point in the view opens the context menu to print the view, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *UMTS HSDPA Configuration View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

UMTS HSDPA MAC Configuration View

The *UMTS MAC Configuration View* shows the configuration of the MAC-hs that the test mobile receives from the network. The MAC-hs is the MAC entity that handles the high speed downlink shared channel (HS-DSCH); see standard 3GPP TS 25.321. The view is updated every time the MAC-hs is reconfigured.

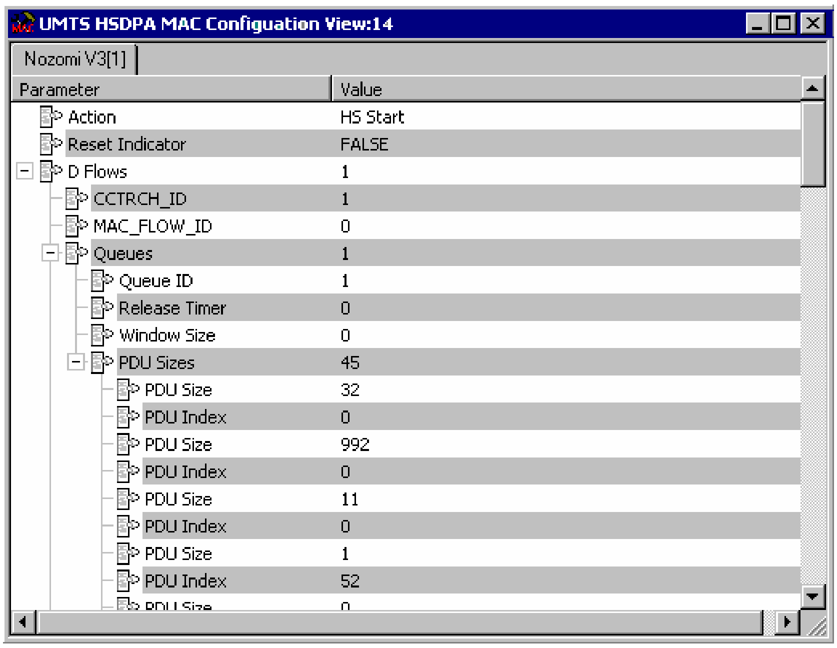


Fig. 4-59 UMTS MAC Configuration View

Diagram The view shows the following Mac-hs parameters with their values:

Action

Indicates the last action that the MAC-hs entity was requested to perform by upper layers: *Start, Stop*, or *Reconfigure*.

Reset Indicator

TRUE indicates that a reset of the MAC-hs entity has been requested.

CCTRCH_ID

Unambiguous identifier for the Coded Composite Transport Channel (CCTrCH) inside the radio link (range 0 to 7).

MAC_FLOW_ID

Mobile-specific parameter, range 1 to 8.

Queue / Queue ID

The Queue ID provides identification of the reordering queue in the receiver, in order to support independent buffer handling of data belonging to different reordering queues (range 1 to 8).

Release Timer

Value of the reordering release timer (T1). The release timer controls the stall avoidance in the mobile's reordering buffer; see 3GPP TS 25.321, section 11.6.2.3.2. Possible values are 10, 20, 30 … 100, 120, 140, 160, 200, 300, 400.

Window Size

Size of the receiver window, given in terms of a TSN range

PDU Size

Size of the Protocol Data Units (PDUs) that can be transferred to MAC within a transmission time interval in the range 0 to 5000 (bits).

PDU Index

MAC PDU Size Index in the range 0 to 7

Logical Channel / RLC ID

Mobile-specific parameter, range 0 to 17.

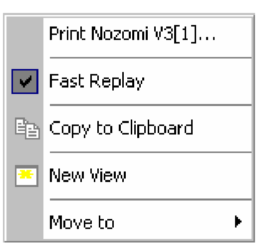
Type

Channel type: BCCH, PCCH, CCCH, DCCH, CTCH, or DTCH.

Mode

Channel Mode: Transparent mode *(TM)*, Unacknowledged mode (UM), or Acknowledged mode (AM)

Context menu

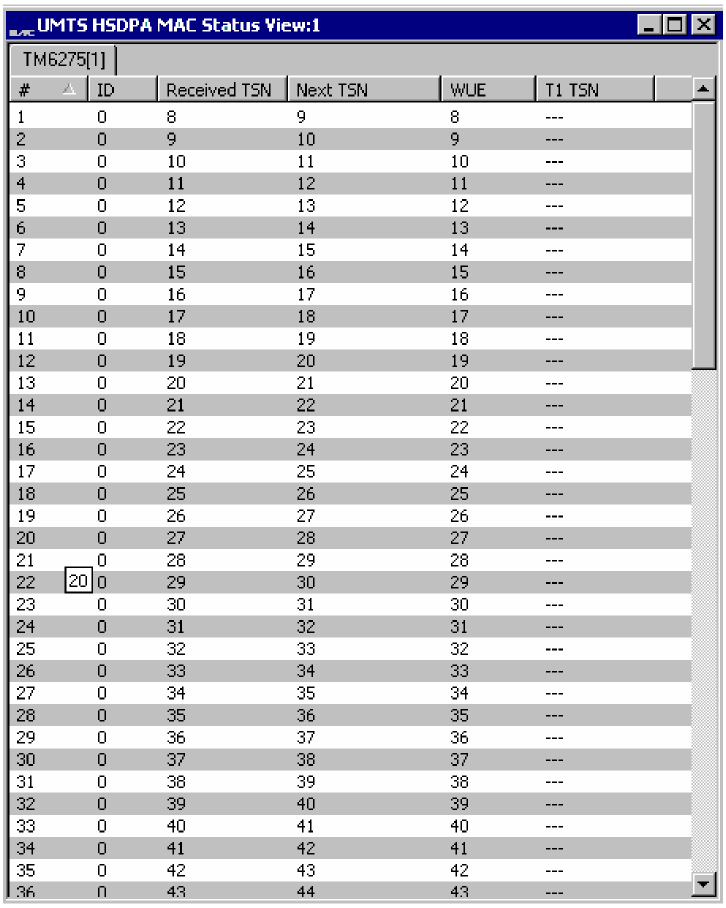


A right mouse click on any point in the view opens the context menu to print the view, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *UMTS MAC Configuration View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

UMTS HSDPA MAC Status View

The *UMTS MAC Status View* gives an overview of the status of the reordering entity in the mobile receiver. The different state variables are described in standard 3GPP TS 25.321. The mobile collects this information in up to 100 consecutive samples which are displayed in a table.


UMTS HSDPA MAC Status View:1
TM6275[1]

#	ID	Received TSN	Next TSN	WUE	T1 TSN
1	0	8	9	8	---
2	0	9	10	9	---
3	0	10	11	10	---
4	0	11	12	11	---
5	0	12	13	12	---
6	0	13	14	13	---
7	0	14	15	14	---
8	0	15	16	15	---
9	0	16	17	16	---
10	0	17	18	17	---
11	0	18	19	18	---
12	0	19	20	19	---
13	0	20	21	20	---
14	0	21	22	21	---
15	0	22	23	22	---
16	0	23	24	23	---
17	0	24	25	24	---
18	0	25	26	25	---
19	0	26	27	26	---
20	0	27	28	27	---
21	0	28	29	28	---
22	0	29	30	29	---
23	0	30	31	30	---
24	0	31	32	31	---
25	0	32	33	32	---
26	0	33	34	33	---
27	0	34	35	34	---
28	0	35	36	35	---
29	0	36	37	36	---
30	0	37	38	37	---
31	0	38	39	38	---
32	0	39	40	39	---
33	0	40	41	40	---
34	0	41	42	41	---
35	0	42	43	42	---
36	0	43	44	43	---

Fig. 4-60 UMTS HSDPA MAC Status View

Diagram The view displays the following information elements:

#
: Current number of the sample, assigned in the range 1 to 100.

ID Queue ID (0 to 7).
: The Queue ID provides identification of the reordering queue in the receiver, in order to support independent buffer handling of data belonging to different reordering queues.

Received TSN
: Transmission Sequence Number (TSN, 0 to 63) of the last received (HS-DSCH) MAC-hs PDU.

Next TSN

Next expected TSN. The TSN following the TSM of the last in-sequence MAC PDU received.

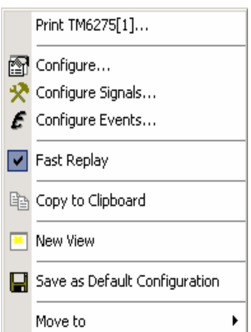
WUE

WUE (Window Upper Edge) represents the TSN at the upper edge of the receiver window. While timer T1 is active, the number is equal to the *Received TSN.* Otherwise it is invalid.

T1 TSN

TSN used in the reordering procedure. The TSN of the latest MAC-hs PDU that cannot be delivered to the disassembly entity, when the timer T1 is started.

Context menu



A right mouse click on any point in the view opens the context menu to print the view, access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS HSDPA MAC Status View Configuration

The *UMTS HSDPA MAC Status View* configuration menu selects the information to be displayed.

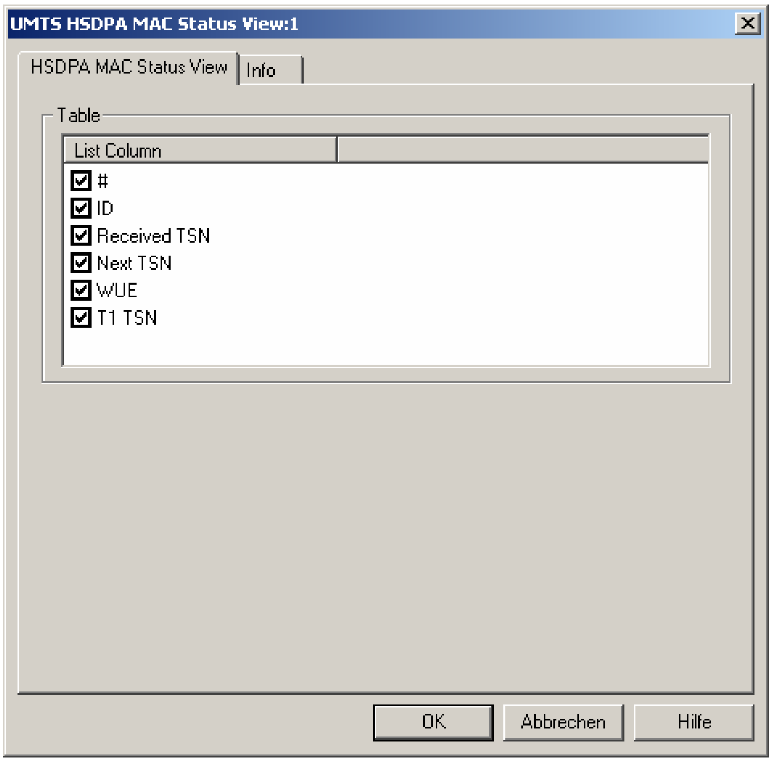


Fig. 4-61 UMTS HSDPA Status View Configuration

UMTS HSDPA MAC Header View

The *UMTS MAC Header View* shows the mobile-specific subframe number and the corresponding (HS-DSCH) MAC-hs headers as defined in standard 2GPP TS 25.321, sections 9.1.4 and 9.2.2.

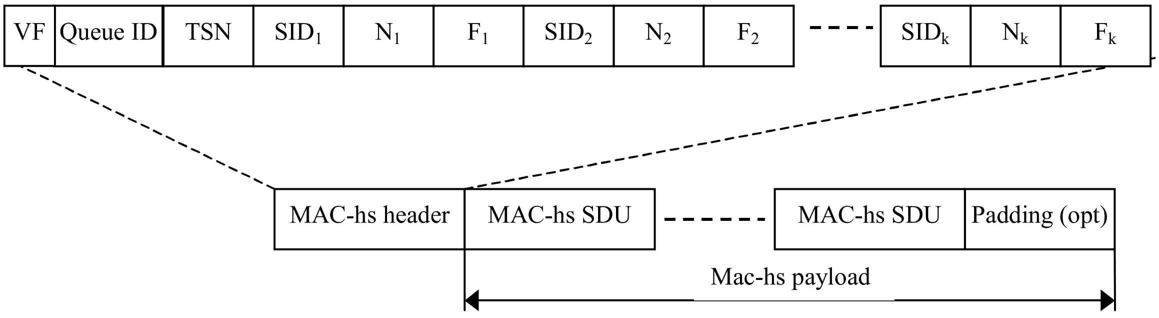


Fig. 4-62 UMTS MAC-hs PDU

TIP

For an overview of the last 100 MAC-hs PDUs use the UMTS HSDPA MAC Status View *(see p. 4.89).*

UMTS HSDPA MAC Header View:1

TM6275[1]

#	FN	VF	ID	TSN	SID(1)	N(1)	SID(2)	N(2)	SID(3)
1	685	0	0	28	0	9			
2	686	0	0	29	0	9			
3	687	0	0	30	0	9			
4	688	0	0	31	0	9			
5	689	0	0	32	0	9			
6	690	0	0	33	0	9			
7	691	989	0	34	0	9			
8	692	0	0	35	0	9			
9	693	0	0	36	0	9			
10	694	0	0	37	0	9			
11	695	0	0	38	0	9			
12	696	0	0	39	0	9			
13	697	0	0	40	0	9			
14	698	0	0	41	0	9			
15	699	0	0	42	0	9			
16	700	0	0	43	0	9			
17	701	0	0	44	0	9			
18	702	0	0	45	0	9			
19	703	0	0	46	0	9			
20	704	0	0	47	0	9			
21	705	0	0	48	0	9			
22	706	0	0	49	0	7			
23	707	0	0	50	0	9			
24	709	0	0	52	0	9			
25	710	0	0	53	0	9			
26	711	0	0	54	0	5			
27	712	0	0	55	0	4			
28	714	0	0	51	0	9			
29	715	0	0	57	0	3			
30	716	0	0	58	0	5			
31	717	0	0	59	0	2			

Fig. 4-63 UMTS HSDPA MAC Header View

Diagram

The MAC-hs header contains the following information elements:

FN

Internal subframe number, range 0 to 1279.

VF

Version flag, at present set to zero.

ID

Queue ID (0 to 7). The Queue ID provides identification of the reordering queue in the receiver, in order to support independent buffer handling of data belonging to different reordering queues.

TSN Transmission

Sequence Number (TSN, 0 to 63) on the HS-DSCH. The TSN field is used for reordering purposes to support in-sequence delivery to higher layers.

SID(n)

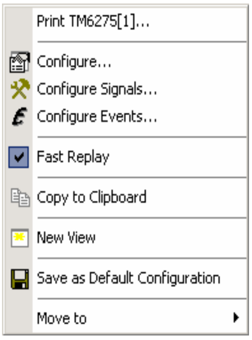
Size Index Identifier (0 to 7), identifies the size of a set of consecutive MAC-d PDUs. The MAC-d PDU size for a given SID is configured by higher layers and is independent for each Queue ID.

N(n)

Number of MAC-D PDUs (0 to 63), the number of consecutive MAC-d PDUs with equal size.

The flag fields *(F)* in Fig. 4-62 above indicate whether the MAC-hs header contains additional *SID* and *N* fields. They are not relevant for the *MAC Header View* because the number of columns in the table is selected in the configuration menu.

Context menu



A right mouse click on any point in the view opens the context menu to print the view, access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS HSDPA MAC Header View Configuration

The *UMTS HSDPA MAC Header View* configuration menu selects the information to be displayed.

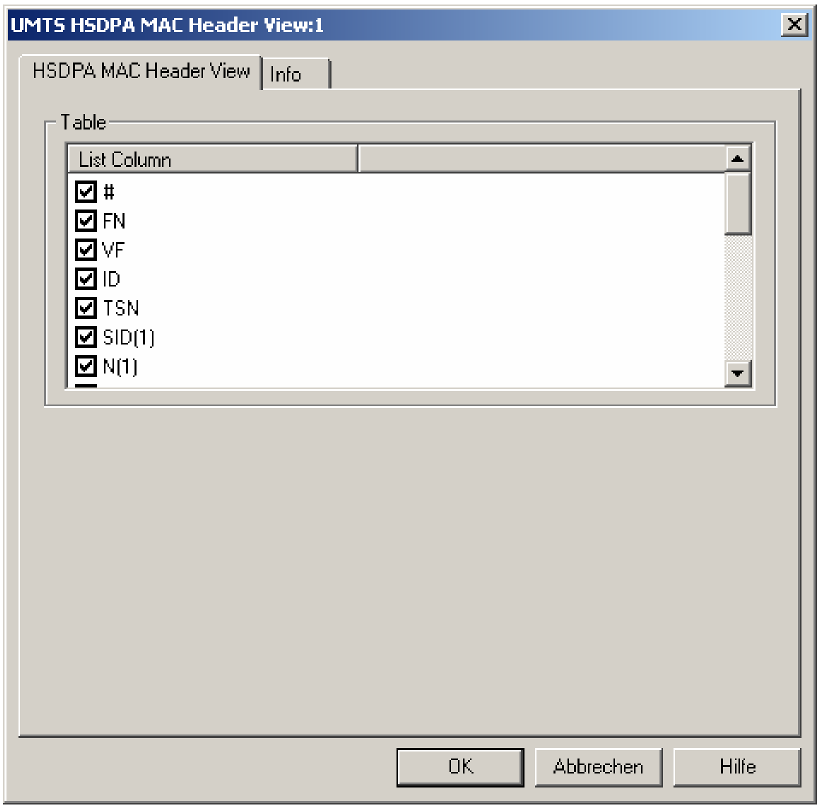


Fig. 4-64 UMTS HSDPA Header View Configuration

UMTS HSDPA Performance View

The *UMTS HSDPA Performance View* contains five preconfigured 2D charts. The signals in these charts are related to the transmission performance, given in terms of the requested or achieved data throughput.

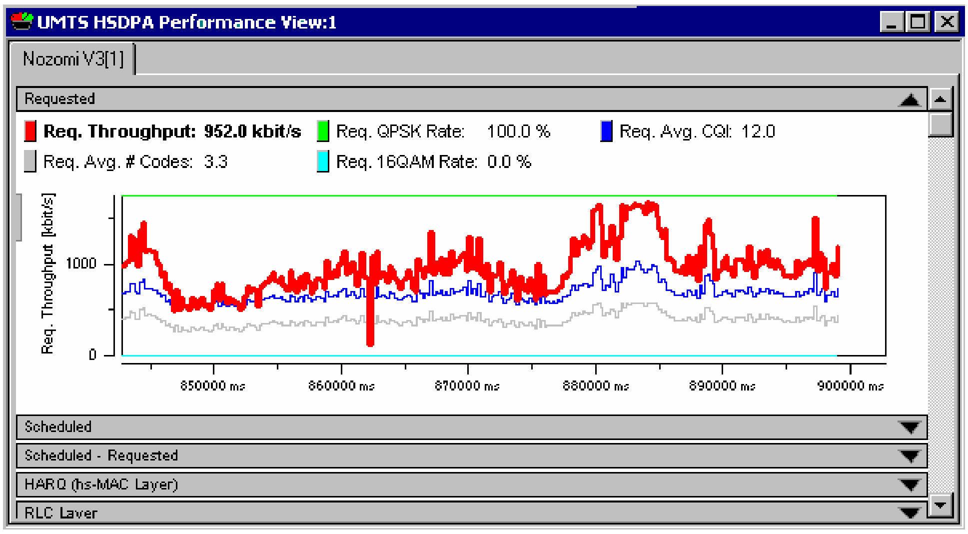


Fig. 4-65 UMTS HSDPA Performance View

A double-click on the *Requested, Scheduled,* title bars opens or closes the sub-diagrams in the performance view. The functionality of all sub-diagrams is analogous to the *2D Chart View* described on p. 4.11, however, an additional *Plot* dialog (see below) provides additional settings to control the diagram content and appearance.

Requested The *Requested* throughput (see Fig. 4-65 above) is the data throughput that the mobile requests according to the measured channel quality. The requested throughput is calculated from the CQI messages that the mobile transmits on the UL HS-DPCCH; see *UMTS HSDPA UL HS-DPCCH View* on p. 4.77. The results are averaged over the number of subframes (100) shown in the *UMTS HSDPA HS-DPCCH* view.

The chart contains the following results:

Req. Throughput
Requested total throughput

Req. Avg. # Codes
Number of HS-(P)DSCH channelization codes in the range between 1 and 15. See *UMTS HSDPA HS Decode Status View* on p. 4.78.

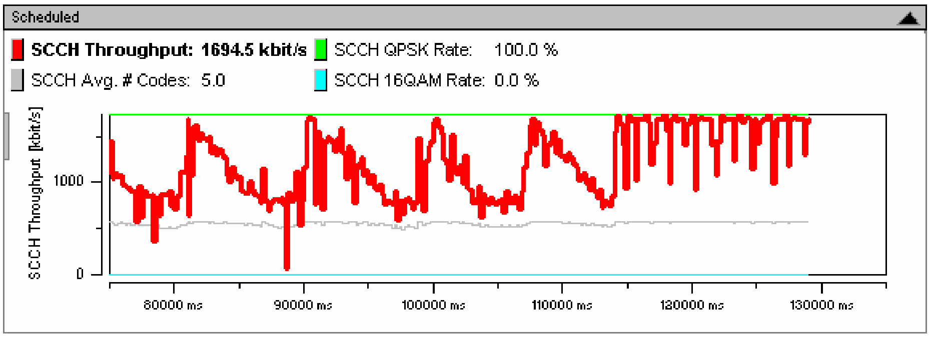
Req. QPSK Rate
Percentage of the requested throughput that should be transferred on QPSK-modulated data blocks.

Req. 16QAM Rate
Percentage of the requested throughput that should be transferred on 16QAM-modulated data blocks.

Req. Avg. CQI
Average CQI value received from the mobile.

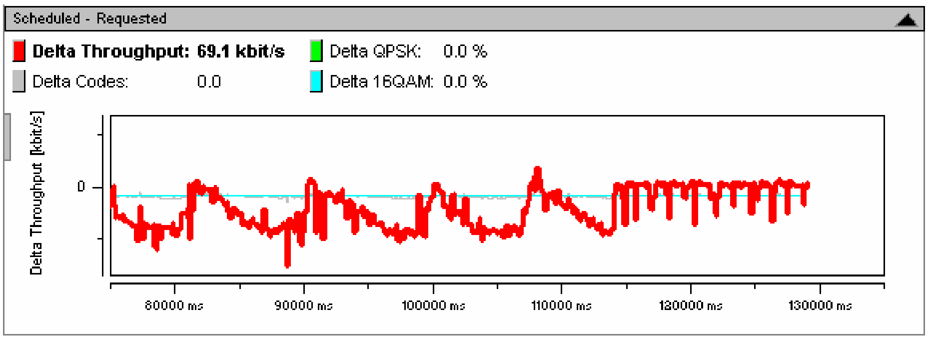
Scheduled

The *Scheduled* throughput is the data throughput that the network uses according to the requests (CQI messages) from the mobile. The results are analogous to the *Requested Throughput* results.



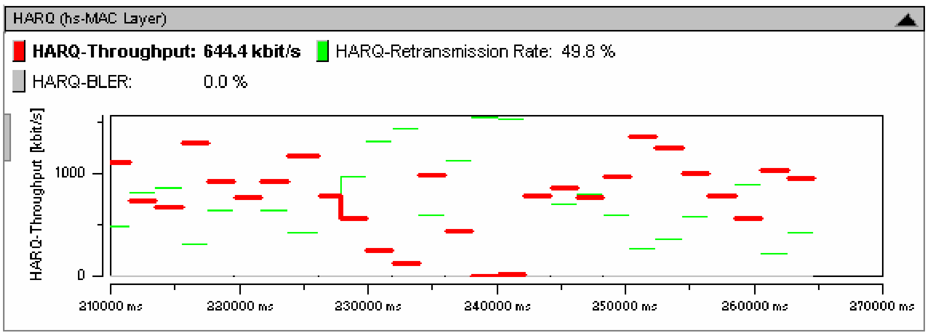
Scheduled – Requested

The *Scheduled – Requested* throughput is the difference between the scheduled and the requested throughputs. The results are analogous to the *Requested Throughput* results. If there is no network congestion, the delta results are close to zero.



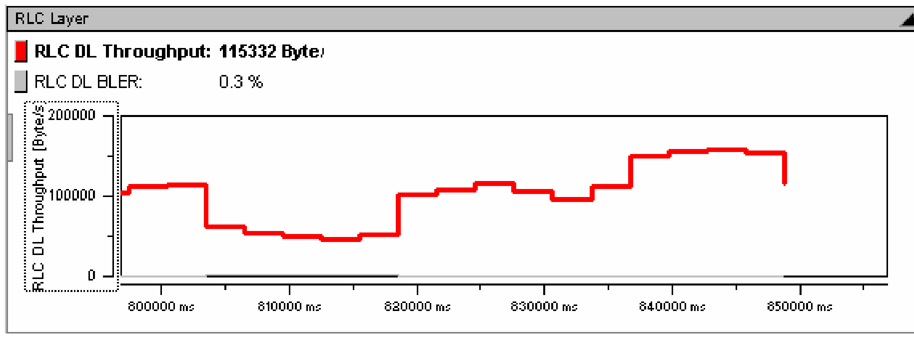
HARQ (hs-MAC Layer)

The *HARQ (hs-MAC Layer)* throughput is the actual DL data throughput achieved. The HARQ throughput depends on the scheduled throughput and the percentage of data blocks that the network has to re-transmit *(HARQ Retransmission Rate):* The larger the retransmission rate, the smaller the HARQ Throughput.



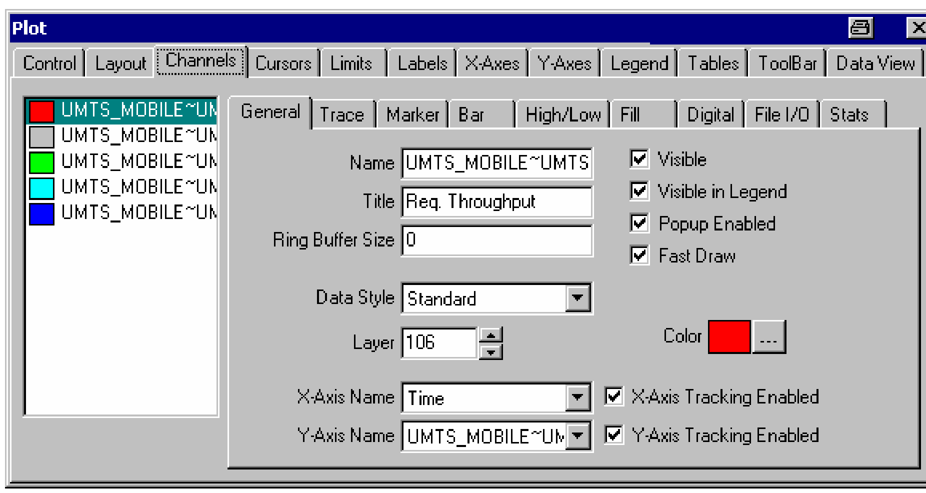
RLC Layer

The *RLC Layer* throughput is the data throughput of the RLC blocks that the mobile receives from the network. The *RLC DL BLER* is the percentage of RLC blocks that the UE received in error.

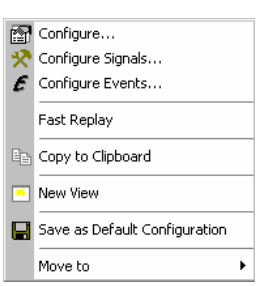


View Configuration

The *Plot* dialog provides additional settings to control the diagram content and appearance. The dialog is opened from a context menu; this menu appears after a right-click on the y-axis labels or on one of the curves in the diagram.



Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS HSDPA Performance View Configuration

The *UMTS HSDPA Performance View* configuration menu scales the axes of the chart and defines its contents and its appearance. All controls are also available in the *Chart Configuration* tab of the *2D Chart Configuration* menu and have the same effect; see Fig. 4-11 on p. 4.15.

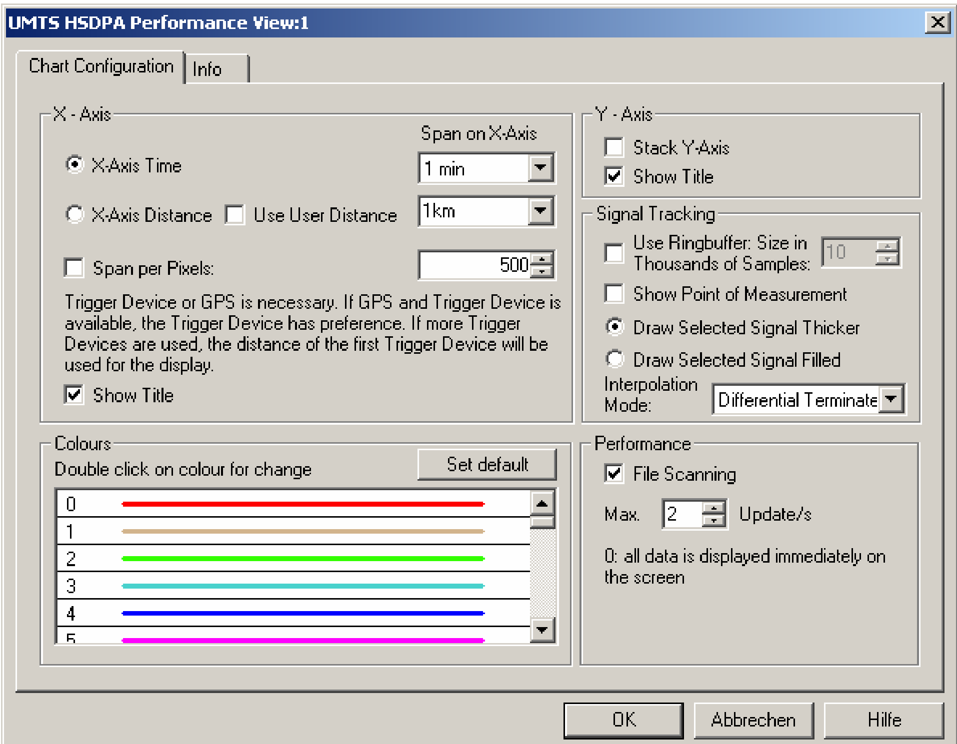
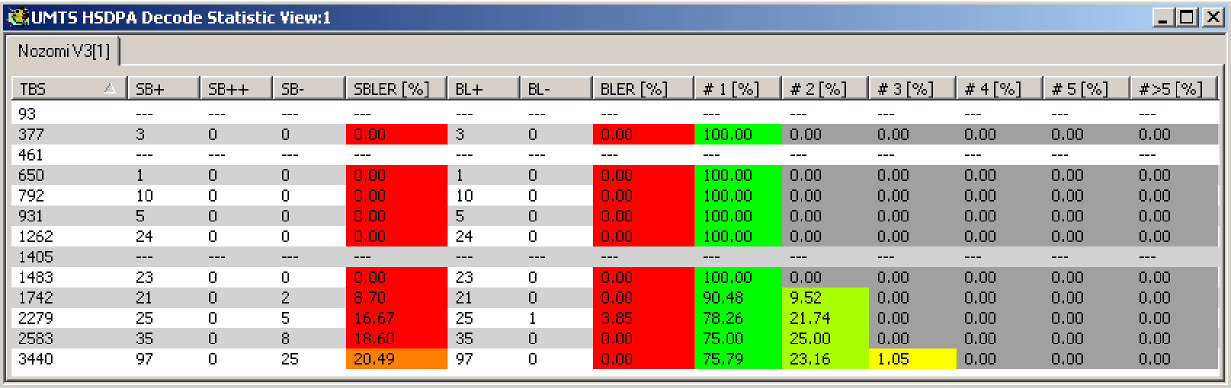


Fig. 4-66 UMTS HSDPA Performance View Configuration

Graph *Show BLER as bar* or *Show New TX as bar* select the visualized quantity. The input fields on the right side set the scale of the bars.

UMTS HSDPA Decode Statistic View

The *UMTS Decode Statistic View* shows a statistical evaluation of the received DL HS-DSCH transport blocks, together with the block error rate and the number of retransmissions needed to successfully decode the blocks of each size. The transport block size depends on the CQI values that the mobile reported to the network; see standard 2GPP TS 25.214 and section *UMTS HSDPA UL HS-DPCCH View* on p. 4.77. The results are averaged over the number of subframes (100) shown in the *UMTS HSDPA HS-DPCCH* view.



TBS	SB+	SB++	SB-	SBLER [%]	BL+	BL-	BLER [%]	# 1 [%]	# 2 [%]	# 3 [%]	# 4 [%]	# 5 [%]	#>5 [%]
93	---	---	---	---	---	---	---	---	---	---	---	---	---
377	3	0	0	0.00	3	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
461	---	---	---	---	---	---	---	---	---	---	---	---	---
650	1	0	0	0.00	1	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
792	10	0	0	0.00	10	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
931	5	0	0	0.00	5	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
1262	24	0	0	0.00	24	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
1405	---	---	---	---	---	---	---	---	---	---	---	---	---
1483	23	0	0	0.00	23	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
1742	21	0	2	8.70	21	0	0.00	90.48	9.52	0.00	0.00	0.00	0.00
2279	25	0	5	16.67	25	1	3.85	78.26	21.74	0.00	0.00	0.00	0.00
2583	35	0	8	18.60	35	0	0.00	75.00	25.00	0.00	0.00	0.00	0.00
3440	97	0	25	20.49	97	0	0.00	75.79	23.16	1.05	0.00	0.00	0.00

Fig. 4-67 UMTS HSDPA Decode Statistic View

Diagram

The table contains the following columns:

TBS

Transport block size in bits, in ascending order. The results in each row are relating to blocks of the same size.

SB+

Number of successfully decoded sub-blocks. A sub-block is a mobile-specific unit comprising the HS-DSCH data of one subframe.

SB++

Number of duplicate sub-blocks. Duplicate sub-blocks are sub-blocks that the network retransmitted although they were received correctly (usually because no ACK message was received from the mobile).

SB–

Number of sub-blocks which could not be decoded successfully and had to be retransmitted. These blocks contribute to the *SBLER* but not necessarily to the *BLER;* see below.

SBLER

Sub-block error rate, SBLER = SB– / (SB+ SB–).

BL+

Number of successfully decoded blocks

BL–

Number of blocks which could not be decoded successfully until the maximum number of retransmissions was reached.

BLER

Block error rate, BLER = BL– / (BL+ BL–). The BLER is usually smaller than the SBLER because it counts only the blocks that could not be decoded until the end of the HARQ process (until the maximum number of retransmissions was reached).

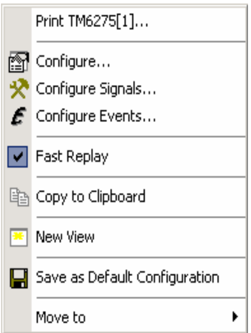
 # 1 [%]

Number of blocks successfully decoded without retransmission.

 # n [%]

Number of blocks successfully decoded after one initial transmission and (n–1) retransmissions.

Context menu



A right mouse click on any point in the view opens the context menu to print the view, access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS HSDPA Decode Statistic View Configuration

The *UMTS HSDPA Decode Statistic View* configuration menu selects the information to be displayed.

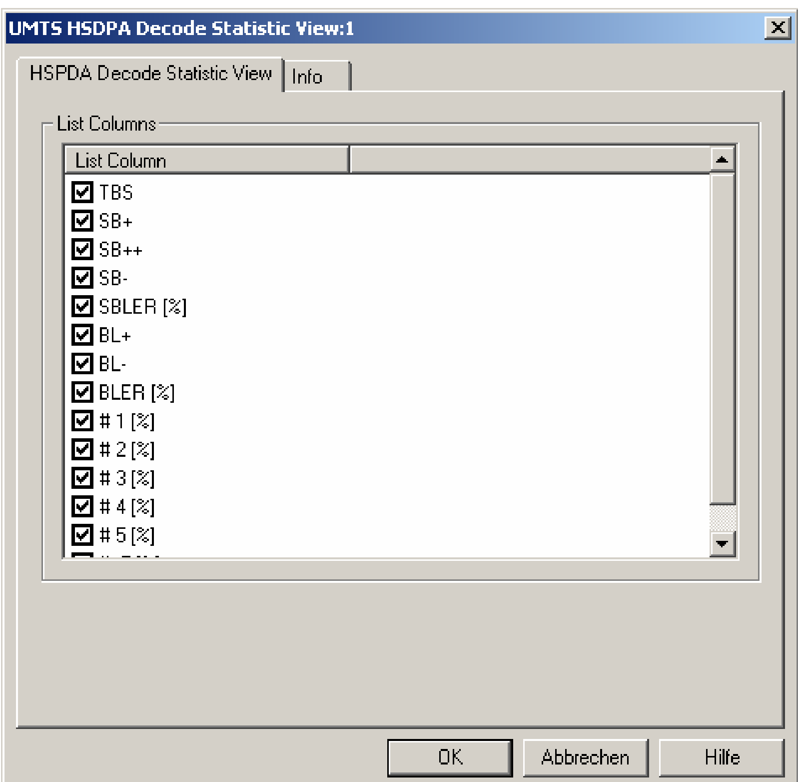


Fig. 4-68 UMTS HSDPA Decode Statistic View Configuration

UMTS Views

The *UMTS Views* display UMTS-specific information acquired with an UMTS test mobile and using the UMTS driver. In general, recording of the different message types shown in the *UMTS Views* must be explicitly activated in the *Configuration* and *Expert Mode* tabs of the driver configuration menu; refer to the relevant description in chapter 6.

The UMTS views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *UMTS*.

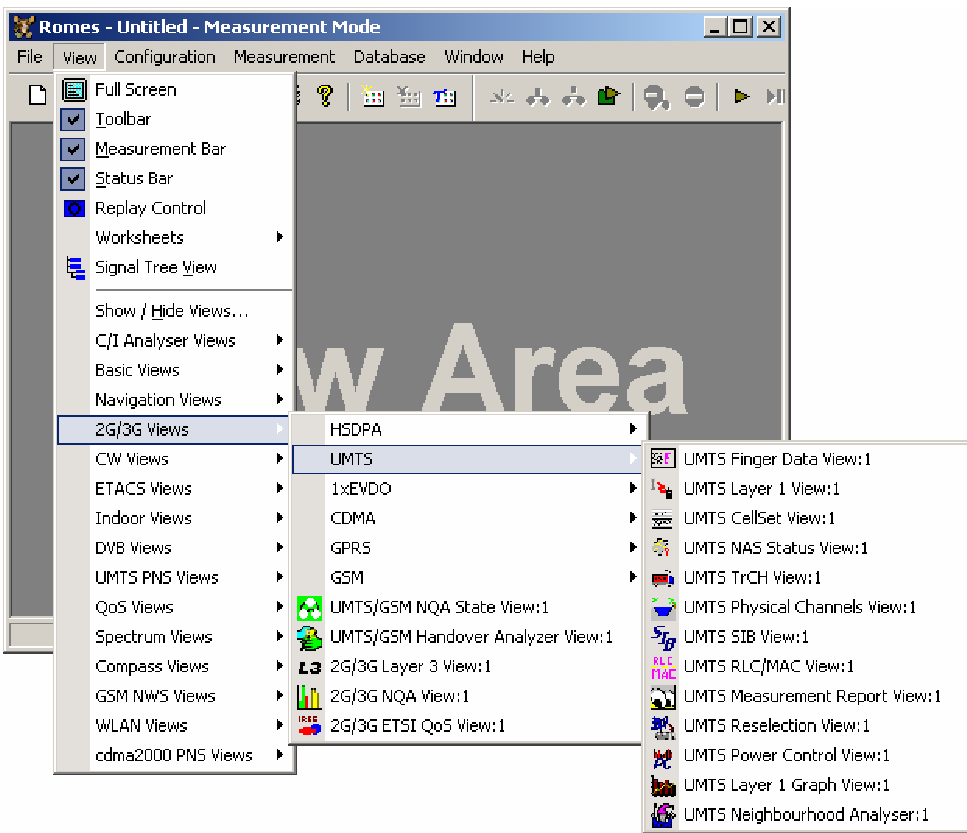
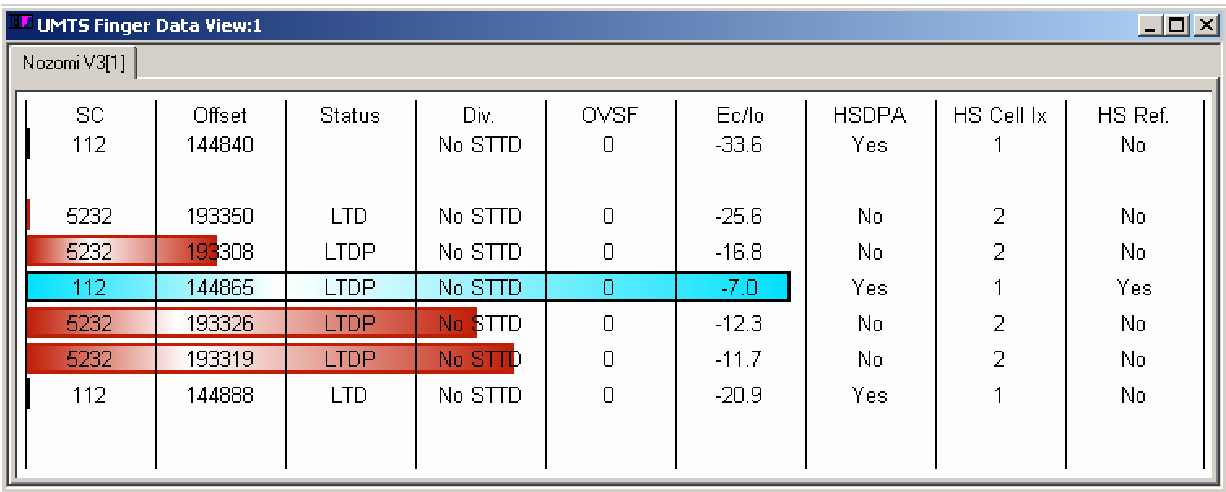


Fig. 4-69 UMTS views

UMTS Finger Data View

The *UMTS Finger Data View* shows the most important layer 1 parameters characterizing the different downlink WCDMA signals received by the mobile, captured with the different branches (fingers) of the test mobile UMTS RAKE receiver. The value of the critical quantity E_c/I_o for each signal is visualized in addition by horizontal bars. A mobile with a Qualcomm chipset must be used to record the data.

The view is empty unless the test mobile is configured to record the *WCDMA Finger Info;* see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.



SC	Offset	Status	Div.	OVSF	Ec/Io	HSDPA	HS Cell Ix	HS Ref.
112	144840		No STTD	0	-33.6	Yes	1	No
5232	193350	LTD	No STTD	0	-25.6	No	2	No
5232	193308	LTDP	No STTD	0	-16.8	No	2	No
112	144865	LTDP	No STTD	0	-7.0	Yes	1	Yes
5232	193326	LTDP	No STTD	0	-12.3	No	2	No
5232	193319	LTDP	No STTD	0	-11.7	No	2	No
112	144888	LTD	No STTD	0	-20.9	Yes	1	No

Fig. 4-70 UMTS Finger Data View

The results for each mobile are arranged in a separate tab.

Results

Table of the most important layer 1 parameters of the captured downlink WCDMA signals. Each table row represents a signal. The maximum number of rows/signals can be set in the configuration menu. The signals are sorted according to the signal-to-noise ratio E_c/I_o, the strongest signal appears on top of the list.

SC Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3.. The primary SC is used to identify the cell.

Offset Time offset of the signal in 1/8-chip units relative to the system time (hardware-dependent). The difference between the offsets of different signals provides important information: Two signals with equal *SC, Status, Div.,* and *OVSF* but different offset and E_c/I_o originate from the same source but propagated along different paths.

Status Status of the receiver fingers; one or several of the following characters:

L (Lock Detection State) This shows whether the finger RSSI is > high threshold regardless of whether the given type of lock is enabled

T (Time Tracking Lock) This shows when time tracking lock is enabled, that the finger RSSI > upper lock threshold

D (Data Combining Lock) This shows when the data combining lock is enabled, that the finger RSSI > upper lock threshold

P (Power Control Bit Lock) This shows when the data combining lock is enabled, that the finger RSSI > power control bit threshold.

Div. Downlink transmit diversity scheme for the CPICH: *STTD* (Space Time Transmit Diversity), *TSTD* (Time Switched Transmit Diversity), *SSDT* (Site Selection Diversity Transmit Power Control), or *No Diversity*

OVSF Orthogonal Variable Spreading Factor, code number of the signal

E_c/I_o Ratio of the received energy per PN chip for the signal to the total received power spectral density at the mobile antenna connector. E_c/I_o is obtained in an unbiased measurement, i.e. the contribution of the noise floor to the powers is subtracted.

The *SC, Offset,* and *Ec/Io* values for each finger generate signals in the *UMTS – <Device> – Finger Info* branch of the data tree.

HSDPA results

The HSDPA-related results in the last three colums are available with option ROMES-UM4. They are closely related to the *Last Action, Ref. Finger,* and *HS Cell Index* parameters in the *UMTS HSDPA Configuration View* (see p. 4.83). Note that signals from the same source (equal SC) have the same *HSDPA* status and *HS Cell Index,* but only a single signal can be the reference signal.

HSDPA

Status of the DL HSDPA transmission, shows *Yes* if the *Last Action* was *Enable*, otherwise *No*.

HS Cell Ix

High speed cell index in the range 0 to 7.

HS Ref.

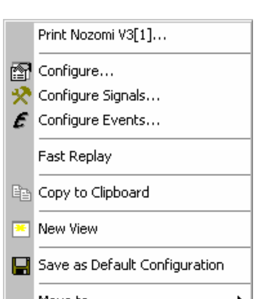
Shows *Yes* for the HSDPA reference finger signal, *No* for all other signals. If no DL HSDPA transmission takes place, *No* is displayed for all signals.

Ec/Io bars

A colored bar overlaid to each table row shows the signal strength, expressed by its E_c/I_o. The scale of the E_c/I_o bars is defined in the configuration menu, the colors denote the SCs of the different signals; they can be customized in the *Colors* tabs of the UMTS view configuration menus (e.g. the one linked to the *UMTS CellSet View)*. If the signal strength falls below the selected minimum, the bar is replaced by a narrow line at the left edge of the diagram.

The SC color codes are also shown in the *Route Track* menu; see paragraph on scrambling code indication on p. 4.37.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS Finger Data View Configuration

The *UMTS Finger Data View* configuration menu defines the maximum number of table rows in the *UMTS Finger Data View* and the scale the E_c/I_o bars and displays information about the view version. It is opened via a right mouse click on a point inside *UMTS Finger Data View* or via the *Configuration – Settings* command (see chapter 3).

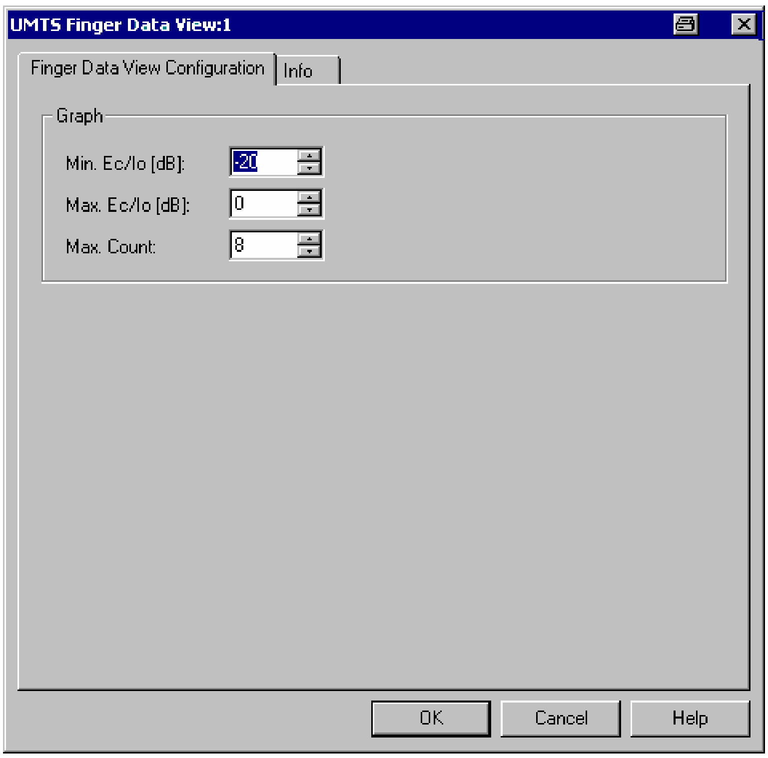


Fig. 4-71 UMTS Finger Data View: Finger Data View Configuration

Graph The *Graph* panel in the *Finger Data View Configuration* tab contains three input fields:

Min. Ec/Io [dB]

Value of E_c/I_o at the left edge of the diagram. The length L of the bars increases with the value of Ec/Io, it is given by the linear formula:

$$L = L_{\max} \cdot \frac{E_c / I_0 - \min(E_c / I_0)}{\max(E_c / I_0) - \min(E_c / I_o)}; \quad 0 \le L \le L_{\max}$$

where L_{max} denotes the diagram width.

Max. Ec/Io [dB]

Value of E_c/I_o at the right edge of the diagram; see above.

Max. Count

Maximum number of signals displayed in the view (= maximum number of table rows). The signals are sorted according to their E_c/I_o, so a small number eliminates weak signals that may be of minor interest.

UMTS Layer 1 View

The *UMTS Layer 1 View* displays the values of layer 1 (physical layer) parameters that are constantly measured and transferred to the base station while the UMTS mobile operates in the network. The layer 1 parameters are shown for all mobiles used.

The view is empty unless the test mobile is configured to perform *Layer 1 Measurements* and record one of the following parameter types: *WCDMA AGC, WCDMA Finger Info, WCDMA BLER;* see description of the *Configuration* tab of the driver configuration menu in chapter 6.

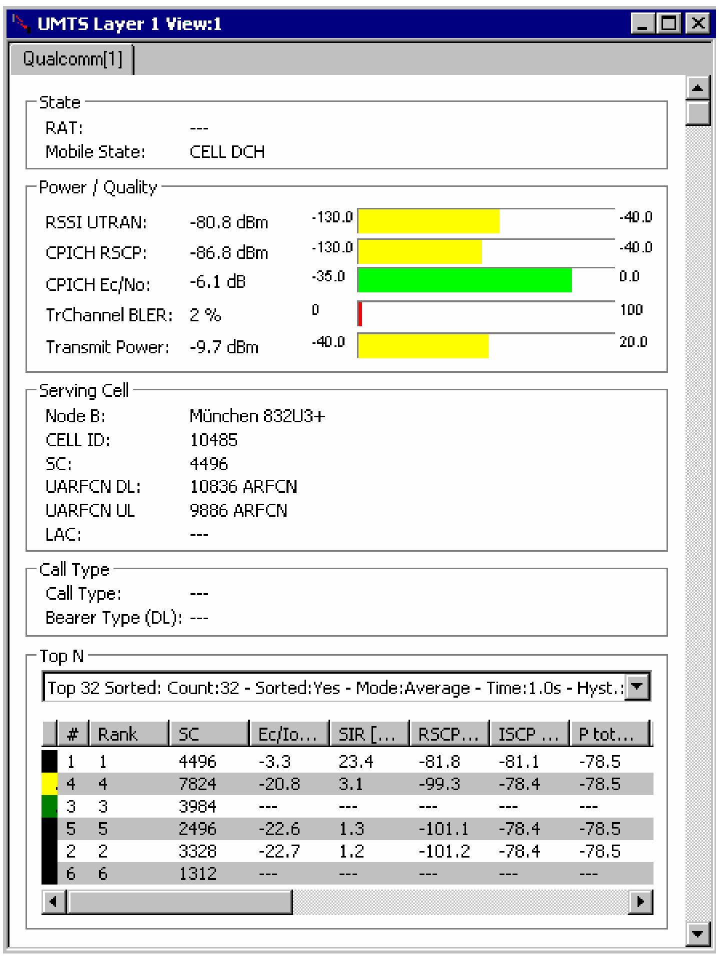
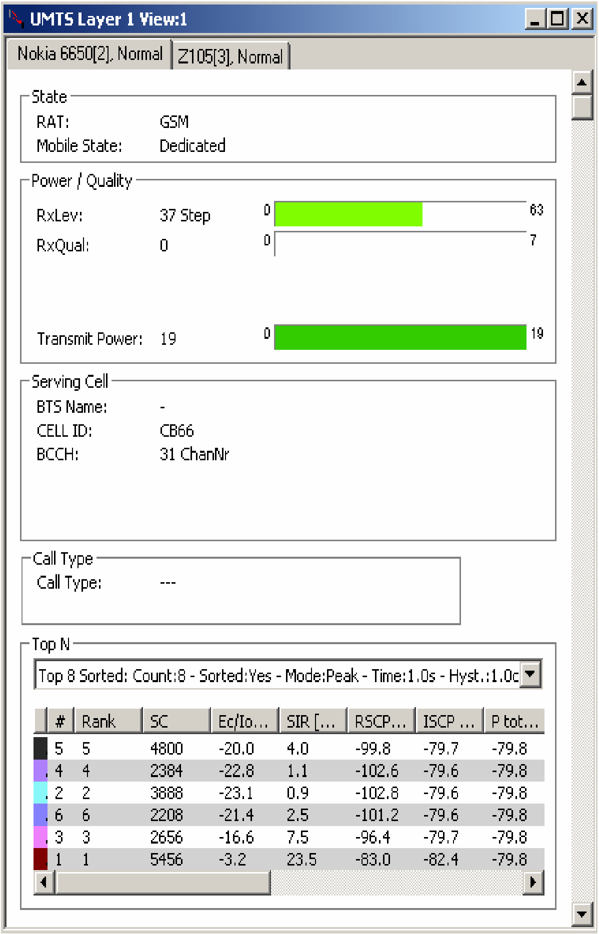


Fig. 4-72 UMTS Layer 1 View

The layer 1 parameters provided by each mobile are arranged in a separate tab. The view area is divided into several panels.

State Current Radio Access Technology (RAT, either UMTS or GSM) and mobile state. If the mobile switches to GSM, the *UMTS Layer 1 View* shows a subset of the GSM parameters displayed in the GSM Views:



TIP *The mobile states correspond to the Phone Mode signal; see p. 4.13.*

Power / Quality

The *Power/Quality* panel displays several parameters describing the signal power and quality reported by the test mobile (see standard 3GPP TS 25.225).

RSSI UTRAN
The received wide band power, including thermal noise and noise generated in the receiver.

CPICH RSCP
CPICH Received Signal Code Power in dBm; the received power on one code, measured on the Primary CPICH.

CPICH Ec/No
The received energy per chip divided by the power density in the band. The *CPICH Ec/No* is identical to *CPICH RSCP* divided by the *RSSI UTRAN*.

TrChannel BLER
Estimation of the transport channel block error rate (BLER) based on evaluating the CRC on each transport block.

Transmit Power
Total mobile transmitted power on one carrier.

The power results are obtained in an unbiased measurement, i.e. the contribution of the noise floor to the powers is subtracted.

Serving Cell

The *Serving Cell* panel displays the following parameters describing the serving cell:

Node B
Name of the node B, taken from the UMTS Node B database (if available).

Cell ID
Cell Identity of the serving cell.

SC
Primary scrambling code of the cell in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.

UARFCN DL
UTRAN Absolute Radio Frequency Channel Number (ARFCN) of the received DL signal. The carrier frequency is equal to

*f = 0.2 MHz * UARFCN*.

UARFCN UL UTRAN
Absolute Radio Frequency Channel Number (ARFCN) of the transmitted UL signal

LAC
Location Area Code

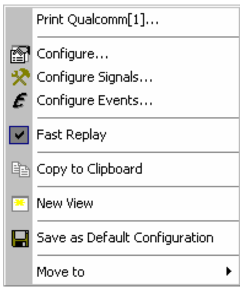
Call Type

For future extensions.

Top N

The *Top N* panel displays UMTS PNS scanner data recorded by means of an FSP spectrum analyzer or an ESPI test receiver and the UMTS PN scanner driver R&S PNS. It shows the properties of the signals from the Node Bs that are elements of the current *Top N Pools.* The data is also displayed in the *PNS Top N View* described on p. 4.331.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS Layer 1 View Configuration

The *UMTS Layer 1 View* configuration menu selects the columns in the Top N table and displays information about the view version. It is opened via a right mouse click on a point inside *UMTS Layer 1 View* or via the *Configuration – Settings* command (see chapter 3).

The ***TOP N List Configuration*** tab displays the complete parameter set to be displayed in the *Top N* table (see description in the *PNS Top N View* section on p. 4.331). Clearing a parameter hides the column in the table.

TIP

Restricting the viewed results makes it easier to read the tables if only a subset of the available parameters is needed. To restrict the number of parameters measured and enhance the system performance, use the settings in the driver configuration menu (see chapter 6).

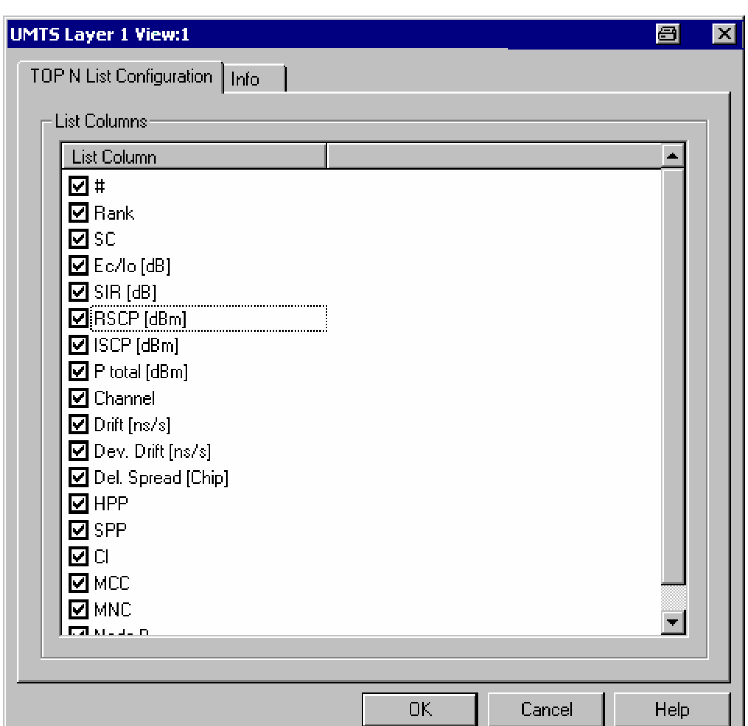


Fig. 4-73 UMTS Layer 1 View: TOP N List Configuration

UMTS CellSet View

The *UMTS CellSet View* shows an overview of the layer 1 parameters of the serving cell and the neighbor cells.

The view is empty unless the test mobile is configured to record the *WCDMA Active Set,* the *WCDMA Neighbor Set,* or the *WCDMA List Searcher* parameters*;* see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.

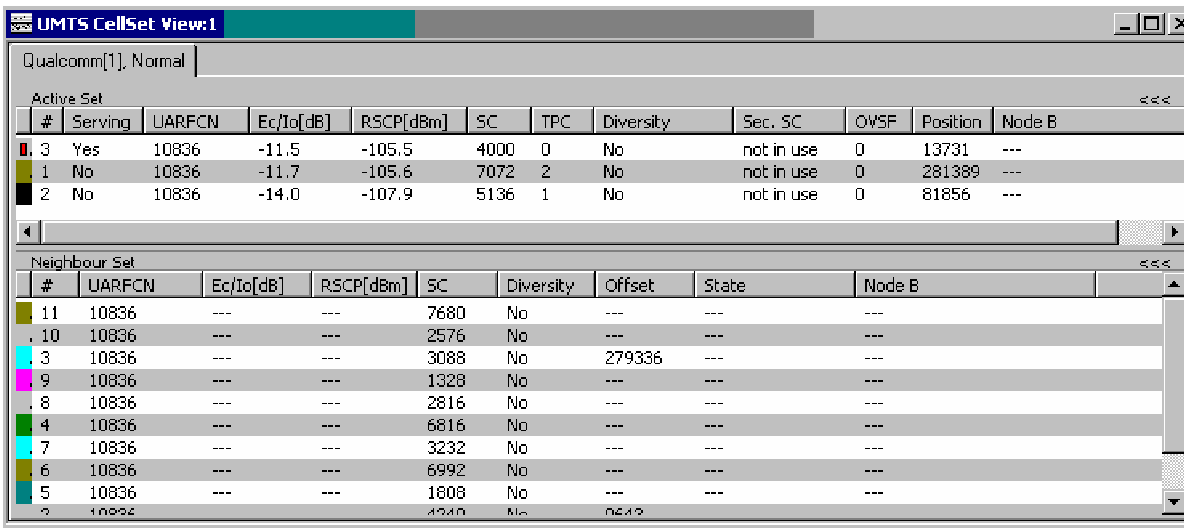


Fig. 4-74 UMTS CellSet View

The results for each mobile are arranged in a separate tab.

View area

The entire view area is horizontally split to accommodate two different tables for the *Active (Cell) Set* and the *Neighbor Set*.

A click on the *Active Set* or *Neighbor Set* title bars compresses and expands the corresponding table. A compressed table leaves more space for the other table. A compressed table is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

The contents of both tables can be selected in the configuration menu.

Active Set

Table of the most important parameters of the downlink WCDMA signals from the UTRAN cells in the active cell set. The active set comprises the serving cell and all other cells that are currently used for the connection; its members are permanently monitored and updated by the network.

Each table row represents a cell. Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order.

Color Symbol
Color code for the Primary SC as defined in the *Colors* tab of the configuration menu. The SC color codes are also shown in the *Route Track* menu; see paragraph on scrambling code indication on p. 4.37.

#
Sequence number for the cell, assigned in chronological order and always starting with 1.

Serving
Indication whether or not the cell is the serving cell *(Yes/No)*.

UARFCN
UTRAN Absolute Radio Frequency Channel Number (ARFCN) of the received DL signal. The carrier frequency is equal to $f = 0.2\ MHz * UARFCN$

E_c/I_o
Ratio of the received energy per PN chip for the signal to the total received power spectral density at the mobile antenna connector. E_c/I_o is obtained in an unbiased measurement, i.e. the contribution of the noise floor to the powers is subtracted.

RSCP
CPICH Received Signal Code Power in dBm; the received power on one code, measured on the Primary CPICH.

SC
Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.

TPC
Cell Transmission Power Control value in the range 0 to 5.

Diversity
Downlink transmit diversity scheme for the CPICH: *STTD* (Space Time Transmit Diversity), *TSTD* (Time Switched Transmit Diversity), *SSDT* (Site Selection Diversity Transmit Power Control), or *No Diversity*

2^{nd} SC
Secondary Scrambling code number. “not in use” is displayed if the cell uses only primary scrambling codes.

OVSF
Orthogonal Variable Spreading Factor, code number of the signal.

Position

Active cell position

Node B

Name of the node B, taken from the UMTS Node B database (if available).

The *SC* and E_c/I_o values for each active set element generate signals in the *UMTS – <Device> – Active Set* branch of the data tree.

Neighbor Set

Table of the most important parameters of the downlink WCDMA signals from all UTRAN cells that are in the neighbor set and not currently used for the connection. The members of the neighbor set are permanently monitored and updated by the network. Most of the parameters are also available for the *Active Set;* see above. Besides the following information is displayed:

State

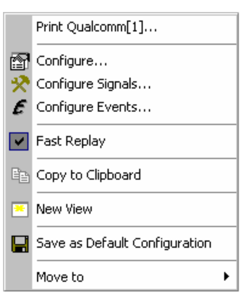
Indication whether the neighbor cell is Monitored, Detected, Undetected, Not Listed or Detected.

Offset

Time offset of the signal in 1/8-chip units relative to the system time (hardware-dependent).

A Qualcomm mobile must be used to record the neighbor set data.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS CellSet View Configuration

The *UMTS CellSet View* configuration menu selects the columns in the view tables, defines the SC color scheme and displays information about the view version. It is opened via a right mouse click on a point inside *UMTS CellSet View* or via the *Configuration – Settings* command (see chapter 3).

The *Cell Set List Configuration* tab displays the complete parameter set to be displayed in the *Active Set* and *Neighbor Set* tables (see description in the *Active Set* paragraph on p. 4.109). Clearing a parameter hides the column in the table.

TIP

Restricting the viewed results makes it easier to read the tables if only a subset of the available parameters is needed. To restrict the number of parameters measured and enhance the system performance, use the settings in the driver configuration menu (see chapter 6).

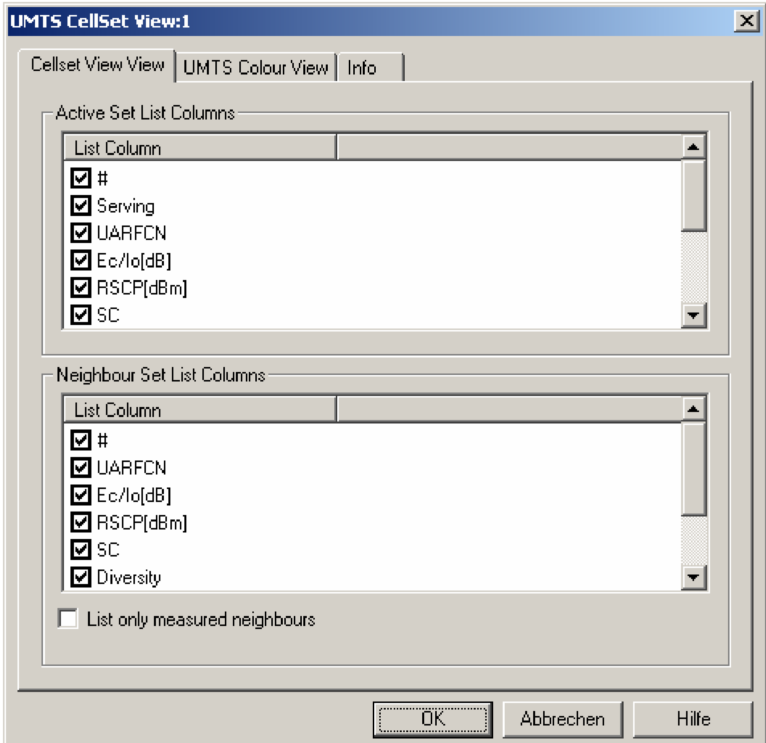


Fig. 4-75 UMTS CellSet View: CellSet List Configuration

The *Cellset View View* tab of the *UMTS CellSet View* dialog selects the list information to be displayed in the active and neigbor sets.

Neighbor Set List Columns

The checkbox selects the neighbors to be displayed:

If *List only measured neighbors* is activated, then only measured neighbor cells are displayed, otherwise all neighbors from the Node B database are shown.

The *UMTS Color View* tab of the *UMTS CellSet* configuration menu is analogous to the *Color Settings* tab of the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

UMTS NAS Status View

The *UMTS NAS Status View* shows an overview of higher-layer (Non Access Stratum, NAS) parameters of the serving cell and the connection. A Qualcomm mobile must be used to record the data (the Nokia test mobile only provides the *Cell ID* and *Name* of the serving cell).

The view is empty unless the test mobile is configured to record the *UMTS NAS GMM State, UMTS NAS MM State, UMTS NAS REG State,* or *UMTS NAS MM Characteristics* data; see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.

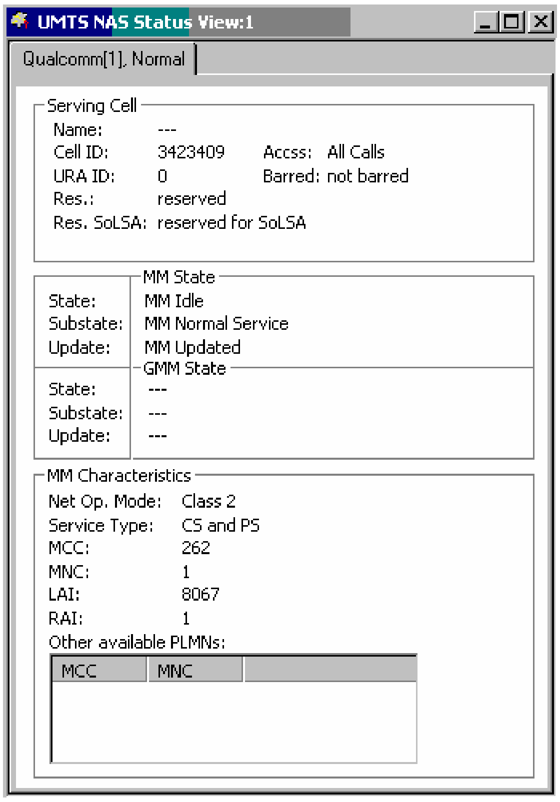


Fig. 4-76 UMTS NAS Status View

The results for each mobile are arranged in a separate tab. Each tab consists of several panels.

Serving Cell Table of the most important higher layer (NAS) parameters of the serving cell.

Name

Name of the serving cell Node B, taken from the UMTS Node B database (if available).

Cell ID

Cell Identity of the serving cell.

URA ID

UTRAN Registration Area

Res.

Cell totally reserved or not reserved

Res. SoLSA

Cell reserved for Support of Localized Service Area

Accss

Indication of possible cell access restrictions: Access for *All Calls* or *Emergency Calls Only*

Barred

Indication whether the cell is barred (for all calls, including emergency calls) or not barred

MM / GMM State

Overview of the current Mobility Management (MM) and GPRS Mobility Management (GMM) states, substates and updates of the mobile. The GMM results are available for test mobiles supporting GPRS functionality (which is true for the ROMES-UM1 test mobile). MM and GMM is described in standard 3GPP TS 24.008.

MM Characteristics

Table of additional MM parameters:

Net Op. Mode
: Network operation mode I, II or III, see standard 3GPP TS 123 060. The operation mode is indicated as system information to the mobile.

Service type
: Circuit switched service *(CS)*, packet switched service *(PS)* or both *(CS and PS)* or *Limited Service*

MCC
: Mobile Country Code

MNC
: Mobile Network Code

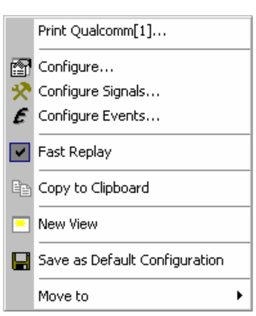
LAI
: Location Area Identity

RAI
: Routing Area Identity

Other available *PLMNs*
: MCC and MNC of other networks detected by the mobile

The *NAS* values generate signals in the *UMTS – <Device> – NAS State* branch of the data tree.

Context menu



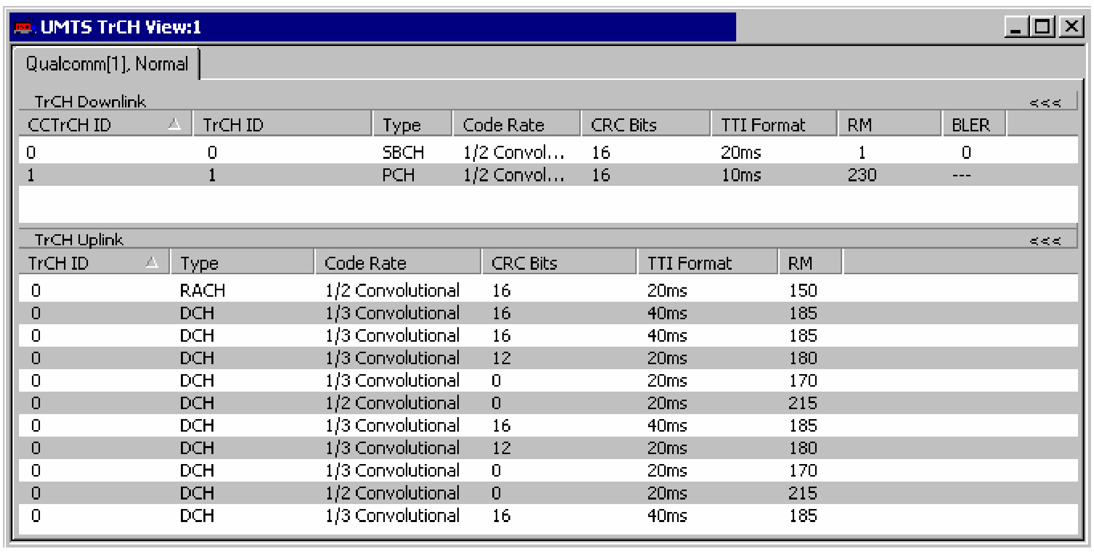
A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu displays information about the view version.

UMTS TrCH View

The *UMTS TrCH View* shows an overview of the channel coding parameters in the downlink and uplink Transport Channels (TrCHs). A Qualcomm mobile must be used to record the data.

The view is empty unless the test mobile is configured to record the *WCDMA TrCH Downlink* or the *WCDMA TrCH Uplink* parameters; see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.



CCTrCH ID	TrCH ID	Type	Code Rate	CRC Bits	TTI Format	RM	BLER
0	0	SBCH	1/2 Convol...	16	20ms	1	0
1	1	PCH	1/2 Convol...	16	10ms	230	---

TrCH ID	Type	Code Rate	CRC Bits	TTI Format	RM
0	RACH	1/2 Convolutional	16	20ms	150
0	DCH	1/3 Convolutional	16	40ms	185
0	DCH	1/3 Convolutional	16	40ms	185
0	DCH	1/3 Convolutional	12	20ms	180
0	DCH	1/3 Convolutional	0	20ms	170
0	DCH	1/2 Convolutional	0	20ms	215
0	DCH	1/3 Convolutional	16	40ms	185
0	DCH	1/3 Convolutional	12	20ms	180
0	DCH	1/3 Convolutional	0	20ms	170
0	DCH	1/2 Convolutional	0	20ms	215
0	DCH	1/3 Convolutional	16	40ms	185

Fig. 4-77 UMTS TrCH View

The results for each mobile are arranged in a separate tab.

View area The entire view area is horizontally split to accommodate two different tables for the *TrCH Downlink* and the *TrCH Uplink*.

A click on the *TrCH Downlink* or *TrCH Uplink* title bars compresses and expands the corresponding table. A compressed table leaves more space for the other table. A compressed table is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

The contents of both tables can be selected in the configuration menu.

TrCH Downlink Table of the channel coding parameters of the downlink TrCHs received by the test mobile.

Each table row represents a single transport channel that has been added during the measurement (and possibly removed). A new table row is created each time that a new transport channel is added. On the other hand, a table row for a removed transport channel is deleted after the *Time Window for DL/UL* set in the configuration menu.

Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order.

CCTrCH ID

Composite Coded Transport Channel ID in the range 0 to 15, identifies unambiguously a CCTrCH inside a Radio Link.

TrCH ID

Transport channel number assigned to L1 by L2. Transport channels are multiplexed to the CCTrCH in the ascending order of these IDs.

Type

Transport channel type, e.g. Paging Channel (PCH), Slow Broadcast Channel (SBCH), Random Access Channel (RACH), Dedicated Channel (DCH), Downlink Shared Channel (DSCH), Forward Access Channel (FACH)

Code Rate

Coding rate and type of error protection/channel coding (convolutional coding, turbo coding)

CRC Bits

Number of CRC bits per transport block.

TTI Format

Length of the Transmission Time Interval in ms.

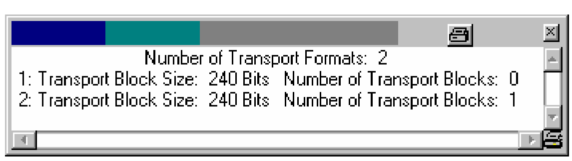
RM

Rate matching attribute, assigned by higher layers and used when the number of bits to be repeated or punctured is calculated.

BLER

Estimation of the transport channel block error rate (BLER) based on evaluating the CRC on each transport block.

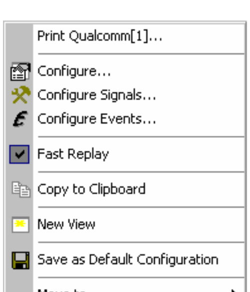
A double-click on a table row opens a popup window with detailed information about the transport block format:



TrCH Uplink

Table of the most important parameters of the uplink WCDMA TrCHs transmitted by the test mobile. The parameters are a subset of the *TrCH Downlink* parameters. Uplink transport channel types are Dedicated Channel (DCH), Random Access Channel (RACH), Common Packet Channel (CPCH).

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS TrCH View Configuration

The *UMTS TrCH View* configuration menu selects the columns in the view tables, defines the time window and displays information about the view version. It is opened via a right mouse click on a point inside *UMTS TrCH View* or via the *Configuration – Settings* command (see chapter 3).

The *TrCH View Configuration* tab displays the complete parameter set to be displayed in the *TrCH Uplink* and *TrCH Downlink* tables (see description in the *TrCH Downlink* paragraph on p. 4.114). Clearing a parameter hides the column in the table.

Restricting the viewed results makes it easier to read the tables if only a subset of the available parameters is needed. To restrict the number of parameters measured and enhance the system performance, use the settings in the driver configuration menu (see chapter 6).

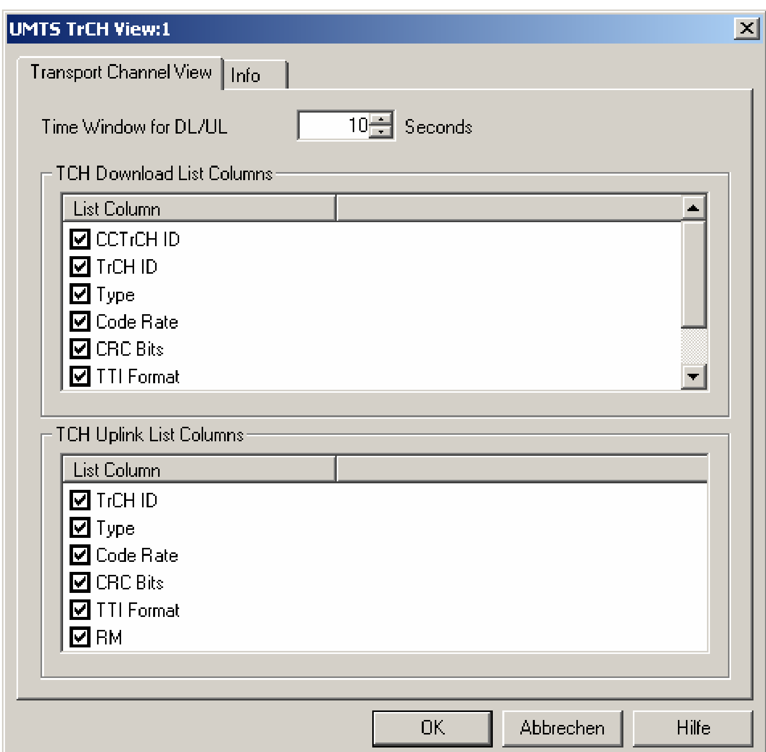


Fig. 4-78 UMTS TrCH View: TrCH List Configuration

Time Window for DL/UL Time after which a table row for a removed TrCH channel is cleared in the *TrCH View* tables. Cleared table rows leave room for new entries.

UMTS Physical Channels View

The *UMTS Physical Channels View* shows an overview of the physical channel parameters in the downlink and uplink WCDMA signals. A Qualcomm mobile must be used to record the data.

The view is empty unless the test mobile is configured to record the *WCDMA Common Physical Channels Downlink, WCDMA Dedicated Physical Channels Downlink, WCDMA Physical Channels Uplink,* or *WCDMA PRACH* parameters*;* see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.

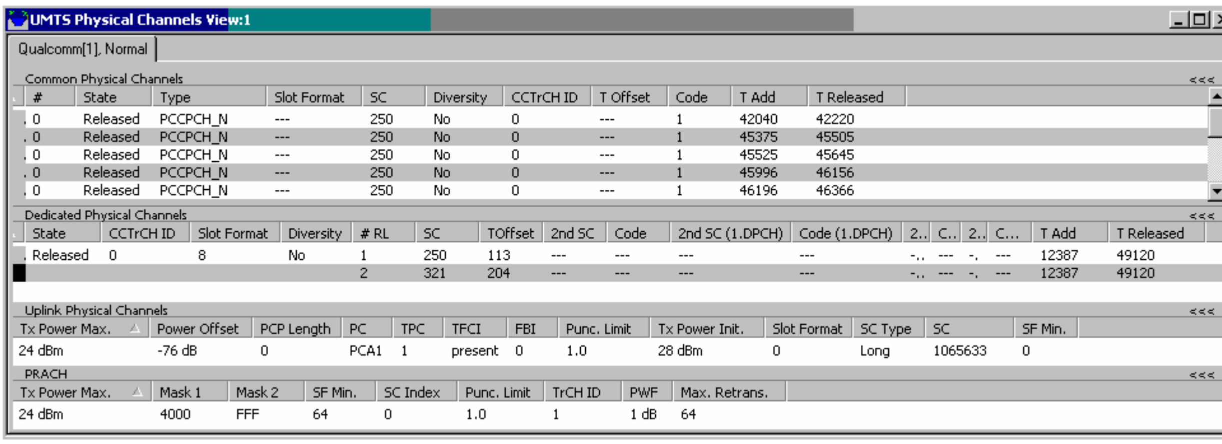


Fig. 4-79 UMTS Physical Channels View

The results for each mobile are arranged in a separate tab.

View area The entire view area is horizontally split to accommodate four different tables for the *Common Physical Channels* (downlink)*, Dedicated Physical Channels* (downlink)*, Uplink Physical Channels,* or *PRACH*.

A click on one of the title bars compresses and expands the corresponding table. A compressed table leaves more space for the other tables. A compressed table is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

The contents of both tables can be selected in the configuration menu.

Common Physical Channels

Parameters of the downlink common physical channels.

Each table row represents a single physical channel that has been added during the measurement (and possibly removed). A new table row is created each time that a new physical channel is added. On the other hand, a table row for a removed physical channel is deleted after the *Time Window for DL/UL* set in the configuration menu.

Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order.

#	Color scheme to distinguish channels with different scrambling codes and sequence number
State	Physical channel state: *Added* (allocated) or *Released*
Type	Physical channel type: PICH, AICH, DPCH, PDSCH, SCCPCH0, SCCPCH1 (on FACH), AICH, PCCPCH_S(serving), PCCPCH_N(eighbor),
Slot Format	Slot format of the SCCPCH in the range 0 to 16
SC	Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.
Div.	Downlink transmit diversity scheme for the CPICH: *STTD* (Space Time Transmit Diversity), *TSTD* (Time Switched Transmit Diversity), *SSDT* (Site Selection Diversity Transmit Power Control), or *No Diversity*
CCTrCH ID	Composite Coded Transport Channel ID in the range 0 to 15, identifies unambiguously a CCTrCH inside a Radio Link.
T Offset	Time offset of the channel relative to the frame boundary, in 156-chip units (corresponding to 1/10 slot or 1/150 frame).
Code	Channelization code number assigned to the channel
T Add	Time when the physical channel was added
T Released	Time when the channel was removed/released

Dedicated Physical Channels

Parameters of the downlink dedicated physical channels (DPCHs). In addition of the parameters for the *Common Physical Channels,* the table contains the following entries:

#RL

Sequence number for the radio links that the test mobile establishes to the network

2nd SC

Secondary Scrambling code number. “---” or “0” is displayed if a primary scrambling code is used.

Uplink Physical Channels

Parameters of the uplink physical channels (DPCCH/DPDCH). The table contains the following entries:

Tx Power Max
Maximum transmit power of the test mobile (+33 dBm, +27 dBm, +24 dBm or +21 dBm for power class 1, 2, 3, or 4 mobiles)

Power Offset
DPCCH power offset in dB. The DPCCH power offset is a reference value for the initial DPCCH power:

P_{DPCCH} = *Power Offset – CPICH_RSCP*

PCP Length
Length of the Power Control Preamble in slots

PC
Power control algorithm (PCA1 or PCA2)

TPC
Transmit Power Control step size in dB

TFCI
Presence of the optional Transport Format Combination Indicator

FBI
Number of Feedback Information bits (0 to 2)

Punc. Limit
Uplink puncturing limit, limits the amount of puncturing that can be applied in order to minimize the number of physical channels.

TX Power Init.
Initial TX power of the test mobile

Slot Format
UL DPCCH slot format

SC Type
Scrambling code type (Long or Short)

SC
UL scrambling code number

SF Min.
Minimum allowed spreading factor

PRACH

Parameters of the uplink Physical Random Access Channel (PRACH), relevant for the physical random access procedure of the test mobile (3GPP TS 25.214). Some of the parameters are analogous to the *Uplink Physical Channel* parameters. Besides the table contains the following entries:

Mask 1
PRACH preamble signature in the range 0 to 15

Mask 2
PRACH subchannel in the range 0 to 11; see 3GPP TS 25.216.

SC Index
PRACH scrambling code index

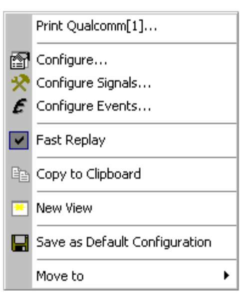
TrCH ID
Transport channel number assigned to L1 by L2. Transport channels are multiplexed to the CCTrCH in the ascending order of these IDs

PWF
PRACH preamble power step size, transmit power difference between two consecutive PRACH preambles

Max. Retrans.
Maximum number of preambles to be transmitted before a single preamble cycle is terminated.

Context menu

A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.



UMTS Physical Channels View Configuration

The *UMTS Physical Channels View* configuration menu selects the columns in the view tables, defines the time window and displays information about the view version. It is opened via a right mouse click on a point inside *UMTS Physical Channels View* or via the *Configuration – Settings* command (see chapter 3).

The *Physical Channel View* tab displays the complete parameter set to be displayed in the view tables (see description in the *Dedicated Physical Channels* paragraph on p. 4.118). Clearing a parameter hides the column in the table.

TIP

Restricting the viewed results makes it easier to read the tables if only a subset of the available parameters is needed. To restrict the number of parameters measured and enhance the system performance, use the settings in the driver configuration menu (see chapter 6).

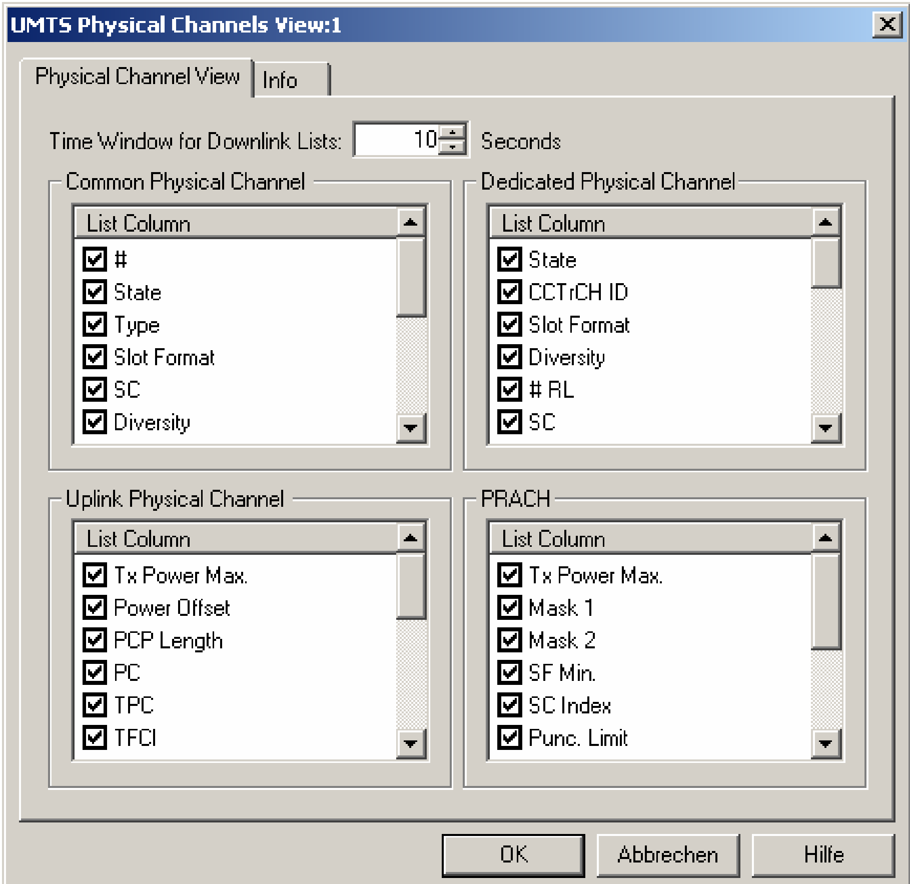


Fig. 4-80 UMTS Physical Channels View: Physical Channel View

Time Window for Downlink Lists Time after which a table row for a removed physical channel is cleared in the *Common Physical Channel* and *Dedicated Physical Channel* tables. Cleared table rows leave room for new entries.

UMTS SIB View

The *UMTS SIB View* shows a tree view of the exchanged System Information Blocks. The block type *(Master Information Block, Scheduling Block 1 and 2, System Information Block type 1 to 18)* can be selected from a pull-down list. The SIB types and their information elements are described in standard 3GPP TS 25.331.

The view is empty unless the test mobile is configured to record the *Layer 3 – WCDMA RRC Signaling Messages;* see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.

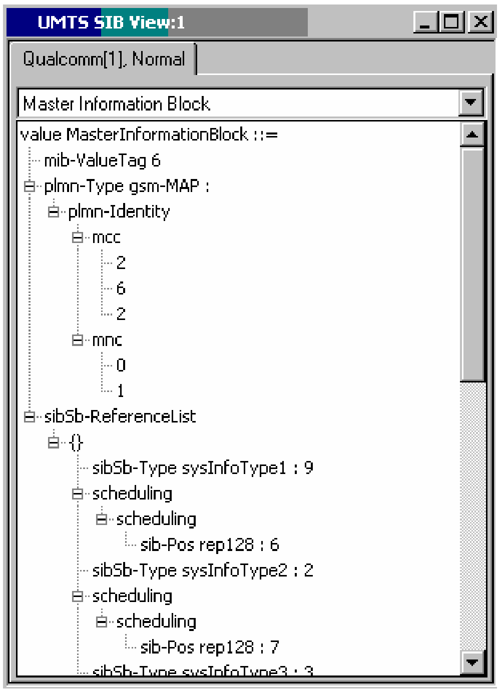
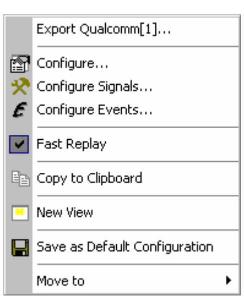


Fig. 4-81 UMTS SIB View

The results for each mobile are arranged in a separate tab.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2*.* The context menu contains the following additional command:

Export <Device>

Opens a *Save As…* dialog to export the contents of the view to a file. The export file is an ASCII file in *.txt format. In the *Save As…* dialog ROMES suggests a default file name and directory *(ExportResult)*.

The configuration menu displays information about the view version.

UMTS RLC/MAC View

The *UMTS RLC/MAC View* displays important Radio Link Control/Medium Access Control parameters of UMTS mobile phones. To record the RLC/MAC parameters, a Qualcomm test mobile must be used and recording of all layer 2 RLC and MAC messages must be enabled in the driver configuration menu (see chapter 6).

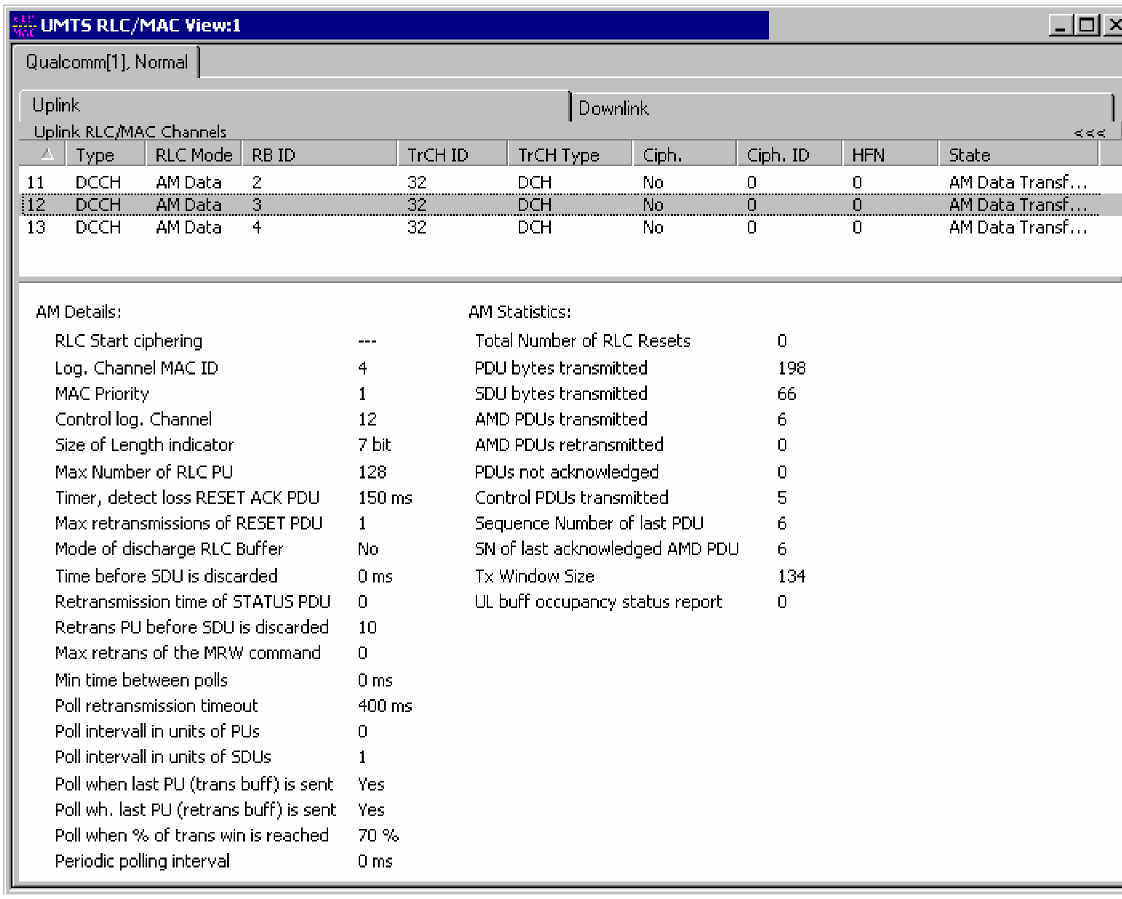


Fig. 4-82 UMTS RLC/MAC View

View

The RLC/MAC parameters for each mobile and for the uplink and downlink are arranged in separate tabs. Each tab is divided into a RLC/MAC channel list in the upper part plus a detailed message section in the lower part.

A click on the *Uplink (Downlink) RLC/MAC Channels* title bar shows or hides the RLC/MAC channel list. A hidden list leaves more space for the detailed message section. A hidden list is characterized by the symbol >>> (instead of <<<) in the title bar. On pausing on the title bar, the cursor displays a compress symbol.

The contents of the RLC/MAC channel list can be selected in the configuration menu.

RLC/MAC Channels

The channel lists monitor the RLC/MAC channels in uplink (mobile station towards base station) and downlink (base station towards mobile station) direction, respectively. The MAC and RLC protocols are specified in standards 3GPP TS 25.321 / TS 25.322 and related standards.

ID
: Logical channel identifier.

Type
: Logical channel type: *CCCH, SHCCH, DCCH* or *DTCH* in uplink direction, *BCCH, PCCH, SHCCH, CCCH, DCCH, DTCH, CTCH* in downlink direction. The logical channels depend on the *RLC Mode.*

RLC Mode
: Type of service that the RLC provides to higher layers: *AM Data (Acknowledged Mode Data transfer), TM (Transparent Mode data transfer), UM (Unacknowledged Mode data transfer)*.

RB ID
: Radio Bearer identity, required by RLC for ciphering.

TrCH ID
: Transport Channel identity of the TrCH on which the MAC operates.

TrCH Type
: Transport Channel type: *DCH, DSCH, FACH, RACH, PCH, BCH, (in FDD: CPCH, USCH)*.

Ciphering
: Ciphering mode: Information whether or not ciphering is used in RLC.

Ciph. ID
: Ciphering key

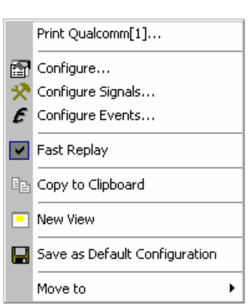
HFN RLC
: Hyper Frame Number *(RLC AM HFN* or *RLC UM HFN)*

State
: RLC state, protocol state for RLC modes AM Data and TM (AM/TM Data Transfer Ready, Null State)

Detailed Messages

The detailed message section is filled when a RLC/MAC channel is selected in the list. The detailed messages depend on the *RLC Mode* and the signal direction (uplink/downlink). An example is shown in Fig. 4-82 above.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS RLC/MAC View Configuration

The *UMTS RLC/MAC View* configuration menu selects the columns in the view tables and displays information about the view version. It is opened via a right mouse click on a point inside *UMTS RLC/MAC View* or via the *Configuration – Settings* command (see chapter 3).

The *RLC/MAC View* tab displays the complete parameter set to be displayed in the RLC/MAC channel lists (see description in the *RLC/MAC Channels* paragraph on p. 4.124). Clearing a parameter hides the column in the table.

Restricting the viewed results makes it easier to read the tables if only a subset of the available parameters is needed. To restrict the number of parameters measured and enhance the system performance, use the settings in the driver configuration menu (see chapter 6).

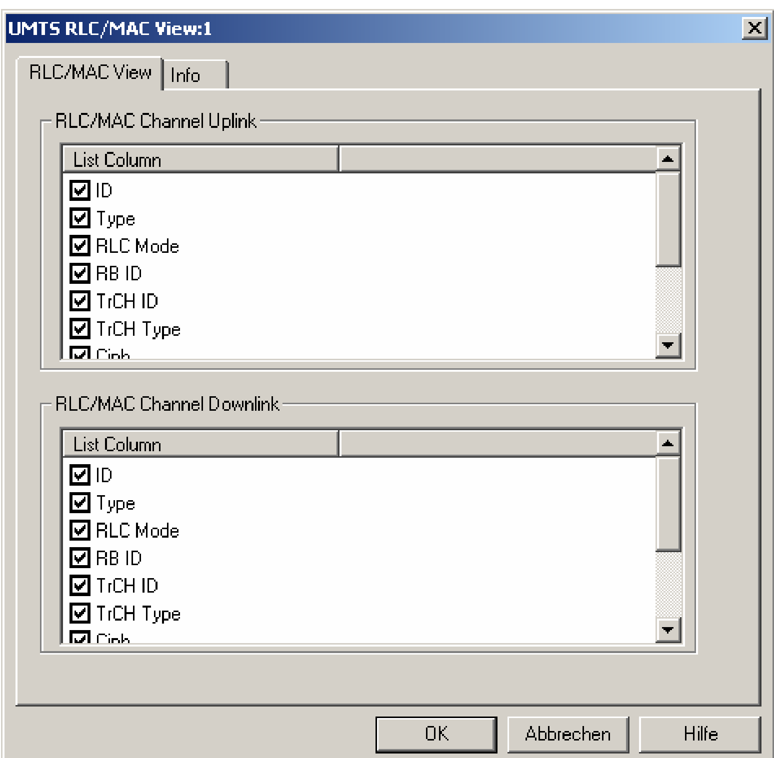
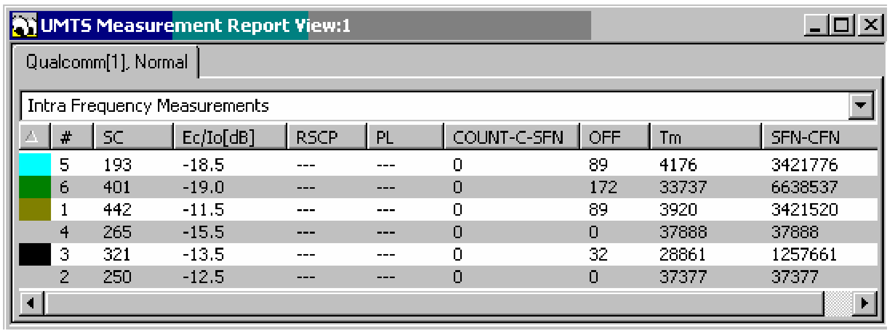


Fig. 4-83 UMTS RLC/MAC View Configuration: RLC/MAC View

UMTS Measurement Report View

The *UMTS Measurement Report View* shows the intra-frequency measurement results that the test mobile sends to the network in a *Measurement Report* RRC message. The message contents are described in standard 3GPP TS 34.108.

The view is empty unless the test mobile is configured to record the *Layer 3 – WCDMA RRC Signaling Messages;* see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.



	#	SC	Ec/Io[dB]	RSCP	PL	COUNT-C-SFN	OFF	Tm	SFN-CFN
	5	193	-18.5	---	---	0	89	4176	3421776
	6	401	-19.0	---	---	0	172	33737	6638537
	1	442	-11.5	---	---	0	89	3920	3421520
	4	265	-15.5	---	---	0	0	37888	37888
	3	321	-13.5	---	---	0	32	28861	1257661
	2	250	-12.5	---	---	0	0	37377	37377

Fig. 4-84 UMTS Measurement Report View

The results for each mobile are arranged in a separate tab.

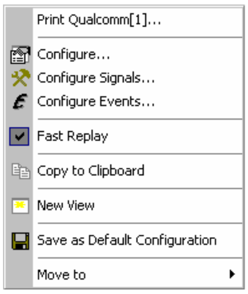
Intra Frequency Measurements

Parameters of the downlink common physical channels.

Each table row represents a physical channel of a definite channel type that has been allocated without interruption. Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order. The number of channels displayed is controlled by means of the Time Window setting in the configuration menu.

#	Color scheme to distinguish channels with different scrambling codes and sequence number
SC	Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.
E_c/I_o [dB]	Ratio of the received energy per PN chip for the signal to the total received power spectral density at the mobile antenna connector. E_c/I_o is obtained in an unbiased measurement, i.e. the contribution of the noise floor to the powers is subtracted off.
RSCP	CPICH Received Signal Code Power in dBm; the received power on one code, measured on the Primary CPICH.
PL	Downlink pathloss: P-CPICH power reported by the Node B minus RSCP.
COUNT-C-SFN	Value of the *COUNT-C-SFN high* parameter transmitted in the *cell synchronization information;* see standard 3GPP TS 25.331, section 10.3.7.6. The value is an integer number of frames between 0 and 3840.
OFF	Value of the *OFF* parameter transmitted in the *cell synchronization information;* see standard 3GPP TS 25.331, section 10.3.7.6. The value is an integer number of frames between 0 and 255.
Tm	Value of the *Tm* parameter transmitted in the *cell synchronization information;* see standard 3GPP TS 25.331, section 10.3.7.6. The value is an integer number of frames between 0 and 38399.
SFN-CFN	*System Frame Number (SFN) – Connection Frame Number (CFN)* observed time difference in chips, given by *SFN-CFN = OFF*38400 + Tm* See standard 3GPP TS 25.215, section 5.1.8.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu displays information about the view version.

UMTS Reselection View

The *UMTS Reselection View* shows parameters that are used for cell reselection of UMTS mobile phones. The reselection process and the parameters are described in standard 3GPP TS 25.304. To record the parameters, *Cell Reselection* must be enabled in the *Expert Mode* tab of the UMTS mobile driver configuration menu (see chapter 6).

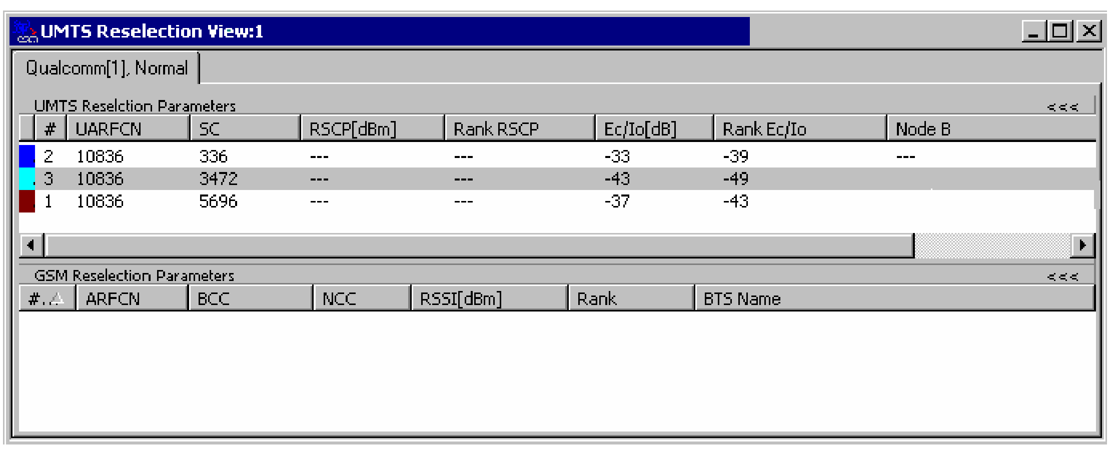


Fig. 4-85 UMTS Reselection View

View

The view is divided into a UMTS cell list in the upper part plus a GSM neighbor cell list in the lower part.

A click on the *UMTS (GSM) Reselection Channels* title bar shows or hides the corresponding cell list. A hidden list leaves more space for the other list. A hidden list is characterized by the symbol >>> (instead of <<<) in the title bar. On pausing on the title bar, the cursor displays a compress symbol.

The contents of the cell lists can be selected in the configuration menu.

UMTS Reselection Parameters

The UMTS cell list shows the reselection parameters of the UMTS cells, listed in the order they are detected and reported by the mobile.

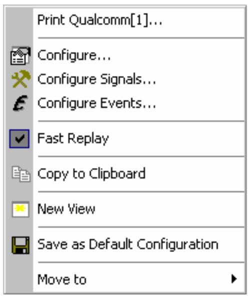
Color Symbol	Color code for the Primary SC as defined in the *Colors* tab of the configuration menu. The SC color codes are also shown in the *Route Track* view; see paragraph on scrambling code indication on p. 4.37.
#	Sequence number for the cell, assigned in chronological order and always starting with 1.
UARFCN	UTRAN Absolute Radio Frequency Channel Number (ARFCN) of the received DL signal. The carrier frequency is equal to *f = 0.2 MHz * UARFCN*
SC	Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.
RSCP	CPICH Received Signal Code Power in dBm; the received power on one code, measured on the Primary CPICH.
Rank RSCP	Cell reselection criterion (cell ranking) Rs or Rn for serving cell or neighbor cell, computed as per 3GPP TS 25.304. Range 0 to 200 or '---' if ranking is not done.
E_c/I_o	Ratio of the received energy per PN chip for the signal to the total received power spectral density at the mobile antenna connector. E_c/I_o is obtained in an unbiased measurement, i.e. the contribution of the noise floor to the powers is subtracted off.
Rank E_c/I_o	Cell reselection criterion (cell ranking) Rs or Rn for serving cell or neighbor cell, computed as per 3GPP TS 25.304. Range 0 to 200 or '---' if ranking is not done.
Node B	Name of the node B, taken from the UMTS Node B database (if available).

GSM Reselection Parameters

The GSM cell list shows the reselection parameters of the GSM neighbor cells, listed in the order they are detected and reported by the mobile.

#	Sequence number for the cell, assigned in chronological order and always starting with 1.
ARFCN	Absolute Radio Frequency Channel Number of the received GSM neighbor cell signal.
BCC	BTS Color Code
NCC	Network Color Code
RSSI	Received Signal Strength Indicator, the received GSM channel power in dBm.
Rank	Determines how much better is the neighbor cell relative to the serving cell (range 0 to 200).
BTS Name	Name of the BTS, taken from the GSM BTS database (if available).

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

UMTS Reselection View Configuration

The *UMTS Reselection View* configuration menu selects the columns in the view tables, defines the SC color scheme and displays information about the view version. It is opened via a right mouse click on a point inside *UMTS Reselection View* or via the *Configuration – Settings* command (see chapter 3).

The *Reselection View* tab displays the complete parameter set to be displayed in the reselection parameter lists (see description in the *UMTS Reselection Parameters* paragraph on p. 4.128). Clearing a parameter hides the column in the table.

Restricting the viewed results makes it easier to read the tables if only a subset of the available parameters is needed. To restrict the number of parameters measured and enhance the system performance, use the settings in the driver configuration menu (see chapter 6).

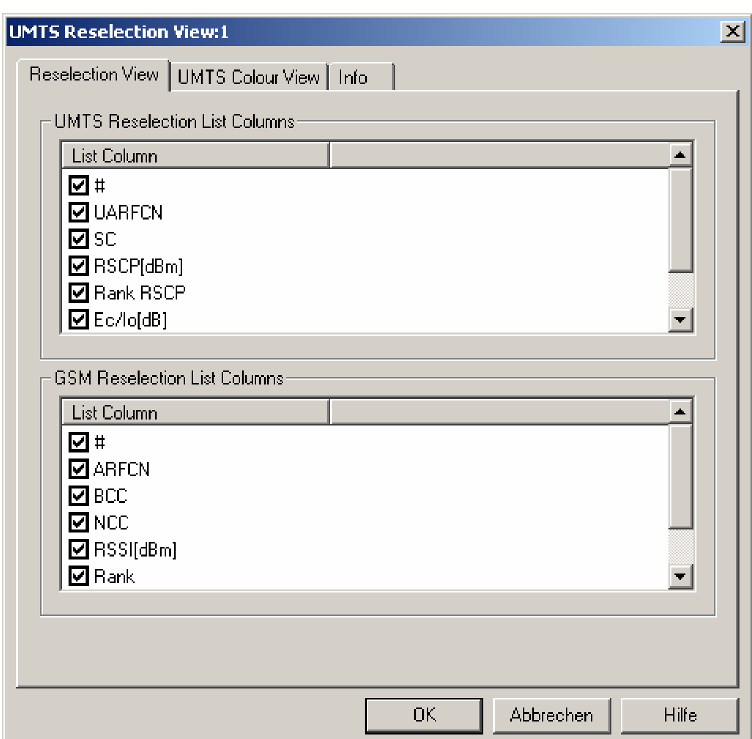


Fig. 4-86 UMTS Reselection View: Reselection View Configuration

The *Color Settings* tab of the *UMTS Reselection* configuration menu is analogous to the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

UMTS Power Control View

The *UMTS Power Control View* shows the transmitter output power of a Nokia UMTS mobile and the parameter that the network uses for closed loop power control.

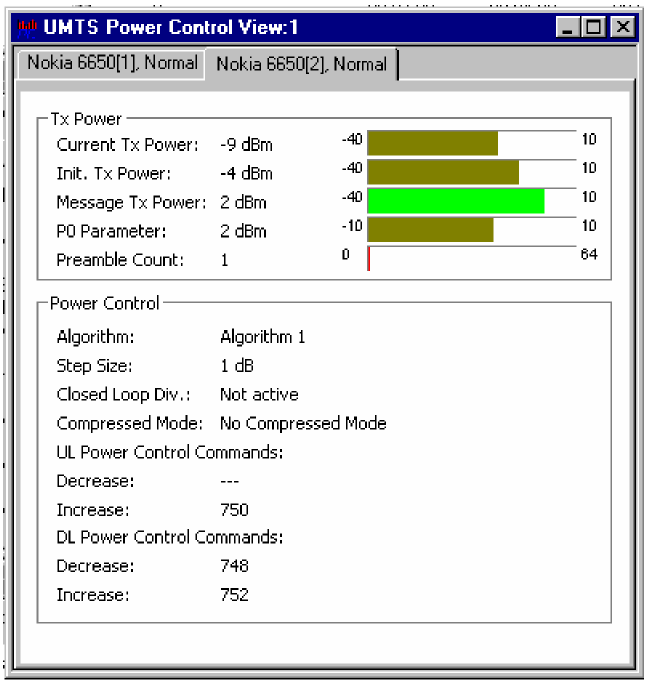


Fig. 4-87 UMTS Power Control View

The results for each mobile are arranged in a separate tab. Each tab consists of two panels.

Tx Power Series of bar graphs showing the transmitter output power parameters of the UMTS mobile during its last random access procedure. The parameters are updated after each random access procedure.

Current Tx Power
Current Tx power of the mobile in dBm.

Init. Tx Power
1st PRACH preamble power

Message Tx Power
Tx power after the end of the preamble sequence, used for transmission of the RACH message part.

P0 Parameter
Optional downlink power control parameter. If P0 is not present, then downlink power control is not used.

Preamble Count
Number of PRACH preambles transmitted by the test mobile

Power Control

Table of closed loop power control parameters. The parameters are updated while a connection is maintained.

Algorithm
Power control algorithm used to control the uplink power. Algorithm 1 means that the mobile power changes after each slot by the *Step Size.* Algorithm 2 means that the mobile power only changes if the same Transmit Power Control (TPC) command is received in a group of 5 consecutive slots.

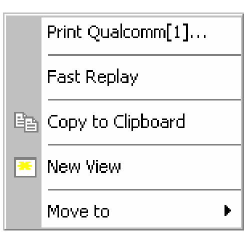
Step Size
Power step that the mobile transmitter performs according to the received TPC pattern and the power control algorithm.

Close Loop Div.
Information whether the mobile uses closed loop mode transmit diversity.

Compressed Mode
Information whether the mobile operates in compressed mode. In compressed mode the mobile transmitter is switched off in periodic gaps so that the mobile can monitor UMTS and GSM neighbor cells.

UL/DL Power Control Commands
Total number of power-down (decrease) and power-up (increase) commands among the last 1500 transmit power control (TPC) commands. If power control algorithm 1 is active, the difference between both DL numbers indicates the net power change of the mobile.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *UMTS Power Control View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

UMTS Layer 1 Graph View

The *UMTS Layer 1 Graph View* contains a Cartesian diagram to display UMTS or GSM layer 1 parameters as a function of time. It corresponds to the *2D Chart View* (described on p. 4.11) with a special selection of signals in the configuration menu. The controls in the view, in the context menu, and in the configuration menu are identical with the *2D Chart View.*

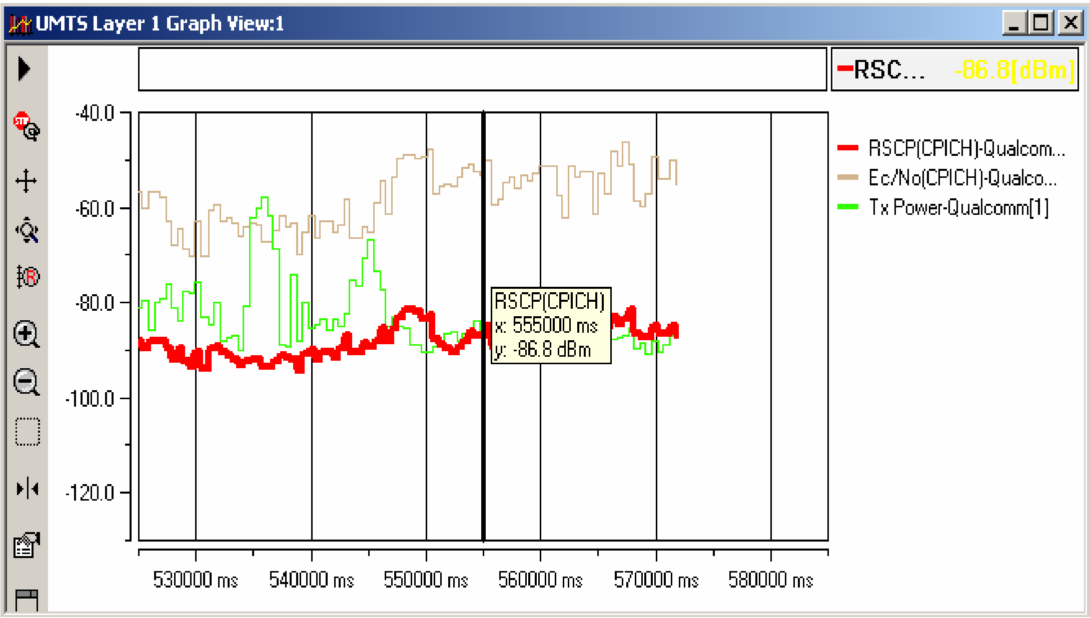


Fig. 4-88 UMTS Layer 1 Graph View

UMTS Neighborhood Analyzer View

The *UMTS Neighborhood Analyzer View* shows the results of the neighborhood analysis of option ROMES-U1. The aim of this analysis is to reveal possible conflicts between the current best server and the transmitters in the neighborhood in order to assess the general condition of a UMTS / GSM network. To this end the neighborhood analyzer post-processes PN scanner, UMTS test mobile, and/or GSM scanner data and compares them with the information stored in a Node B and BTS data base (see description of ATD files in chapter 7, in particular the neighbor cell columns 2GNC and 3GNC). In case of a mismatch between the detected Node Bs and the Node Bs in the data base, an alarm is generated. The same holds if a missing neighbor of the best server or a potential interferer is found.

The neighborhood analysis requires option ROMES-U1, *Handover and Neighborhood Analysis.*
PN scanner data recorded with a TSMU are needed; moreover the TSMU must be equipped with option TSMU-K14, *BCH Demodulation,* in order to decode the SIB type 11 blocks received from the UMTS node Bs (see description of the UMTS PNS driver configuration menu in chapter 6). Data from a UMTS test mobile and GSM scanner data can be used in addition to refine and extend the analysis.

The neighborhood analyzer is a performance-critical tool which must be activated explicitly in the *UMTS/GSM Neighborhood Analyzer View* configuration menu.

TIP

The UMTS/GSM Handover Analysis, which is also part of option ROMES-U1, is evaluated in the UMTS/GSM Handover Analyzer View; see p. 4.252.

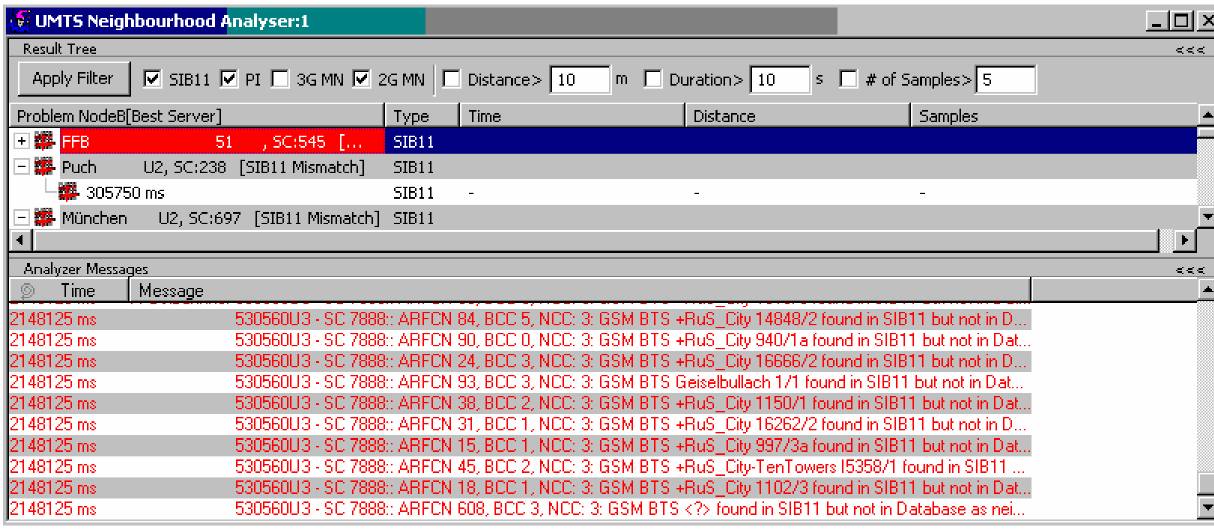


Fig. 4-89 UMTS Neighborhood Analyzer View

Neighborhood analysis

The PN scanner results for a particular top N pool (configured in the UMTS PNS driver configuration menu and selected for the neighborhood analysis using the *UMTS Neighborhood Analyzer View)* provide the essential data for the neighborhood analysis. The analysis involves several steps:

1. The top N pool member with the strongest CPICH level (1st top N member) is rated as the best server; its UARFCN, SC, and geographical position (and CI, if the PN scanner is able to decode the SIB3) is compared with the entries in the node B data base.
2. If possible, the SIB11 of the best server is decoded, and the neighbors list is compared with the neighbors list in the node B data base.
3. For the remaining top N members the analyzer checks whether they are missing neighbors or potential interferers; see below.

The results are updated whenever the top N pool members change. ROMES creates one of the events described below whenever a problem is detected. The conditions for the analysis can be modified in the *UMTS Neighborhood Analyzer View.*

Node B not found

NodeB/BTS not found in database

A *Node B not found in database* event can be generated in step 1 of the analysis: The detected best server is not listed in the node B data base.

SIB11 mismatch

Node B List differs from SIB11

An SIB11 mismatch can be detected in step 2 of the analysis: A particular node B is found in the data base but not in the SIB11 or vice versa.

Missing neighbor/ Potential interferer

Potential Interferer

Missing Neighbour

Node Bs that are detected with sufficient signal strength but not listed as neighbors can be missing neighbors or potential interferers. They are detected in step 3 of the analysis. The conditions for potential interferers and missing neighbors are defined in the view configuration menu; see description of the *Active Set Parameters* on p. 4.139.

View

The view is divided into an upper *Result Tree* and a lower *Analyzer Messages* section. A click on one of the title bars shows or hides the corresponding section. A hidden section leaves more space for the other section. A hidden section is characterized by the symbol >>> (instead of <<<) in the title bar. On pausing on the title bar, the cursor displays a compress symbol.

Result tree: Filter

The checkboxes across the top of the result tree define filter conditions for the problem nodes displayed in the result tree. E.g. if *SIB11* is cleared, all problem nodes of type *SIB11* mismatch are not displayed in the tree.

Apply Filter updates the result tree in accordance with the current filter conditions.

Result tree

The result tree consists of the following columns:

Problem Node B [Best Server]
Name of the best server for which a problem occurred together with the scrambling code (SC, for UMTS node Bs) and description of the problem. GSM base stations (if available) are listed with their name, BCCH, and BSIC. Detailed information (e.g. the time when the problem node was detected) is listed below the problem node. It is possible to expand or collapse the detailed information for a single problem node (click the + / – symbols or double-click the line) or all handovers (use the context menu).

Type
Short description of the problem type, e.g. *SIB11* for SIB11 mismatch.

The remaining columns are used for missing neighbors and potential interferers:

Time
Time during which a neighbor was classified as a missing neighbor or potential interferer. The accuracy depends on the tome and distance trigger settings in the view configuration menu; see below.

Distance
Covered distance during which a neighbor was classified as a missing neighbor or potential interferer. The accuracy depends on the tome and distance trigger settings in the view configuration menu; see below.

Samples
Number of samples acquired while a neighbor was classified as a missing neighbor or potential interferer.

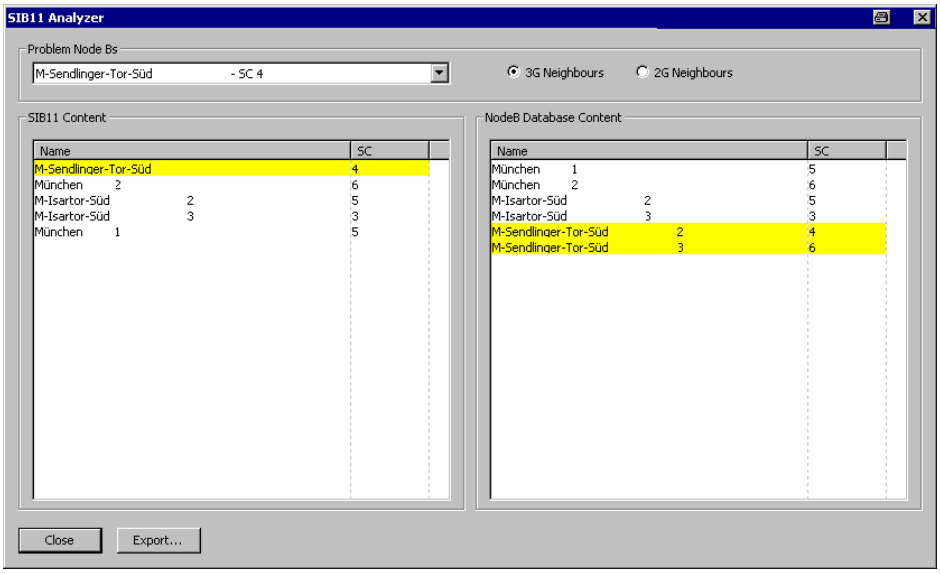
Analyzer Messages

The *Analyzer* M*essages* section shows the problem report in chronological order *(Time)*. A *Message* is generated whenever a problem is detected.

- For a *Node B not found* event, the name, UARFCH, and SC of the node B is listed.
- For the other events, a pair of best server and neighbor (2^{nd} to N^{th} element of the top N pool) is displayed.

Further analysis

The *SIB11 Analyzer…* command in the context menu (see below) opens an overview of all node Bs / base stations decoded from the SIB11 of the best server, and all node Bs / base stations in the Bs / BTS data bases. Node Bs and base stations that are not listed in both the SIB11 and the data base appear on a colored background.



The *SIB11 Analyzer* dialog provides the following control elements:

Problem Node Bs

Selects the best server for which the neighbors are shown.

3G / 2G Neighbors

Changes between Node B and GSM BTS display in the *SIB11 Content* and *Node B Database Content* lists.

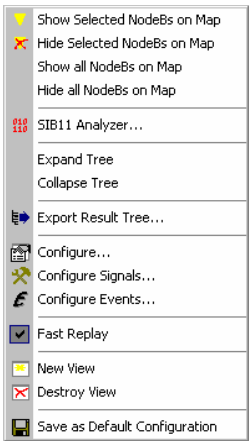
Export

Selects a file for exporting the contents of the *SIB11 Analyzer*. The export file is an ASCII table in *.csv format that can be opened and processed by Excel. The table contains all problem node Bs together with the corresponding *SIB11 Content* and *Node B Database Content*. Node Bs and base stations that are not listed in both the SIB11 and the data base are preceded by *!!!!*.

A shorter export file can be generated from the context menu; see below.

It is also instructive to monitor the measurement route and the node Bs / base stations in the *Route Track* view (see p. 4.37). Best servers, potential interferers, and missing neighbors can be displayed with different colors using the *Show Node Bs/BTSs on Map* command in the context menu The color code can be configured in the *UMTS/GSM Neighborhood Analyzer View* configuration menu; see below.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, activate the fast replay mode, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2. The context menu provides the following additional, view-specific commands:

Show Node B…
: Use the color code defined in the *UMTS/GSM Neighborhood Analyzer View* configuration menu (see below) to visualize the best servers, potential interferers, and missing neighbors in the *Route Track* view. This feature is only available while a best server is selected in the result tree. The UMTS layer / GSM BTS layer in the *Route Track* view must be visible to use this feature.

Hide Node B…
: Remove the previous action, display the selected cell symbol with standard colors.

Show all Node B...
: Display all cell symbols with the color code defined in the *UMTS/GSM Neighborhood Analyzer View* configuration menu.

Hide all Node B…
: Display all cell symbols with standard colors.

SIB 11 Analzer…
: Open the *SIB11 Analyzer* dialog described above.

Expand/Collapse Tree
: Show or hide the additional information for each best server in the *Results Tree*.

Export…
: Export the information in the result tree or in the message list to a *.csv export file that can be opened and processed by Excel. An extended export file can be generated from within the *SIB11 Analyzer* dialog; see above.

UMTS/GSM Neighborhood Analyzer View Configuration

The *UMTS/GSM Neighborhood Analyzer View* configuration menu enables the neighborhood analyzer, defines criteria for the analysis, and specifies the color scheme for the Node B / BTS symbols in the *Route Track View*. It is opened via a right mouse click on a point inside *UMTS/GSM Neighborhood Analyzer View* or via the *Configuration – Settings* command (see chapter 3).

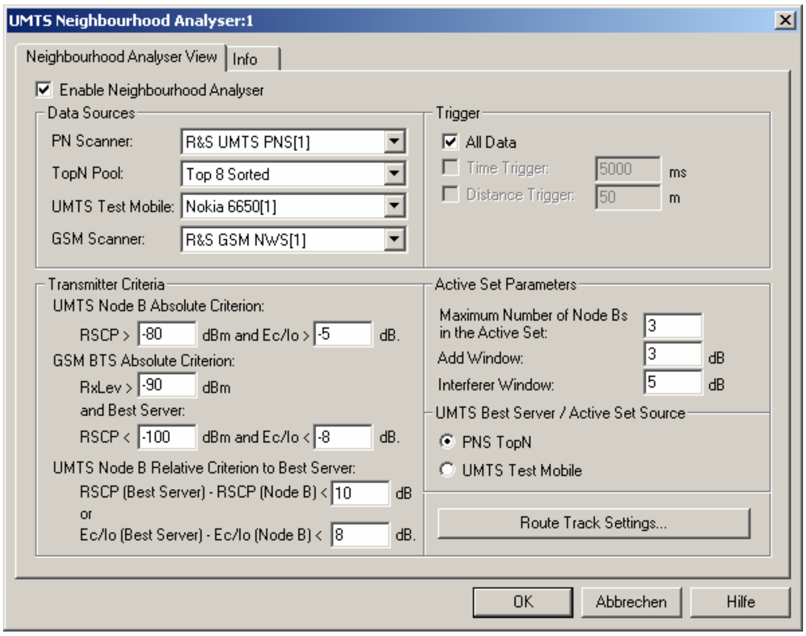


Fig. 4-90 UMTS/GSM Neighborhood Analyzer View: Configuration

Enable Neighborhood Analyzer

The neighborhood analyzer must be enabled explicitly in order to post-process the measured data and obtain the results in the *UMTS Neighborhood Analyzer View.*

For this option a separate licence is required, otherwise it cannot be enabled.

This holds for the data viewed during the measurement tour as well as for replayed measurement files. The *UMTS Neighborhood Analyzer View* is empty if the neighborhood analyzer is disabled.

The necessary hardware drivers must be loaded or a measurement (.cmd) file must be open in order to enable the neighborhood analyzer, select the data sources, or define the criteria for the analysis. After starting up ROMES, only the *Route Track Settings* are accessible.

Data Sources

The four drop-down lists in the *Data Sources* panel contain all UMTS and GSM test devices involved in the measurement. The lists are populated when the device drivers are loaded or when a measurement file is opened for replay.

Note:
The neighborhood is automatically disabled when the selected data sources are no longer available, e.g. because a new measurement file is loaded.

PN Scanner and *Top N Pool*
The neighborhood analysis requires a PN scanner with a *Top N* pool containing the N observed Node Bs with the strongest signal level. The top N pools can be configured in the *UMTS PNS* driver configuration menu as described in chapter 6.

UMTS Test Mobile
Use of an UMTS test mobile in addition to the PN scanner is optional. The test mobile can be used to determine (and possibly replace) the best server and the cells in the active set otherwise determined by the PN scanner; see *UMTS Best Server / Active Set Source* below.

GSM Scanner
A GSM scanner is only required if GSM base stations are to be included in the neighborhood analysis. GSM scanner data can be provided by a GSM test mobile in *Scan* mode or by a GSM network scanner.

Note:
In addition to the measured data the neighborhood analysis requires a node B list and a (separate) GSM BTS list with included neighbor cell information (see description of ATD files in chapter 7). For a unique identification of the node Bs the list must contain the columns named 2GNC (for GSM BTS lists) and 3GNC (for UMTS BTS lists). The column 2GNC must contain the LAC, MNC, and MCC of each GSM BTS. The column 3GNC must contain MNC, MCC, CI, and LAC. The import of node B and BTS list files is described in chapter 3.

Trigger

The PN scanner provides the top N pool data in periodic intervals (up to once per second for the TSMU). Trigger settings can reduce the amount of data considered and speed up the analysis.

All
Evaluate all top N data sets provided by the PN scanner.

Time Trigger
Evaluate a new top N data set only after the specified time has elapsed.

Distance Trigger
Evaluate a new top N data set only after the test vehicle has covered the specified distance.

Transmitter Criteria

To limit the amount of data processed, UMTS node Bs or GSM base stations are only considered if their signal strength exceeds a specified limit. ROMES provides absolute criteria that every node B and BTS must fulfill and relative criteria for the elements no. 2, …, N of the top N pool.

UMTS Node B Absolute Criterion

Minimum Received Signal Code Power of the DL P-CPICH *(CPICH RSCP)* and minimum ratio of the received energy per PN chip of the DL P-CPICH to the total transmit power spectral density (*Ec/Io)*.

GSM BTS Absolute Criterion

Minimum received signal level (RxLev) at the GSM test mobile. An additional condition is that the best UMTS server is so weak that a GSM handover is likely to occur.

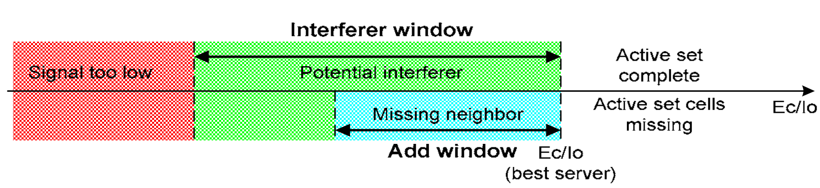
UMTS Node B Relative Criterion to Best Server

Maximum difference between the best server *RSCP* or *Ec/Io* and the *RSCP* or *Ec/Io* of any other node B in the top N pool. If both limits are exceeded the signal strength of the node B is deemed too low so that the node B is excluded from the analysis.

Active Set Parameters

The *Active Set Parameters* provide the criteria for classifying the node Bs no. 2, ..., N of the top N pool. Each of these node Bs can be a *missing neighbor* or a *potential interferer,* provided it is detected with a sufficient signal strength (i.e. it meets the *Transmitter Criteria* described above) and is **not** listed as a neighbor in the node B data base.

- A UMTS cell is a *missing neighbor* if its CPICH Ec/Io is within the *add window* **and** if the number of cells in the active set is below a specified *maximum number.*
- A cell is a *potential interferer* if it does not meet the criteria for a *missing neighbor* and if its CPICH Ec/Io is within the *interferer window.* GSM cells can be potential interferers but no missing neighbors.



Maximum Number of Node Bs…

Size of the active set. If the actual number of Node Bs in the active set is below this maximum number, a node B which is of listed in the SIB11 can be a *missing neighbor.*

Add Window

Size of the *add window* in dB; see figure above.

Interferer Window

Size of the *interferer window* in dB; see figure above.

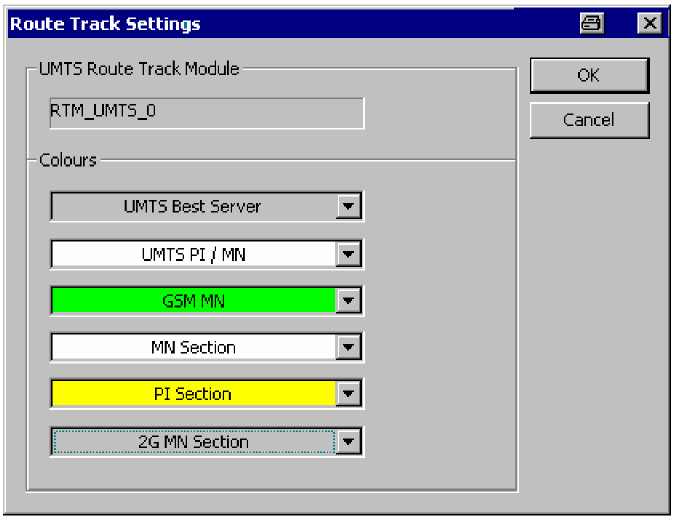
UMTS Best Server / Active Set Source

The best server and the cells in the active set are usually determined by the PN scanner. The best server corresponds to the first element of the top N pool.

As an alternative, it is possible to use the best server and active set determined by a UMTS test mobile. This can be desirable e.g. if the test mobile is suspected to assess the network conditions more realistically.

Route Track Settings

The *Route Track Settings…* button opens a dialog to define the color scheme for the Node B / BTS symbols in the *Route Track View*.



The *UMTS Route Track Module* panel is reserved for future extensions. The *Colors* distinguish the following UMTS Node Bs and GSM base stations:

UMTS Best Server
UMTS best server

UMTS PI/MN
UMTS potential interferers and missing neighbors

GSM MN
GSM missing neighbors

The remaining color codes are used for the sections of the route that correspond to the problem node B selected in the *Problem Node (Best Server)* list.

1xEV-DO Views

The *1xEV-DO Views* show 1xEV-DO-specific information included in the measurement data of 1xEV-DO mobiles. 1xEV-DO data can be acquired using one of the CDMA2000/1xEV-DO drivers described in chapter 6. Before a measurement is recorded, data acquisition for most views must be explicitly enabled in the *Define Measuremen*t tab of the CDMA2000 configuration menu (for an overview see chapter 6).

The 1xEV-DO views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *1xEV-DO Views*.

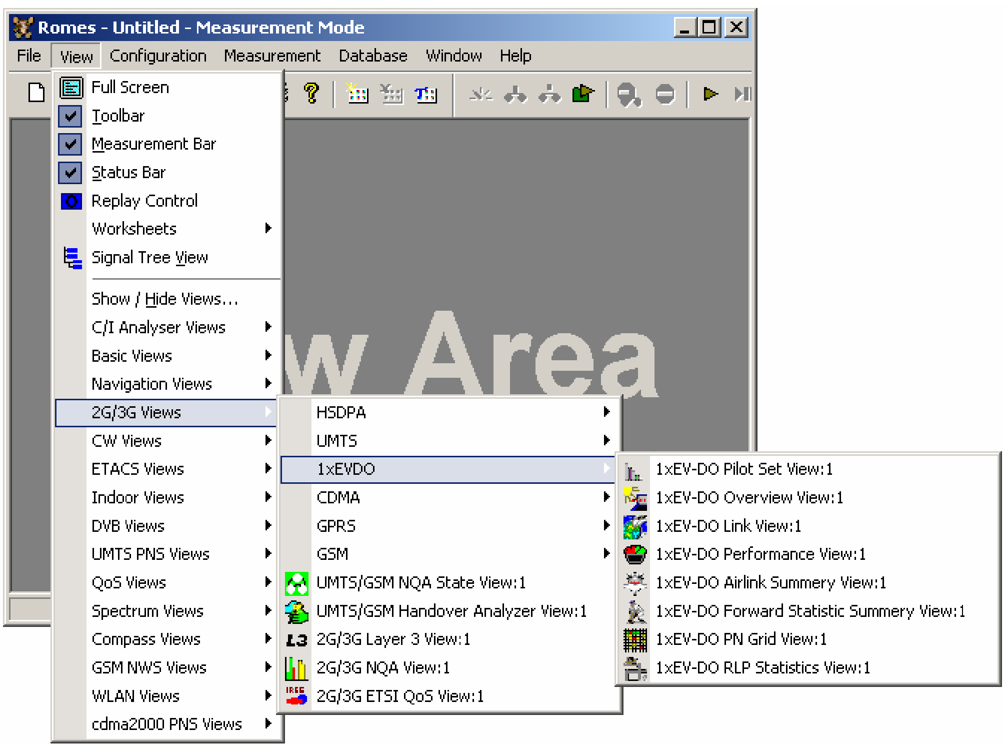


Fig. 4-91 1xEV-DO views

1xEV-DO Pilot Set View

The *1xEV-DO Pilot Set View* contains a list and a bar graph showing the pilot channel signal strength from the active and several neighbor base stations. The diagram is empty unless the *Pilot Sets* checkbox in the *Define Measurement* tab of the Expert Mode tab of the corresponding Qualcomm Driver (e.g. for the Z720) menu is enabled.

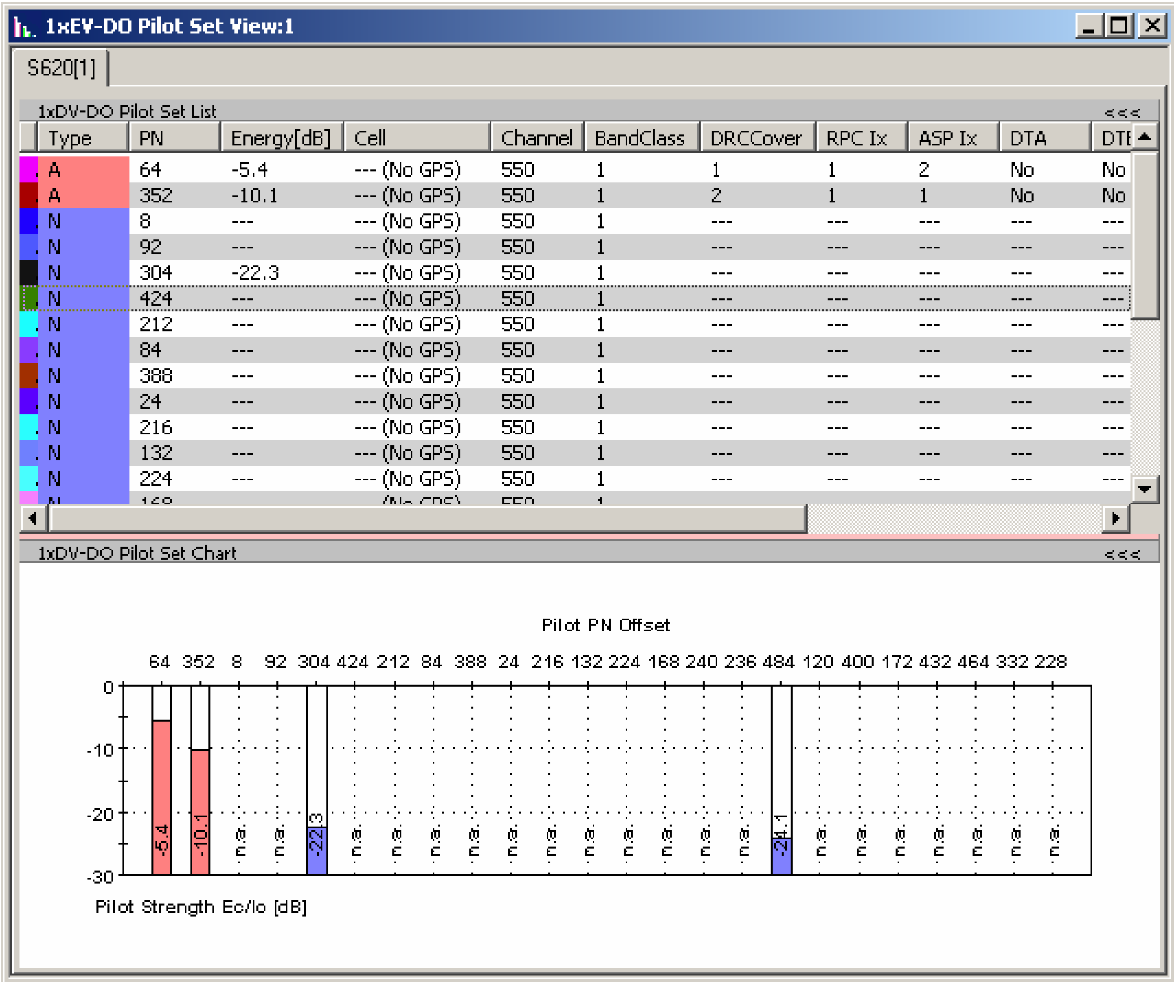


Fig. 4-92 1xEV-DO Pilot Set View

Pilot Set List The 1xEV-DO Pilot Set List panel displays the following information:

Type	Cell type as detected by the test mobile: active (A), neighbor (N), or candidate (C)
PN	The pilot PN sequence offset for the current sector in units of 64 PN chips.
Energy (dB)	Measured strength of the pilot per chip (in dB).
Cell	Name of the cell
Channel	1xEV-DO pilot channel number
BandClass	The band class number corresponding to the frequency assignment of the specified channel
DRCCover	Index of the DRC cover accociated with the measured sector used to transmit DRC.
RPC Ix	Reverse Power Control Index
ASP Ix	Active Set Pilot Index
DTA	The drop timer is activated whenever the measured pilot strength becomes less than the value threshold of the plot drop. If the strength of the pilot returns above the pilot drop

threshold before the timer expires, the pilot drop timer is reset. DTA (Drop Timer Active) indicates whether or not the drop timer is active.

DTE (Drop Timer Expired) indicates whether or not the drop timer is expired.

MAC Ix The 7-bit MAC Index for each pilot in the active set, ranging from 0 to 127.

Win Center For the active set, the search window is centered around the earliest usable multipath component for pilots.
For neighbor sets, the search window is centered around the pilot PN sequence offset plus the search window offset.

Win Size The search window size is specified by attribute for pilots in the active set and candidate set. For each pilot in the neighbor set, the search window size specified by the corresponding neighbor structure in the route update neighbor list is shown.

Win Offset The displayed search window offset is defined by the corresponding neighbor structure in the route update neighbor list.

AGE Maximum AGE value beyond which members from the neighbor set are dropped

A click on the arrows in the title row of the *Pilot Set List* closes the display panel of the list.

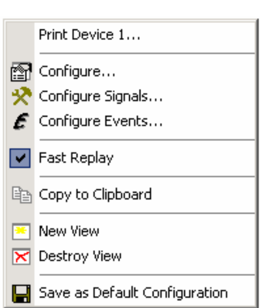
Pilot Set Chart

The diagram is a bar graph showing the relative strength of a variable number of pilot, candidate and neighbor cell signals. The 1xEV-DO channel numbers of the signals are indicated above the bars. The channel strength is expressed as the ratio *Ec/Io* in dB where E_c denotes the chip energy of the pilot signal, I_0 denotes the noise level. The diagram has a fixed y-axis scale of –30 dB to –0 dB.

The update rate of the diagram and the number of signals displayed depend on the mobile station and its operating conditions.

A click on the arrows in the title row of the *Pilot Set Chart* closes the display panel of the diagram.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

1xEV-DO Pilot Set View Configuration

The *1xEV-DO Pilot Set View* configuration menu defines the list settings, chart cell colors and shows information on the current view version. It is opened via a right mouse click on a point inside the *1xEV-DO Pilot Set View* or via the *Configuration – Settings* command (see chapter 3).

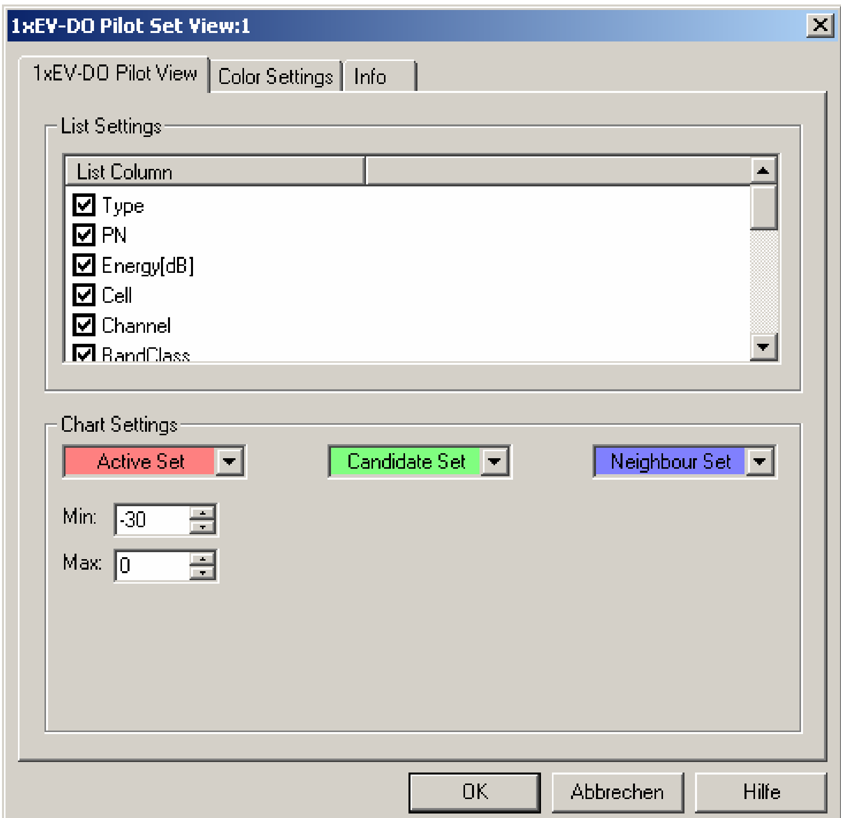


Fig. 4-93 1xEV-DO Pilot Set View configuration: Pilot View

List Settings The *List Settings* panel offers checkboxes to select the elements displayed in the Pilot Set view.

Chart Settings With the *Chart Settings* panel the colors for the pilot set cell types (active, candidate, neighbor) can be defined.

Min./Max.

With the *Min./Max.* selection field the y-axis scale of the 1xEV-DO pilot set chart can be defined within the range between –30 dB to – 0 dB.

The *Color Settings* tab sets the color scale for the possible PN offsets.

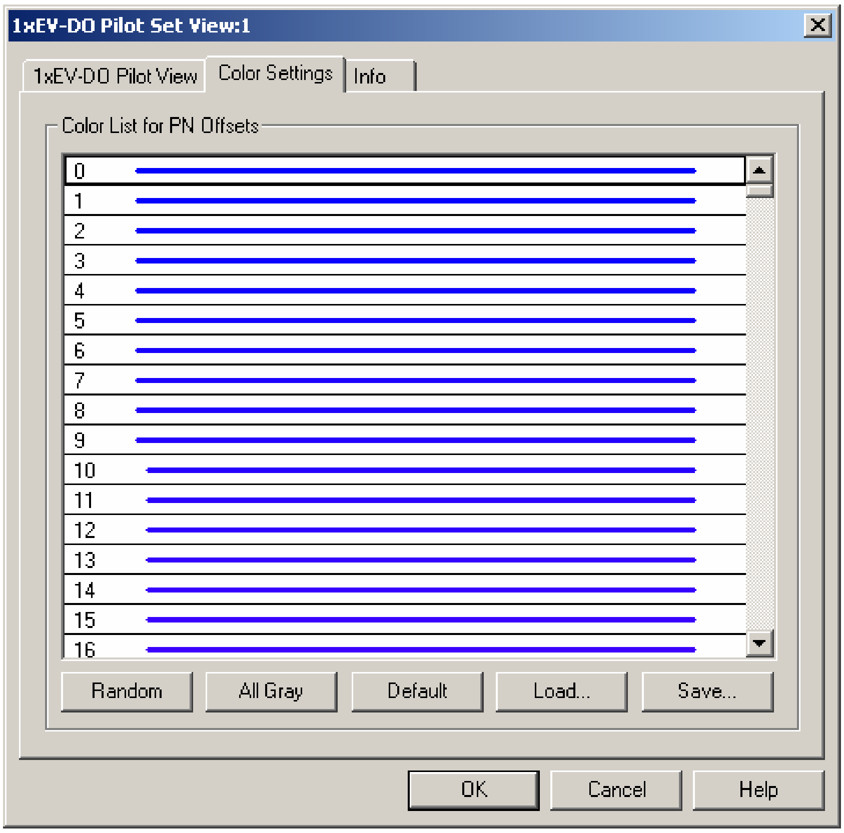


Fig. 4-94 1xEV-DO Pilot Set View configuration: Color Settings

The colors are displayed in the diagram (power peaks) and in the first table column (pilot set list). A double-click on a line in the *Color List* opens the *Colors* dialog (see p. 4.322) to change the current display color.

Random	No ordering; colors are assigned to the PN offsets at random.
All Gray	Color scale suppressed; all colors are gray. This option is suitable e.g. to distinguish a single PN offset (or a small number of PN offsets), colored different, from all other codes, colored gray.
Default	Predefined color scale: Colors change continuously as the PN offsets increase.
Load/Save	A color scale can be loaded from an SC color file (*.scc) and user-defined color scales can be stored to *.scc files to be reused in a later session.

1xEV-DO Overview View

The 1xEV-DO Overview view displays a summary of the test mobile state, power/quality, sector, airlink quality results, and, if applicable, results from a connected 1xEV-DO PN scanner.

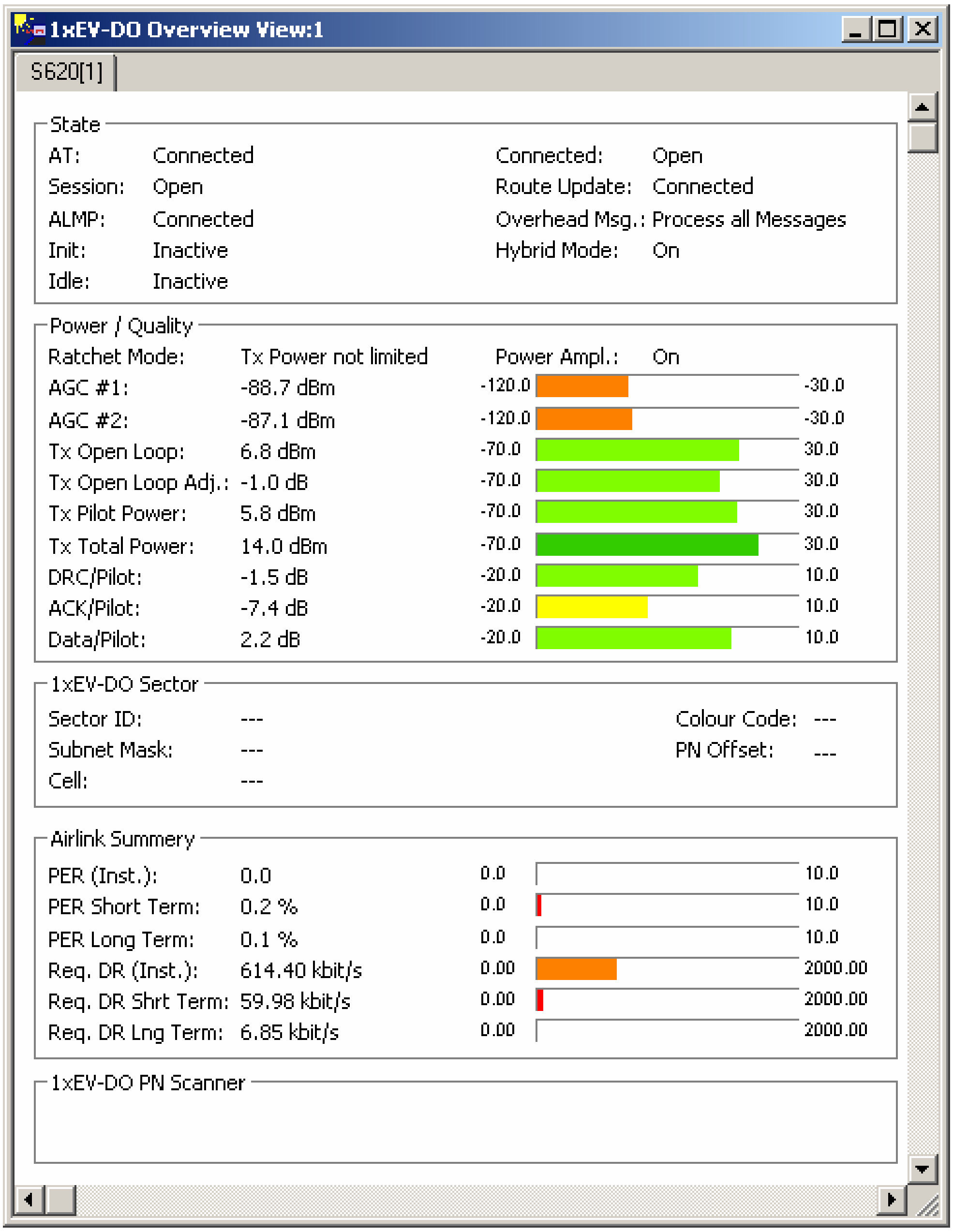


Fig. 4-95 1xEV-DO Overview View

The 1xEV-DO PN Scanner field group is only filled if an actual scanner is configured and running.

State

The 1xEV-DO state parameters of the access terminal and the traffic session on the connection layer are arranged in a field with 2 columns: Some of the parameters may not be provided by all test mobiles.

AT	Signaling state of the access terminal.
Session	State of the current session.
ALMP	The Air Link Management protocol (ALMP) maintains the overall connection state in the AT and the AN. The protocol can be in one of three states, corresponding to whether the AT has yet to acquire the network (Initialization State), has acquired the network but the connection is closed (Idle State), or has an open connection with the AN (Connected State).
Init	The Initialization State Protocol provides the procedures that an AT follows to acquire a network and that an AN follows to support network acquisition. It has the possible states *Inactive*, *Network Determination*, *Pilot Acquisition*, or *Synchronization*
Idle	In the Idle State, the AT autonomously maintains the Active Set. Route update messages from the AT to the AN are based on the distance between the current serving sector of the AT and the serving sector at the time the AT last sent an update. It has the possible states *Inactive, Sleep, Monitor,* and *Connection Setup*.
Connected	State of the Connected State protocol (ALMP) of the radio link between mobile and access terminal (Open / Inactive/ Close).
Route Update	State of the Route Update Protocol, which performs the actions associated with keeping track of an AT location and maintaining the radio link between the AT and the AN (.Connected / Idle / Inactive).
Overhead Msg.	This protocol performs supervision on the messages necessary to keep the Connection Layer functioning. It can be in two states: *Wait for link* (Inactive) or *Process all Messages* (Active).
Hybrid Mode	If the mobile station is able to support services on both the IS-2000/IS-95 (CDMA) and IS-856 (1xEV-DO) systems, a hybrid mode MS/AT can connect services available on either system. This is useful to e.g. to monitor voice calls when in a 1xEV-DO data connection.

Power / Quality The field group displays a summary of power and quality measurement-related results:

Ratchet Mode	The RatchetMode register shows the state of the Tx power limiting: 0 – Tx power not limited 1 – Tx power is limited
Power Ampl.	Power amplification (On/Off)
AGC #1/2	Automatic Gain Control, the field shows the total receive power as seen by antenna 1/2
Tx Open Loop	The Tx power determined by the open loop adjust mechanism (range is –70 to +30 dBm)
Tx Open Loop Adj,	Open loop adjustment value (dB).
Tx Pilot Power	The Tx power determined by the closed loop adjust mechanism (range is –70 to +30 dBm). The value represents the pilot power that is transmitted over the pilot channel; this is calculated based on the Tx Open Loop power and the Tx Closed Loop Adjustment.
Tx Total Power	Tx Total Power holds the total Tx power as determined by the entire Tx AGC mechanism (range –70 to +30 dBm).
DRC/Pilot	DRC channel gain
ACK/Pilot	ACK channel gain
Data/Pilot	Data chanel gain

1xEV-DO Sector The measured 1xEV-DO sector data and sector-related settings are displayed in this field group:

Sector ID	This field displays the 128-bit sector address of the serving sector
Subnet Mask	The sector subnet identifier (default 104). The AN sets this field to the number of consecutive 1's in the subnet mask of the subnet to which the corresponding sector belongs.
Cell	Number of cells in the active set.
Color Code	The color code corresponding to the related sector.
PN Offset	*PN Offset* sets the offset of the PN sequence. Changing the PN offset (default 0) changes the timing of the short code spreading, the contents of the Sync message on the Control Channel.

Airlink Summary	The field group shows the receiver quality-related measurement information:	
	PER (Inst.)	Current Packet Error Rate
	PER Short Term	Short-term Packet Error Rate
	PER Long Term	Long-term Packet Error Rate
	Req. DR (Inst.)	Currently requested Data Rate
	Req. DR Shrt Term	Short-term Data Rate as defined by Qualcomm
	Req. DR Lng Term	Long-term Data Rate as defined by Qualcomm
	Part of the information on this view is also displayed in the *1xEV-DO Airlink Summary View;* see p. 4.159 .	
1xEV-DO PN Scanner	If a 1xEV-DO PN scanner is configured and running, this panel displays the Top Ns of the scanner as decribed for the *UMTS Layer 1 View* on p. 4.104.	

The *1xEV-DO Overview* view has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

1xEV-DO Link View

The *1xEV-DO Link View* shows the attempt-related information for access, connection and session attempts.

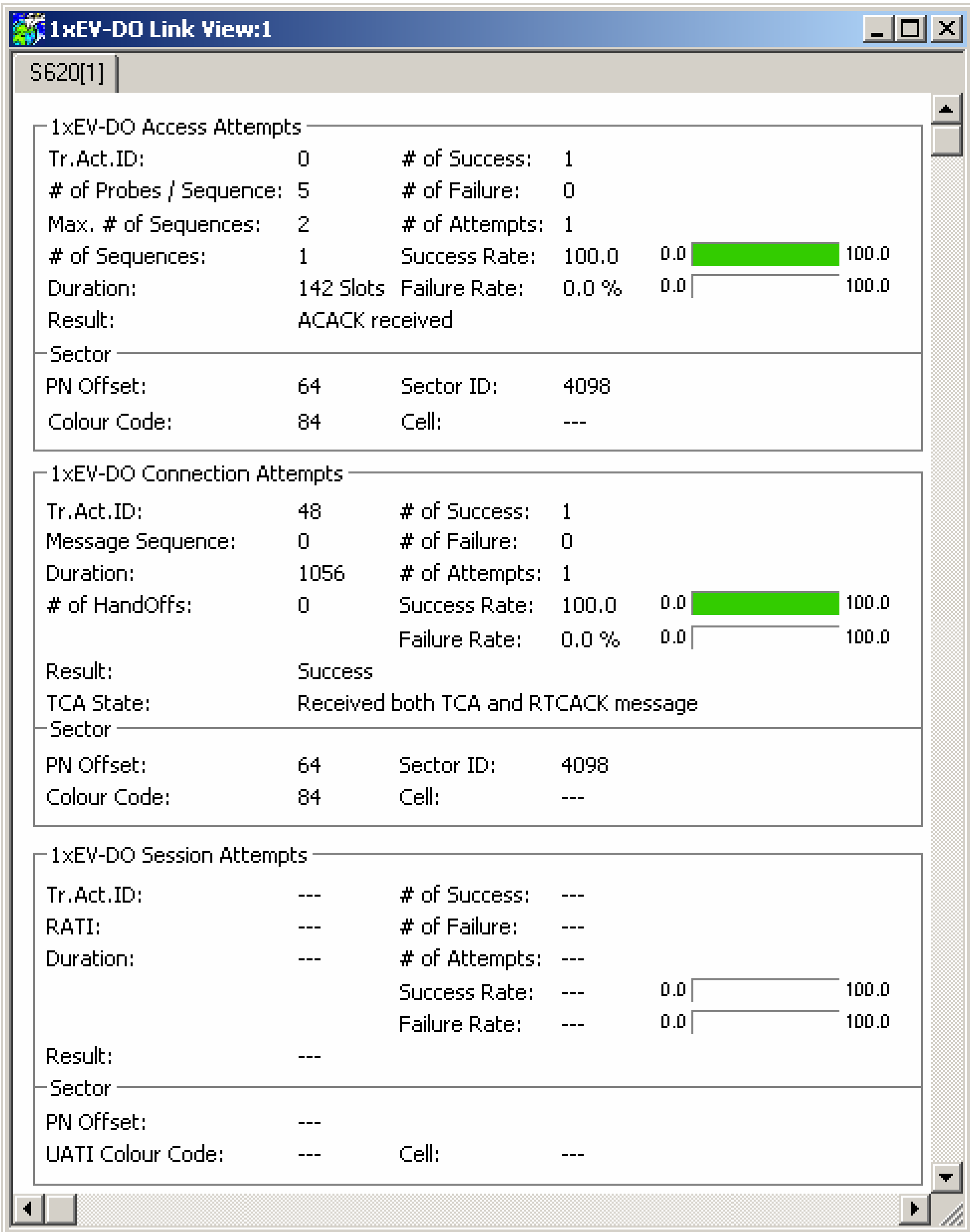


Fig. 4-96 1xEV-DO Link View

The measurement results for each attempt are arranged in a separate panel. The panels show the attempt information first, then the relevant sector parameters are appended.

1xEV-DO Access Attempts

The *1xEV-DO Access Attempts* panel display the summary of the access attempt-related measurement results:

Tr.Act.ID	Transaction ID of the connection request sent by the AT.
# of Probes / Sequence	*Access Probes* allow the setting of the AN to ignore or acknowledge the access probes from the AT, where "Acknowledge" is the default value. The AT transmits access probes during its power on cycle, at the AN timer based registration setting and when the AT initiates a call. This column shows the number of probes in the current measurement sequence.
Max. # of Sequences	Maximum number of test sequences.
# of Sequences	Number of actually transmitted access test sequences.
Duration	Indication of the time needed for successful access attempts.
Result	Result indication of the access attempt: 0 – ACAck not received 1 – ACAck received 2 – TCA message received 3 – Probe Interrupted Other values are reserved
# of Success	Number of successful access attempts.
# of Failure	Number of unsuccessful access attempts.
# of Attempts	Total number of access attempts.
Success Rate	Percentage of successful access attempts relative to the total number of access attempts. The success rate percentage is also shown as a histogram chart which is colored according to the rate result.
Failure Rate	Percentage of successful access attempts relative to the total number of access attempts. The failure rate percentage is also shown as a histogram chart which is colored according to the rate result.
Sector – PN Offset	PN of the sector that sends the ACAck or the TCA message. If the *Result* field equals 0 or 3, then this field is reserved.
Sector – Colour Code	Sector Colour Code on which the access probe was sent.
Sector – Sector ID	Sector ID on which the access probe was sent.
Sector – Cell	Number of the active cell.

1xEV-DO Connection Attempts

The *1xEV-DO Connection Attempts* panel display the summary of the connection attempt-related measurement results:

Tr.Act.ID — Transaction ID associated with the *ConnectionDeny* message. If there is no response from the AN or a *ConnectionDeny* message is not received, this field represents the Transaction ID that was used to send the *ConnectionRequest* message.

Message Sequence — The Message Sequence present in the received TCA message. This field is valid only if a TCA message is actually received, that is, if the most significant nibble of result field equals 1 or 2.

Duration — Time (in slots) needed to complete the attempt

# of Handoffs — Number of handoffs during the connection attempt analysis.

Result — The least significant nibble of this field indicates the following possible connection attempt outcomes:

0 – ConnectionDenyReceived with DenyReason "General"
1 – ConnectionDenyReceived with DenyReason "Network Busy"
2 – ConnectionDenyReceived with DenyReason "Authentication or billing failure"
3 – Maximum access probes
4 – System lost (supervision failures)
5 – Not preferred (SD told OVHD to switch systems, QC redirect, Access network ID)
6 – Redirect (ALMP received a redirect message)
7 – Connection setup timeout
8 – PowerDownReceived
9 – OfflineReceived
A – NAMChangeReceived
B – UserAbort
C – AccessHandoff
D through E – Reserved
F – Success

The most significant nibble of this field indicates the following reception status of the TCA and RTCACK messages:

0 – Not received either TCA or RTCACK message
1 – Received TCA message but not received RTCACK message
2 – Received both TCA and RTCACK messages

TCA State — The most significant nibble of this field indicates the following reception status of the TCA and RTCACK messages:

0 – Received neither TCA nor RTCACK message
1 – Received TCA message but not RTCACK message
2 – Received both TCA and RTCACK messages

# of Success	Number of successful connection attempts.
# of Failure	Number of unsuccessful connection attempts.
# of Attempts	Total number of connection attempts.
Success Rate	Percentage of successful connection attempts relative to the total number of connection attempts. The success rate percentage is also shown as a histogram chart which is colored according to the rate result.
Failure Rate	Percentage of successful connection attempts relative to the total number of connection attempts. The failure rate percentage is also shown as a histogram chart which is colored according to the rate result.
Sector – PN Offset	If the *Result* field indicates that a *ConnectionDeny* message was received then the PN Offset represents the PN of the sector that sent the *ConnectionDeny* message. If the *Result* field indicates that a TCA message was received then it represents the PN of the sector that sent the TCA message. For all other cases, it represents the PN of the sector at the time when the connection setup failed.
Sector – Color Code	Sector Colour Code on which the access probe was sent.
Sector – Sector ID	Sector ID on which the access probe was sent.
Sector – Cell	Number of the active cell.

1xEV-DO Session Attempts

The *1xEV-DO Session Attempts* panel display the summary of the session attempt-related measurement results:

Tr.Act.ID	Transaction ID associated with the UATI request message
RATI	Random Access Terminal Identifier
Duration	Time (in slots) needed to complete the attempt
Result	Result indication of the session attempt: 0 – Received UATIAssignment message 1 – Did not receive UATIAssignment message
# of Success	Number of successful session attempts.
# of Failure	Number of unsuccessful session attempts.
# of Attempts	Total number of session attempts.
Success Rate	Percentage of successful session attempts relative to the total number of session attempts. The success rate percentage is also shown as a histogram chart which is colored according to the rate result.
Failure Rate	Percentage of successful session attempts relative to the total number of session attempts. The failure rate percentage is also shown as a histogram chart which is colored according to the rate result.
Sector – PN Offset	PN of the sector that sent the UATI assignment message.
Sector – UATI Color Code	Color code of the Unicast Access Terminal Identifier
Sector – Cell	Number of the active cell.

The *1xEV-DO Link View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

1xEV-DO Performance View

The *1xEV-DO Performance View* contains four preconfigured 2D charts. The signals in these charts are related to the transmission performance, given in terms of the requested or achieved data throughput.

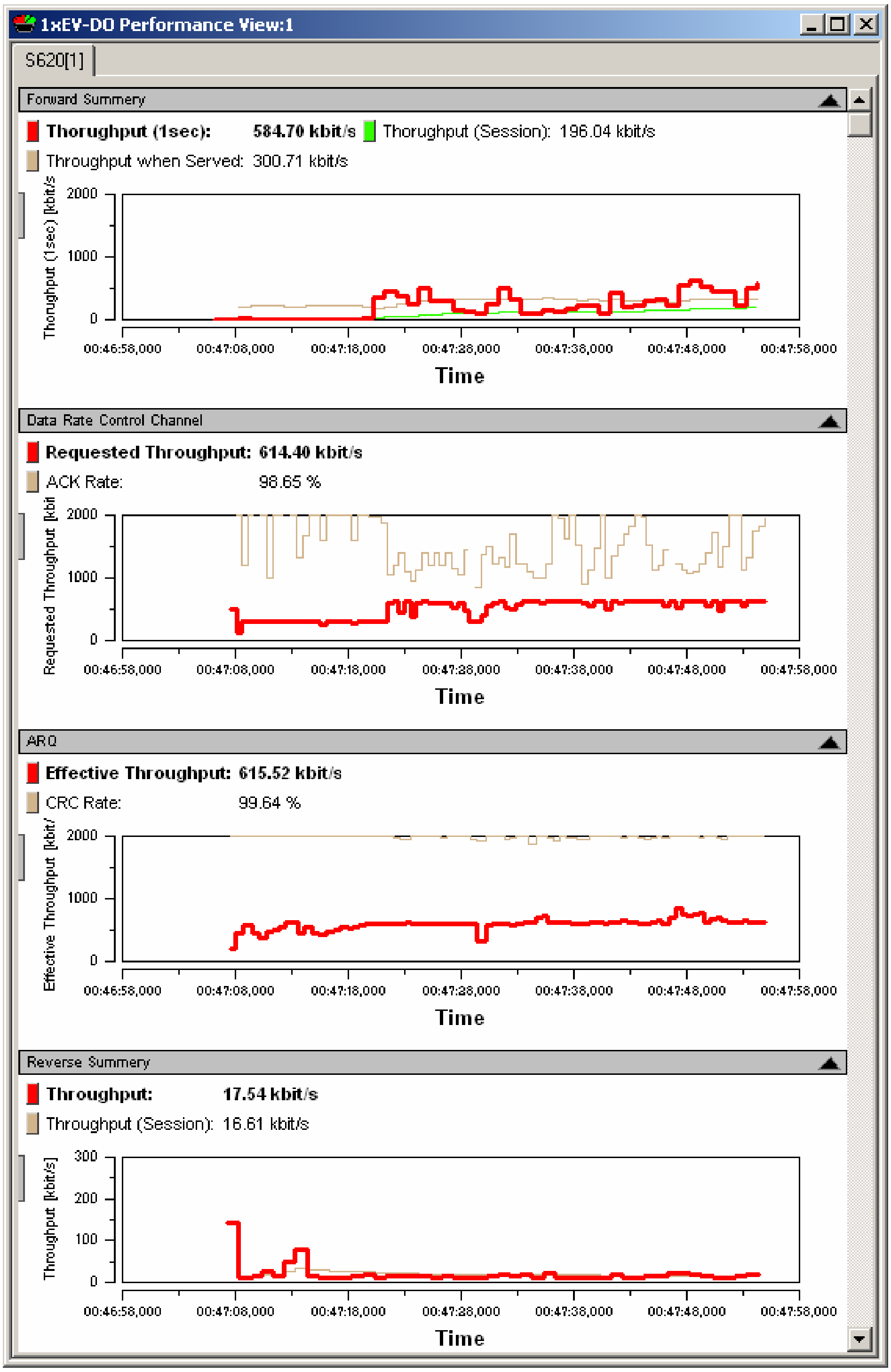


Fig. 4-97 1xEV-DO Performance View

A double-click on the *Forward Summary, Data Rate Control Channel, ARQ, or Reverse Summary* title bars opens or closes the sub-diagrams in the performance view. The functionality of all sub-diagrams is analogous to the *2D Chart View* described on p. 4.11, however, an additional *Plot* dialog (see below) provides additional settings to control the diagram content and appearance.

Forward Summary

The total throughput (see Fig. 4-97 above) of the forward channel is the data throughput that the mobile receives according to the measured forward channel quality.

The forward throughput is calculated from the the FTAP MAC layer packets transmitted on the forward traffic channel that the mobile could receive successfully. This includes the information about the forward channel frame counts. It contains the good and bad CRC counters for Control and Traffic Channel packets. It also contains the number of forward link traffic channel and control channel packets received at various rates. These values are updated if the CRC has passed for the decoded packets. Each rate counter name also includes the SlotsDecoded part that indicates the number of slots taken to decode the particular rate packet.

The chart contains the following results:

Throughput (1 sec)	The throughput during the last second of the measurement is displayed [kBit/s]
Throughput (Session)	The averaged throughput for the current AT session.
Throughput when Served	The *Throughput when Served* is calculated from a Qualcomm-specific formula when the AT is actually receiving data.

The most recent *1 sec, session,* and *when served* throughput values are displayed in the legend above the diagrams. Selecting one of the items in the legend will highlight the corresponding curve.

Data Rate Control Channel

The DRC Channel is used by the access terminal to indicate to the access network the requested Forward Traffic Channel data rate and the selected serving sector on the Forward Channel.

The requested throughput (see Fig. 4-97 above) by the DRC channel is shown together with the corresponding ACK rate:

Requested Throughput	Requested data rate as determined from the reverse DRC channel.
ACK Rate	The percentage of ACKnowledged data rate requests.

ARQ

Each sector of an access network transmits a positive acknowledgment (ACK) or a negative acknowledgment (NAK) in response to a physical layer packet using the ARQ Channel, which is a part of the reverse MAC channel.

The chart contains the following results:

Effective Throughput	The effective receive rate (threoughput) is calculated as: $RateDecoded * Slots_{alloted}/Slots_{required}$ For example, if a 38.4 kbps packet needs 8 slots to decode instead of the alloted 16 slots, then the effective rate is 38.4 * 2 = 76.8 kbps.
CRC Rate	The percentage of successful CRCs for the ARQ channel throughput..

Reverse Summary

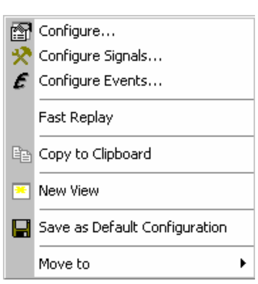
The total throughput (see Fig. 4-97 above) of the reverse channel is the data throughput that the access network receives according to the measured reverse channel quality.

Data rate per unit of time (in kBit/s) of the RTAP RTC MAC packets from the mobile that the R&S CMU could receive successfully

The chart contains the following results:

Throughput	The throughput during the last second of the measurement is displayed [kBit/s]
Throughput (Session)	The averaged throughput for the duration of the current AT session is shown.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

View Configuration

The *Edit...* dialog provides additional settings to control the diagram content and appearance. The dialog is opened from a context menu; this menu appears after a right-click on the y-axis labels or on one of the curves in the diagram.

Hold/Release This option pauses and resumes the display of the resulting measurement output.

Axes Move Here the axes of the chart can be scrolled by panning the mouse cursor over the axis area of the chart.

Axes Stretch This option enables the dynamic increase or decrease of the axis scale

Y-Axis Reset This option resets the y-axis scale to its default value, which resets all previous zooming, stretching or moving y-axis activities

Zoom In Zoom into the graph by positioning and clicking the looking-glass cursor.

Zoon Out Zoom out of the graph by positioning and clicking the looking-glass cursor.

Zoom Rect Select a rectangle within the graph to be zoomed.

Marker This option creates a vertical line with an associated information dialog which shows the associated absolute values of the selected measurement curve.

1xEV-DO Performance View Configuration

The *Chart Configuration* tab of the *1xEV-DO Performance View Configuration* dialog is analogous to the *Chart Configuration* tab of the 2D Chart View configuration menu, see Fig. 4-11 on p 4.15.

1xEV-DO Airlink Summary View

The *1xEV-DO Airlink Summary View* contains three preconfigured 2D charts. The signals in these charts are the pilot energy, the requested throughput, and the PER over the measurement time.

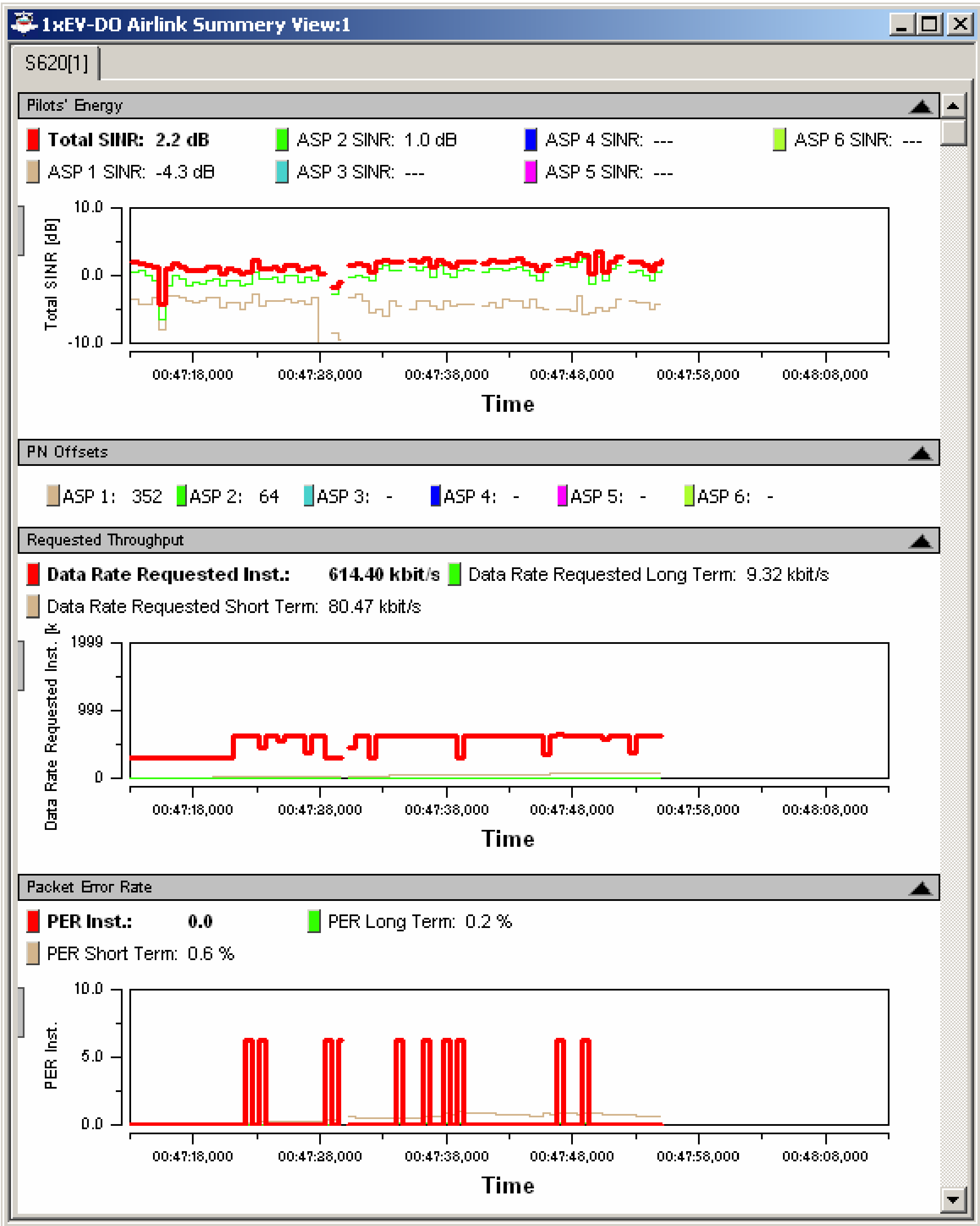


Fig. 4-98 1xEV-DO Airlink Summary View

A double-click on the *Pilot's Energy, PN Offsets, Requested Throughput, or Packet Error Rate* title bars opens or closes the sub-diagrams in the airlink summary view. The functionality of all sub-diagrams is analogous to the *2D Chart View* described on p. 4.11, however, an additional *Edit* dialog (see below) provides additional settings to control the diagram content and appearance.

Pilot's Energy The chart contains the following results:

Total SINR [dB]	Signal-to-Interference-plus-Noise Ratio. When the mouse cursor is located over the y-axis, it changes its shape to a hand. The scroll wheel or dragging the hand cursor shifts the y-axis left or right, depending on the direction of dragging or scrolling.
ASP 1 to 6 SINR [dB]	Signal-to-Interference-plus-Noise Ratio of the Active Set Pilots 1 through 6.
Time	Timeline of the measurement. When the mouse cursor is located over the time axis, it changes its shape to a hand. The scroll wheel or dragging the hand cursor shifts the time axis left or right, depending on the direction of dragging or scrolling.

PN Offsets The chart shows the following settings:

ASP 1 to ASP 6	Active Set Pilots PN Offset

Requested Throughput The *Requested* throughput (see *Fig. 4-98* above) is the data throughput that the mobile requests according to the measured channel quality.

The chart contains the following results:

Data Rate Requested Inst.	The currently requested data rate as determined from the reverse DRC channel.
Data Rate Requested Long Term	The requested data averaged over the long term as calculated using Qualcomm specifications.
Data Rate Requested Short Term	The requested data averaged over the short term as calculated using Qualcomm specifications.
Time	Timeline of the measurement. When the mouse cursor is located over the time axis, it changes its shape to a hand. The scroll wheel or dragging the hand cursor shifts the time axis left or right, depending on the direction of dragging or scrolling.

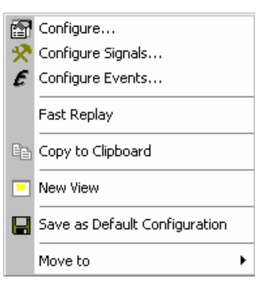
Packet Error Rate

The *Packet Error Rate* panel shows the PER-related measurement results with the packet errors instead of the received packets, as the standard specifies. Packet errors are calculated as the difference between the sent and received packets, but they ignore lost packets at a data rate of 0.0 kBit/s. The advantage of this approach is that the overall PER will not be influenced by these "lost" packets, since this is a valid and normal condition.

The chart contains the following results:

PER Inst.	Current Packet Error Rate
PER Long Term	Long-term Packet Error Rate as defined by Qualcomm
PER Short Term	Short-term Packet Error Rate as defined by Qualcomm
Time	Timeline of the measurement session. When the mouse cursor is located over the time axis, it changes its shape to a hand. The scroll wheel or dragging the hand cursor shifts the time axis left or right, depending on the direction of dragging or scrolling.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

View Configuration

The *Edit...* dialog provides additional settings to control the diagram content and appearance. The dialog is opened from a context menu; this menu appears after a right-click on the y-axis labels or on one of the curves in the diagram.

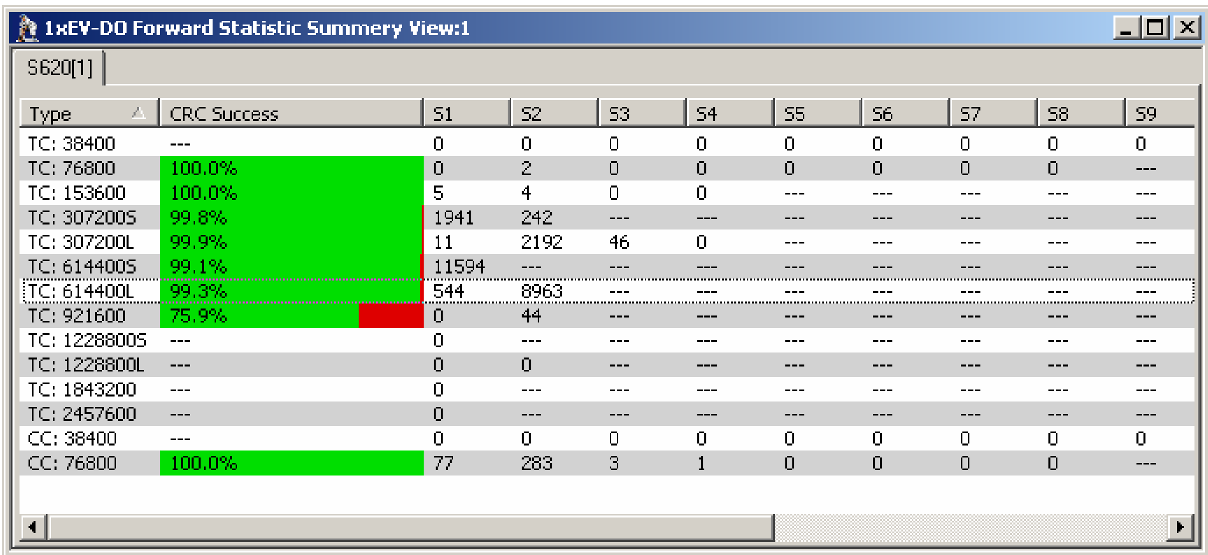
Hold/Release	This option pauses and resumes the display of the resulting measurement output.
Axes Move	Here the axes of the chart can be scrolled by panning the mouse cursor over the axis area of the chart.
Axes Stretch	This option enables the dynamic increase or decrease of the axis scale
Y-Axis Reset	This option resets the y-axis scale to its default value, which resets all previous zooming, stretching or moving y-axis activities
Zoom In	Zoom into the graph by positioning and clicking the looking-glass cursor.
Zoon Out	Zoom out of the graph by positioning and clicking the looking-glass cursor.
Zoom Rect	Select a rectangle within the graph to be zoomed.
Marker	This option creates a vertical line with an associated information dialog which shows the associated absolute values of the selected measurement curve.

1xEV-DO Airlink Summary View Configuration

The *Chart Configuration* tab of the *1xEV-DO Airlink Summary View Configuration* dialog is analogous to the *Chart Configuration* tab of the 2D Chart View configuration menu, see Fig. 4-11 on p 4.15.

1xEV-DO Forward Statistic Summary View

The *1xEV-DO Forward Statistic Summary View* shows the CRC success rates on the measured forward traffic and forward control channel slots.



Type	CRC Success	S1	S2	S3	S4	S5	S6	S7	S8	S9
TC: 38400	---	0	0	0	0	0	0	0	0	0
TC: 76800	100.0%	0	2	0	0	0	0	0	0	---
TC: 153600	100.0%	5	4	0	0	---	---	---	---	---
TC: 307200S	99.8%	1941	242	---	---	---	---	---	---	---
TC: 307200L	99.9%	11	2192	46	0	---	---	---	---	---
TC: 614400S	99.1%	11594	---	---	---	---	---	---	---	---
TC: 614400L	99.3%	544	8963	---	---	---	---	---	---	---
TC: 921600	75.9%	0	44	---	---	---	---	---	---	---
TC: 1228800S	---	0	---	---	---	---	---	---	---	---
TC: 1228800L	---	0	0	---	---	---	---	---	---	---
TC: 1843200	---	0	---	---	---	---	---	---	---	---
TC: 2457600	---	0	---	---	---	---	---	---	---	---
CC: 38400	---	0	0	0	0	0	0	0	0	0
CC: 76800	100.0%	77	283	3	1	0	0	0	0	---

Fig. 4-99 1xEV-DO Forward Statistic Summary View

Forward Statistic Summary View

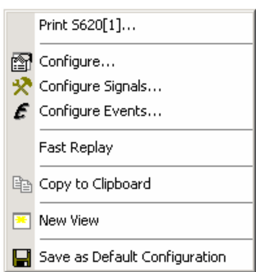
The 1xEV-DO Forward Statistic Summary View measurement results are shown as a list panel displaying the following information:

Type
This column shows the channel type (TC = traffic channel, CC = control channel) and the channel rate (in bit/s). An S or L after the rate denotes Short or Long.

CRC Success
This column shows the CRC success rate calculated as [Good / (Good + Bad)]. The field backgrounds also contain a relative bar graph showing the *CRC Success* rate colored green and red.

S1 to S16 These columns contain the information about the forward channel frame counts, the good and bad CRC counters for Control and Traffic Channel packets, and the number of forward link traffic channel/control channel packets received at various rates for the 16 available channel slots. These values are updated if the CRC has passed for the decoded packets. Each rate counter name also includes the SlotsDecoded part that indicates the number of slots taken to decode the particular rate packet. Data for this packet is both sampled and logged every second.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, activate the fast replay mode, copy the view contents to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The *1xEV-DO Statistic Summary View* configuration menu contains a single *Info* tab; see p. 4.4.

1xEV-DO Forward Statistic Summary View Configuration

The *1xEV-DO Forward Statistic Summary View Configuration* menu defines the list information to be viewed and selects the data set displayed for the current view. It is opened via a right mouse click on a point inside *1xEV-DO Forward Statistic Summary View* or via the *Configuration – Settings* command (see chapter 3).

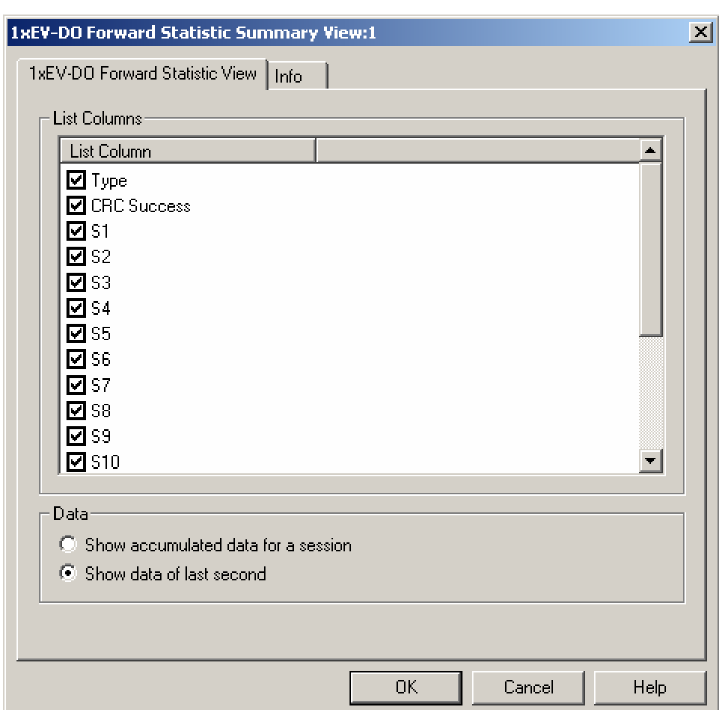


Fig. 4-100 1xEV-DO Forward Statistic Summary View Configuration

List Columns The checkbox selects the summary view elements to be displayed on the list panel:

Data The radio buttons select whether the accumulated data of the current session is displayed or just the data from the last second of the measurement.

1xEV-DO PN Grid View

The *1xEV-DO PN Grid View* shows the forward channel PN offsets 0 to 511 as a matrix with 16 offsets in a row. Within this grid, the PN offsets in the currently active set are marked in shades of pink (default), the candidate set is marked in shades of green (default) and the neighbor set is marked in shades of blue (default).

Depending on the defined energy limits of the sets, the darker color shade is defined per default to show limit shortfalls, the lighter color shade shows limit exceedance.

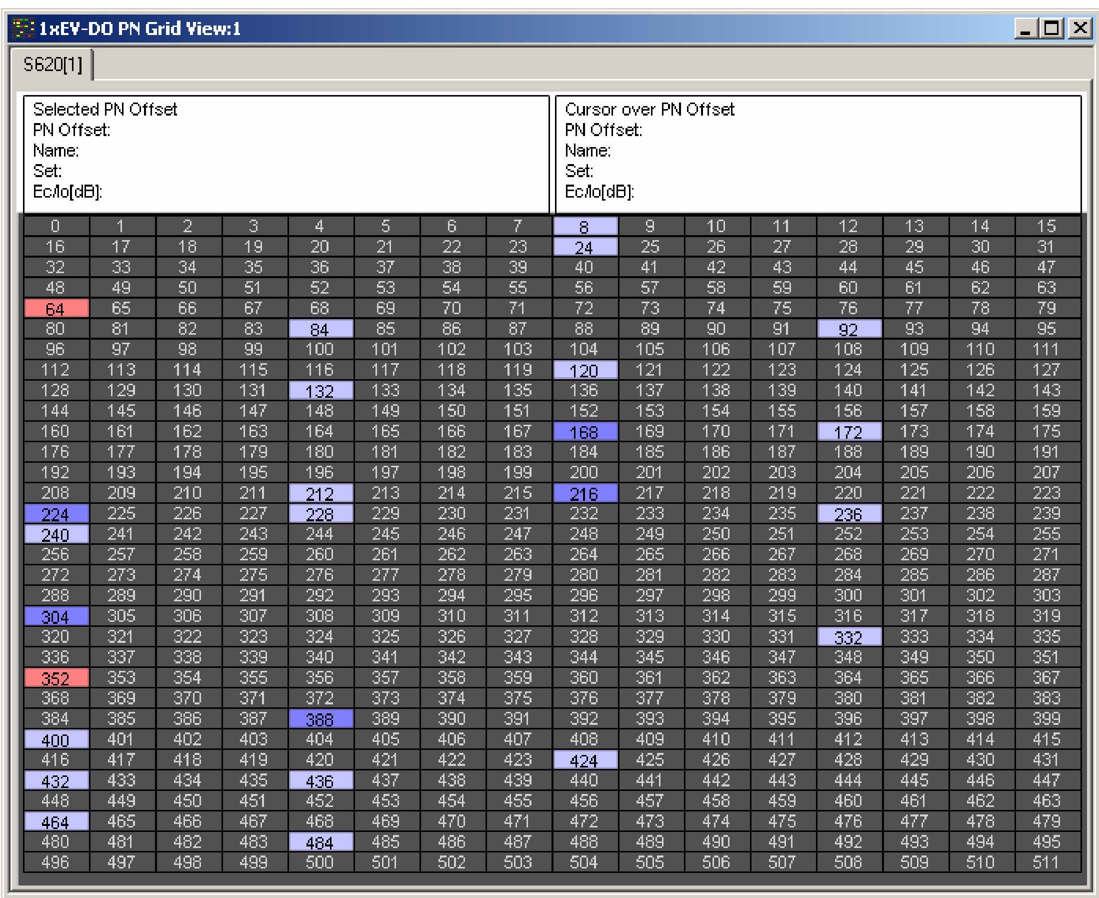


Fig. 4-101 1xEV-DO PN Grid View

Grid Header

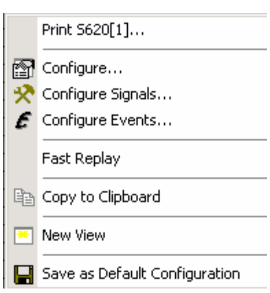
The header above the grid is divided into two halves, the first one displaying information of the currently selected PN offset grid element. Any grid element can be selected by clicking on it. The other half shows the corresponding information of the grid element over which the mouse cursor is currently hovering, which allows the direct comparison between any two PN offset grid elements.

PN Offset	The number of the current grid element is displayed.
Name	Here the name of the current grid element is displayed, if applicable. If no name is available, "---" is shown. In some cases, this field also displays auxiliary information, e.g. "No GPS" if this is the case during the measurement.
Set	The current set (active / candidate / neighbor) of the selected PN offset grid element is shown.
Ec/Io [dB]	The ratio of the average power of the forward channel to the total power comprised of signal plus interference, within the signal bandwidth. It is expressed in dB units.

PN Offset Grid

The PN Offsets from 0 to 511 are arranged as a grid with 16 elements in a row. With the corresponding grid cell background colors for active, candidate, and neighbor set energy limits it is quickly possible to see the related sets of the individual PN offsets.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

1xEV-DO PN Grid View Configuration

The *1xEV-DO PN Grid View* configuration menu sets the energy limits for the active, candidate, and neighbor sets for the PN offsets displayed in the PN grid view.

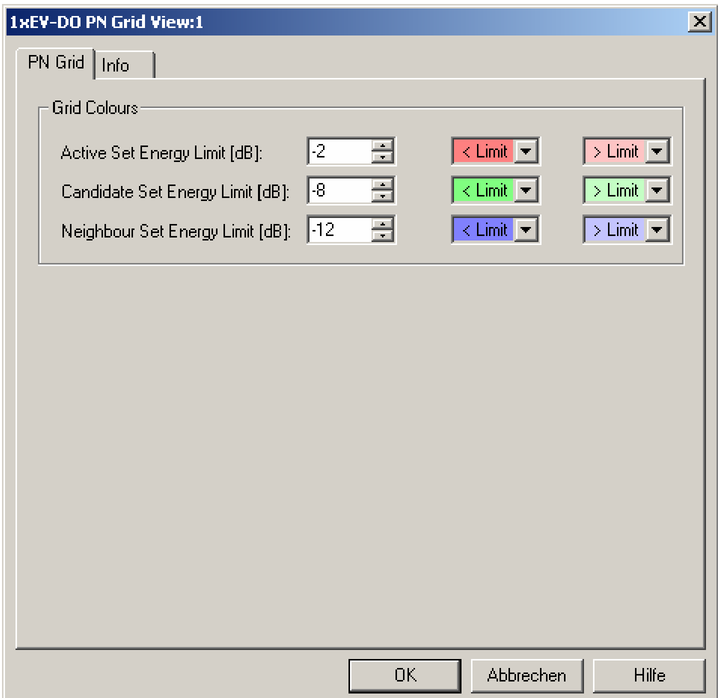


Fig. 4-102 1xEV-DO PN Grid View: Configuration

Grid Colors

The *Grid Colors* option fields define the energy limits and the corresponding background colors for the PN offsets of the cell sets in the grid view.

Active / Candidate / Neighbor Set Energy Limit [dB]

These list boxes allow the definition of the energy limits for the grid display of the active, candidate, and neighbor sets in a range from –20 to +20 dB. The default values are:

–2 dB for the Active Set,
–8 dB for the Candidate Set, and
–12 dB for the Neighbor Set.

< Limit

Opening this list box shows a color selection dialog, where a background color for the PN Offset grid elements can be selected. The grid cell will show the background color defined here when the measured active / candidate / neighbor set energy limit falls short of the defined value.

> Limit

Opening this list box shows a color selection dialog, where a background color for the PN Offset grid elements can be selected. The grid cell will show the background color defined here when the measured active / candidate / neighbor set energy limit exceeds the defined value.

1xEV-DO RLP Statistics View

The *1xEV-DO RLP Statistics View* displays important parameters describing the reverse link performance during the measurement.

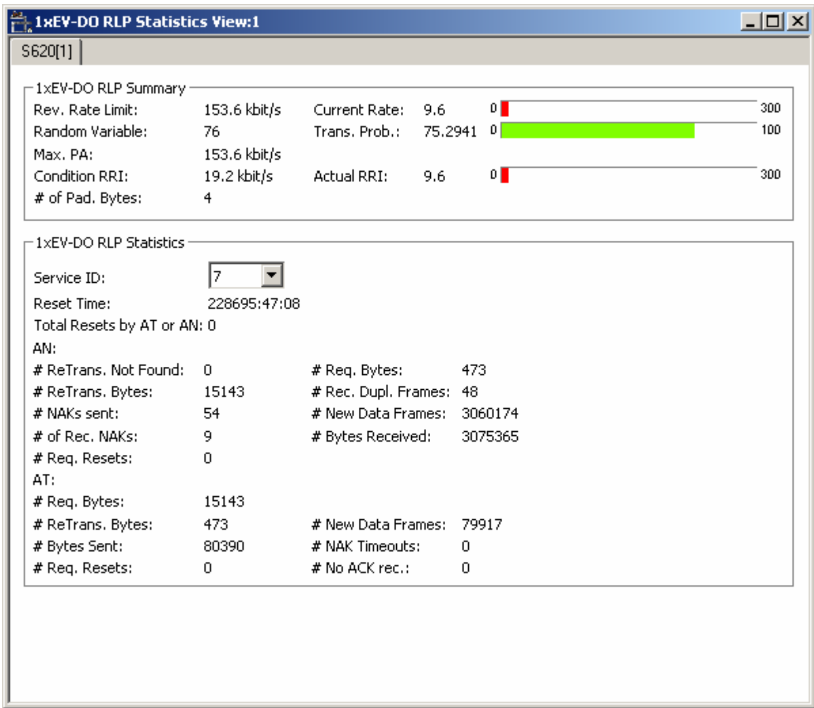


Fig. 4-103 1xEV-DO RLP Statistics View

1xEV-DO RLP Summary

The *1xEV-DO RLP Summary* panel displays several parameters describing the measured reverse link performance.

Rev. Rate Limit — The theoretically possible data rate for the reverse traffic channel is shown. Possible values are 9.6, 19.2, 38.4, 76.8, or 153.6 kbit/s

Current Rate — The measured data rate for the reverse traffic channel is displayed as an absolute value and as a bar graph showing the percentage relative to the *Rev. Rate Limit.*

Random Variable — Value of the random variable used to calculate the new reverse rate; it is multiplied by a factor of 255 to produce a value from 0 to 255

Trans. Prob. — Transition probability used to calculate the new reverse rate; it represents the probability that satisfies the condition specified in section 8.5.6.1.5.2 of standard IS-856.

Max. PA — The maximun PA headroom at which the AT is restricted to transmit (in kbit/s)

Condition RRI — The RRI channel is only active for 1/8 of a slot, which results in the *Condition RRI* of one eighth of the Reverse Rate Limit.

Actual RRI — The measured reverse traffic data rate from the Reverse Rate Indicator (RRI) channel that is used by the AT to indicate the data rate at which the reverse traffic channel is transmitted.

# of Pad. Bytes	Number of pad bytes included in the reverse link packets.

1xEV-DO RLP Statistics

The *1xEV-DO RLP Summary* panel displays the RLP Statistics measurement parameters and results. The RLP procedures and frame types are described in standard 3GPP2 C.S0017-0-2.10.

Service ID		Service identification number which identifies the RLP service
Reset Time		Time stamp when statistics were last reset to 0.
Total Resets by AT or AN		Sum of performed resets by AT and AN
AN:	*# ReTrans. Not Found*	Number of retransmitted frames not found
AN:	*# Req. Bytes*	Number of bytes requested by the AN for re-transmission
AN:	*# ReTrans Bytes*	Number of bytes transmitted.
AN:	*# Rec. Dupl. Frames*	Number of received duplicate frames
AN:	*# NAKs sent*	Number of NAK messages sent
AN:	*# New Data Frames*	Number of new data frames received
AN:	*# Req. NAKs*	Number of NAK bytes requested by the AT for re-transmission
AN:	*# Bytes Received*	Number of new data frames received
AN:	*# Req. Resets*	Number of times the reset was requested by the AN
AT:	*# Req. Bytes*	Number of bytes requested for retransmission from AN
AT:	*# ReTrans Bytes*	Number of transmitted retransmitted bytes
AT:	*# New Data Frames*	Number of new data frames received
AT:	*#Bytes Sent*	Total number of bytes transmitted
AT:	*# NAK Timeouts*	Nak timeouts or aborts
AT:	*# Req. Resets*	Number of resets requested by the AT
AT:	*# No ACK rec.*	Number of ACKs received from the AN

The *1xEV-DO RLP Statistics View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

CDMA Views

The *CDMA Views* show CDMA-specific information included in the measurement data of cdma2000 as well as CDMA (IS-95) mobiles. CDMA data can be acquired using one of the CDMA drivers described in chapter 6. Before a measurement is recorded, data acquisition for most views must be explicitly enabled in the *Define Measurement* tab of the CDMA configuration menu (for an overview see chapter 6).

Due to the different measurement data result sets returned by cdma2000 and CDMA (IS-95) mobiles, some fields of the described views may be empty.The CDMA views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *CDMA Views*.

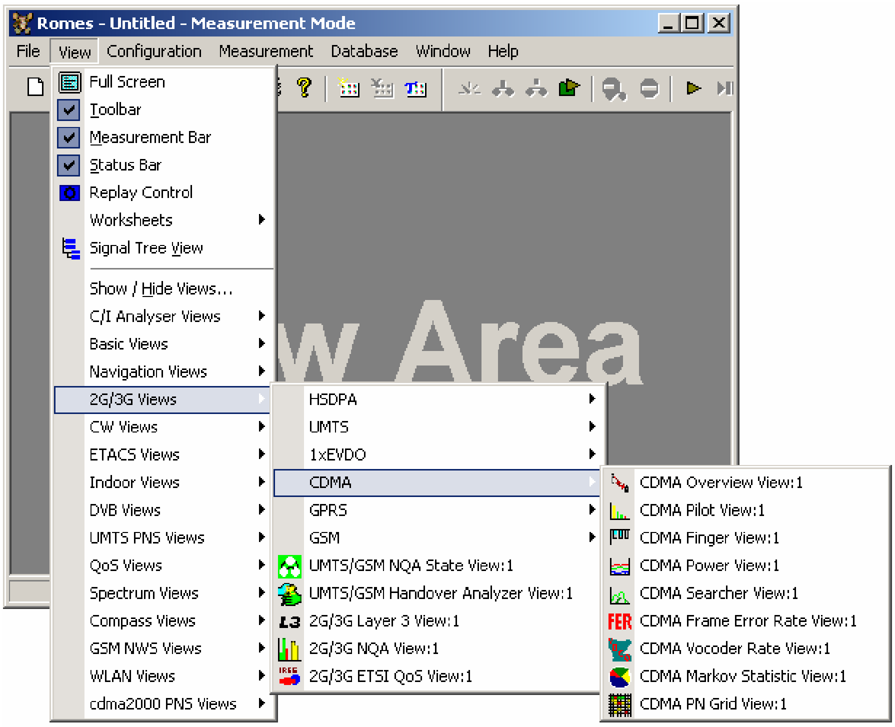


Fig. 4-104 CDMA views

Important Note on CDMA Measurements:
*The CDMA Test Mobile **Kyocera QCP3035A-B** is allowed only for use outside Europe.*
It is not allowed to put this mobile into operation inside Europe.

CDMA Overview View

The *CDMA Overview View* displays a summary of the test mobile state, power/quality, active set and system parameters, and, if applicable, results from a connected CDMA PN scanner.

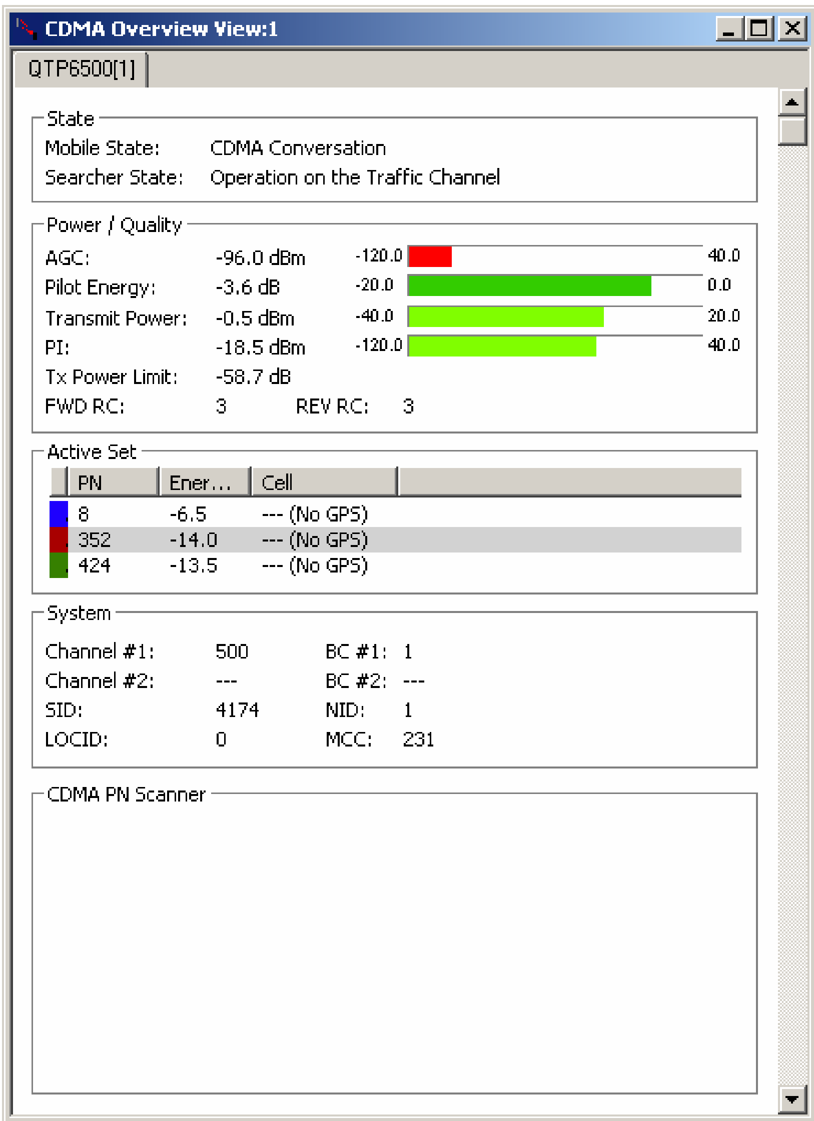


Fig. 4-105 CDMA Overview View

The *CDMA PN Scanner* field group is only filled if an actual scanner is configured and running.

State This field group contains the mobile state and the CDMA mobile searcher state.

Mobile State Possible CDMA of the mobile are:

0x81 – Initialization
0x82 – Idle
0x83 – Voice channel initialization
0x84 – Waiting for order
0x85 – Waiting for answer
0x86 – Conversation
0x87 – Release
0x88 – Update overhead information
0x89 – Mobile station origination attempt
0x8a – Page response
0x8b – Order/message response
0x8c – Registration access
0x8d – Message transmission
0x8E – Use subsystem cmd 75 (subsys 30, cmd_code 2) to obtain detailed state information 1xEV (HDR) states:
0x10 – Phone is offline
0x11 – Phone is offline HDR
0x12 – Phone is offline analog
0x13 – Reset ! 0x14 – Powerdown
0x15 – Powersave
0x16 – Powerup
0x17 – Low Power mode
0x18 – Dedicated System Measurement mode (searcher)
0x40 – 1xEV mode

Searcher State The state of the CDMA mobile searcher component which measures the relative strength of the different multipath components of the pilot signal as a function of their time offset. Possible searcher states are:

0 – Raw initialization state
1 – Deep sleep in start state
2 – Initial state for CDMA operation
3 – Acquisition of the pilot channel
4 – Reception of the sync channel
5 – Transition from sync to paging channel (slew)
6 – Operation on the paging channel
7 – Slotted mode sleep state
8 – Operation on the traffic channel
9 – Return from paging or traffic to sync channel (unslew)
10 – Operation in PCG state
11 – Powerup state

TIP *The mobile states correspond to the Phone Mode signal; see p. 4.13.*

Power / Quality The *Power/Quality* panel displays several parameters describing the signal power and quality reported by the test mobile (see standard 3GPP TS 25.225).

AGC	*Automatic Gain Control (range –120 to +40 dBm)*
Pilot Energy	Received pilot energy per chip (Ec, energy per modulating bit, range –20 to +0 dBm)
Transmit Power	CDMA transmit power during the call. (range –20 to +0 dBm)
PI	Problem Indicator
Tx Power Limit	Max. transmitted power of the mobile during the call.
FWD RC	Forward Radio Configuration
REV RC	Reverse Radio Configuration

The power results are obtained in an unbiased measurement, i.e. the contribution of the noise floor to the powers is subtracted.

Active Set The Active Set panel shows information of the PN Offsets which are currently in the active, candidate, or neighbor set of the test mobile.

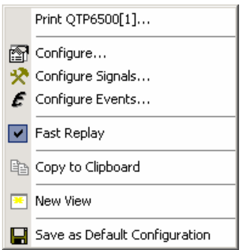
Pilot PN Offset Color Code	The coloring of the first row element is defined in the *Chart Settings* panel of the *CDMA Pilot View Configuration* described on p. 4.177. By default, the Active Set is marked orange, the Candidate Set is marked green, and the Neighbor Set is marked blue.
PN	Pilot PN Offset number (range 0 to 511)
Energy [dB]	Measured Pilot Energy in dB
Cell	Cell name, if applicable. The field also contains auxiliary information (e.g. "No GPS")**...**

System

Channel #1	First CDMA Channel
BC #1	Band Class of the first CDMA channel
Channel #2	Second CDMA Channel
BC #2	Band Class of the second CDMA channel
SID	System ID communicated to the mobile under test.
NID	16-bit Network Identification number communicated to the mobile under test.
LOCID	Location ID
MCC	Mobile Country Code

CDMA PN Scanner If a CDMA PN scanner is configured and running, this panel displays the Top Ns of the scanner as decribed for the *UMTS Layer 1 View* on p. 4.104.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, or save the current configuration; see *Context menu* description on p. 4.2.

CDMA Overview View Configuration

The *CDMA Overview View Configuration* menu defines the list information to be viewed. It is opened via a right mouse click on a point inside *CDMA Overview View* or via the *Configuration – Settings* command (see chapter 3).

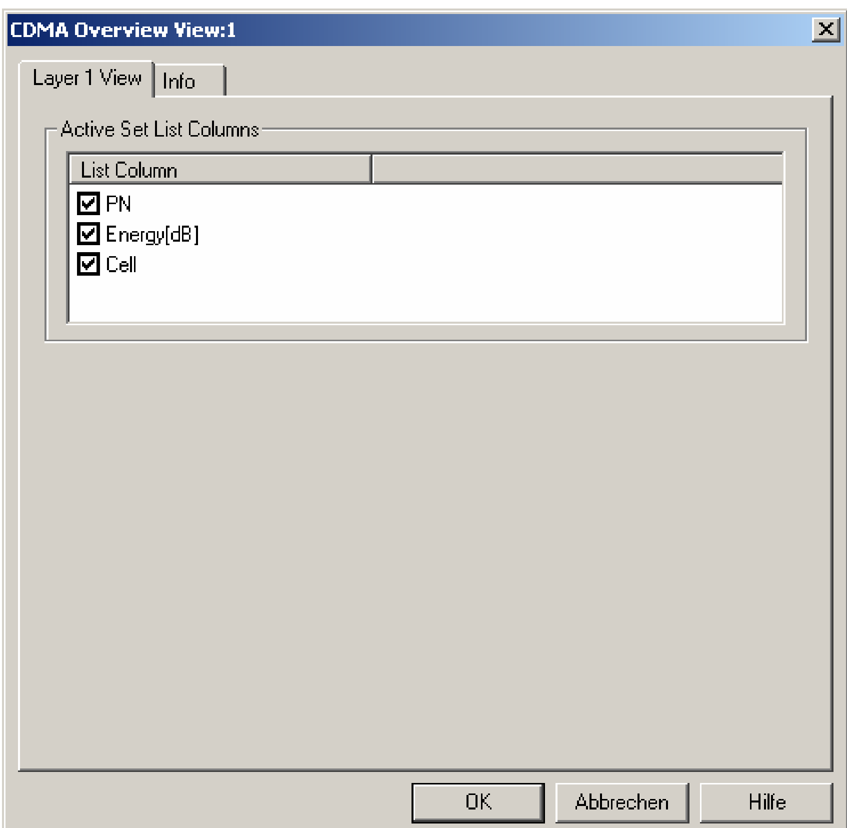


Fig. 4-106 CDMA Overview View: Layer 1 View Configuration

Active Set List Columns

The checkboxes select the view list elements to be displayed on the list panel:

PN	Pilot PN Offset number (range 0 to 511).
Energy [dB]	Measured Pilot Energy in dB
Cell	Cell name, if applicable. If no name is available, "---" is shown. In some cases, this field also displays auxiliary information, e.g. "No GPS" if this is the case during the measurement.

CDMA Pilot View

The *CDMA Pilot View* contains a list and a bar graph showing the pilot channel signal strength from the active and several neighbor base stations. The diagram is empty unless the *Pilot Sets* checkbox in the *Define Measurement* tab of the CDMA configuration menu is enabled.

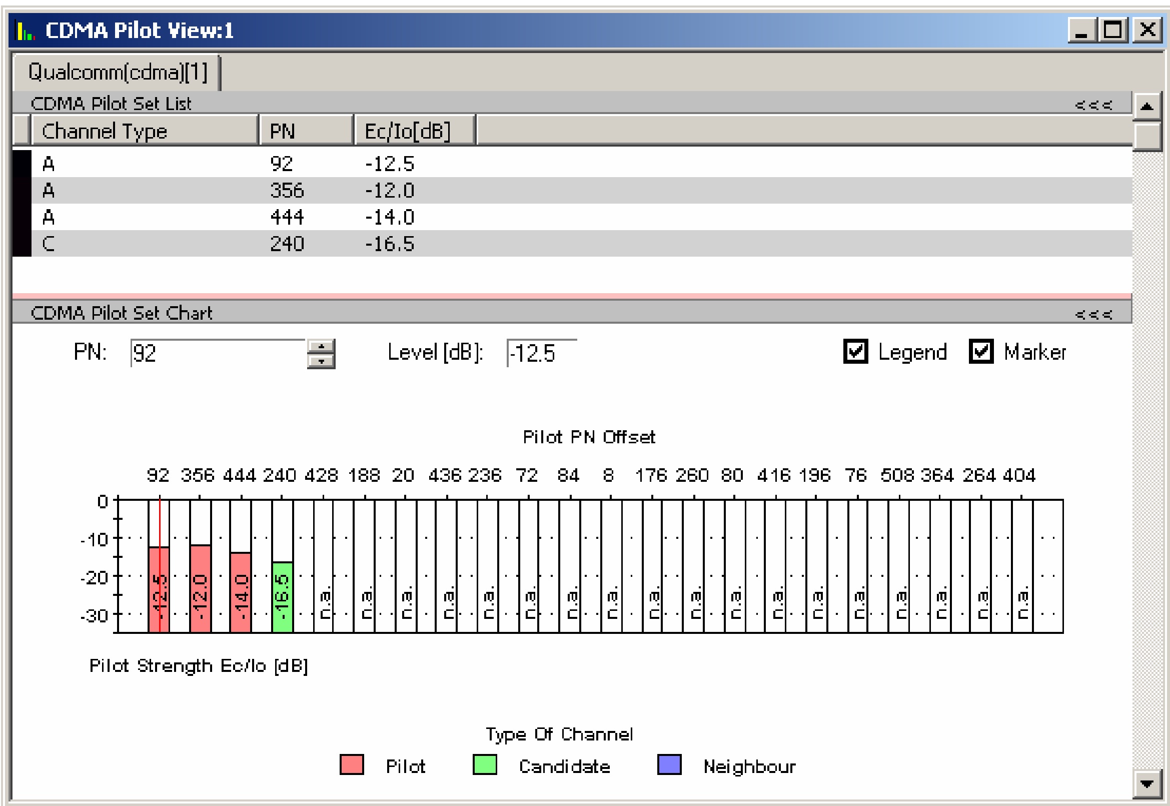


Fig. 4-107 CDMA Pilot View

CDMA Pilot Set List

The *CDMA Pilot Set List* panel displays several parameters of the current PN offset-related sets

Channel Type — The type of channel associated with the PN Offset (A = Active, C = Candidate, N = Neighbor)

PN — Pilot PN Offset number (range 0 to 511)

Ec/Io [dB] — The pilot energy is expressed as the ratio *Ec/Io* in dB where E_c denotes the energy density of the pilot signal, I_0 denotes the noise level.

The power results are obtained in an unbiased measurement.

CDMA Pilot Set Chart

The diagram is a bar graph showing the relative strength of a variable number of pilot, candidate and neighbor cell signals. The CDMA channel numbers of the signals are indicated above the bars. The channel strength is expressed as the ratio *Ec/Io* in dB where E_c denotes the chip energy of the pilot signal, I_0 denotes the noise level. The diagram has a fixed y-axis scale of –35 dB to –0 dB.

The update rate of the diagram and the number of signals displayed depend on the mobile station and its operating conditions.

Device

The pull-down list on the left side above the diagram shows all mobiles measured. The pilot strength of the selected mobile is shown in the diagram.

PN / Level [dB]

The fields to the right of the device list show the current pilot channel number and the corresponding relative level (strength) of the current signal. If a marker is switched on, it is placed to the current signal.

Marker

If the box is checked, a marker line is displayed in the diagram. The *PN* and the strength of the marked signal is indicated in the corresponding fields in the toolbar. The marker line can be shifted to the left and to the right by means of the cursor keys or by varying the channel number in the toolbar. Besides, a double click places the marker on a particular bar.

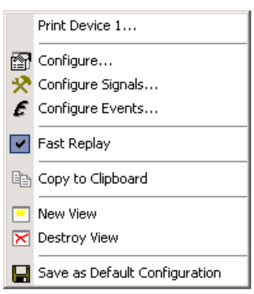
Legend

If the box is checked, a legend showing the different channel types and the associated colors is displayed below the diagram:

Pilot	Active pilot channel, available in the dedicated mode only (during a call)
Candidate	Channel considered as a possible future pilot channel
Neighbor	Neighbor cell channel

The number of *Pilots* and *Candidates* depends on the operating mode of the mobile station.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, or save the current configuration; see *Context menu* description on p. 4.2.

CDMA Pilot View Configuration

The *CDMA Pilot View Configuration* menu defines the list information to be viewed and the set colors for the pilot view chart. It is opened via a right mouse click on a point inside *CDMA Pilot View* or via the *Configuration – Settings* command (see chapter 3).

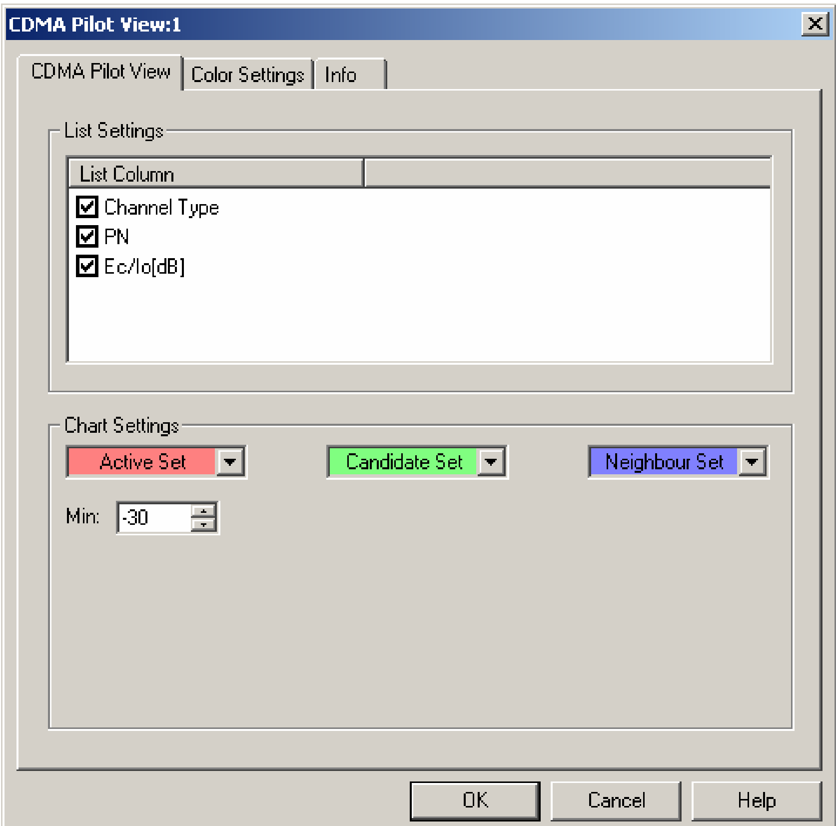


Fig. 4-108 CDMA Pilot View: Layer 1 View Configuration

List Settings

The *CDMA Pilot View List Settings* panel selects the channel-related list elements:

Channel Type	The type of channel associated with the PN Offset (A = Active, C = Candidate, N = Neighbor)
PN	Pilot PN Offset number (range 0 to 511)
Ec/Io [dB]	The channel strength is expressed as the ratio *Ec/Io* in dB where E_c denotes the energy density of the pilot signal, I_0 denotes the noise level.

The power results are obtained in an unbiased measurement.

Chart Settings

The colors distinguish the following sets:

Active Set / Candidate Set / Neighbor Set Opening this list box shows a color selection dialog, where a background color for the PN Offset grid elements can be selected. The grid cell will show the background color defined here when the measured active / candidate / neighbor set energy limit exceeds the defined value.

Min. Least value of channel strength Ec/Io (dB)

The list box backgrounds for the sets display the currently active color selection.

The *Color Settings* tab sets the color scale for the PN Offsets 0 to 511.

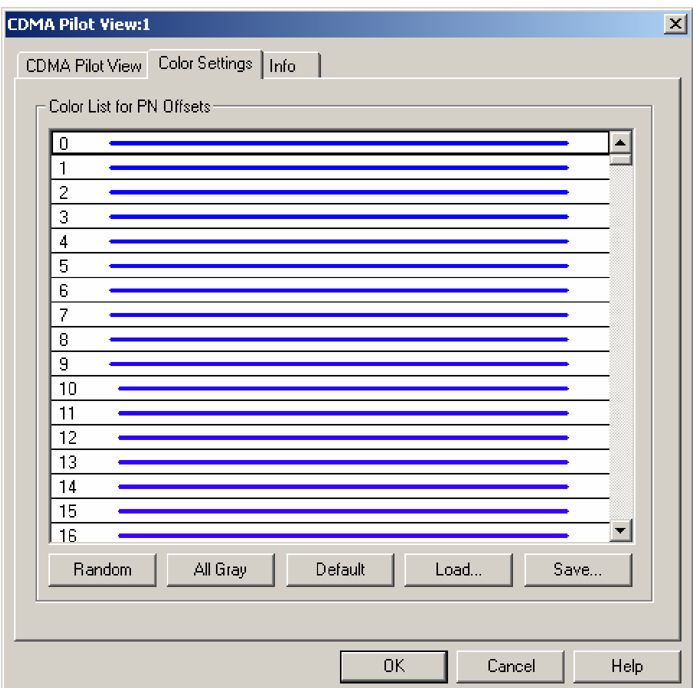


Fig. 4-109 CDMA Pilot View Configuration: Color Settings

The colors are displayed in the diagram (power peaks) and in the first table row (current set of the PN Offset). A double-click on a line in the *Color List* opens the *Colors* dialog (see p. 4.322) to change the current display color.

Random No ordering; colors are assigned to the scrambling codes at random.

All Gray Color scale suppressed; all colors are gray. This option is suitable e.g. to distinguish a single scrambling code (or a small number of scrambling codes), colored different, from all other codes, colored gray.

Default Predefined color scale: Colors change continuously as the scrambling codes increase.

Load/Save A color scale can be loaded from an SC color file (*.scc) and user-defined color scales can be stored to *.scc files to be reused in a later session.

CDMA Finger View

The *CDMA Finger View* shows the finger info, i.e. the relative strength of the different multipath components of the pilot signal detected by the RAKE receiver of the CDMA mobile. The diagram is empty unless the *Finger info* checkbox in the *Define Measurement* tab of the CDMA configuration menu is enabled.

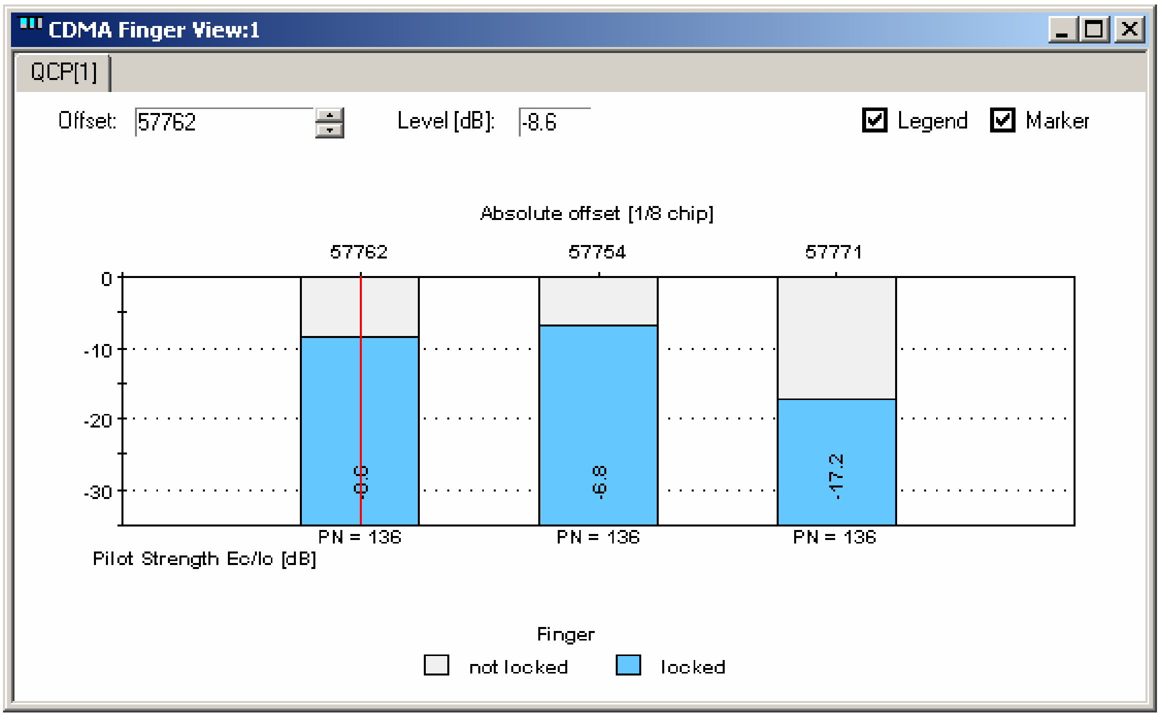


Fig. 4-110 CDMA Finger View

Diagram The diagram is a bar graph showing the relative strength of the multipath components the number of which is given by the fingers of the mobile station RAKE receiver. The signals are detected with different time offsets that are indicated above the bars as an absolute multiple of 1/8 chip periods. The pilot channel number for the signals is displayed below the x-axis. The channel strength is expressed as the ratio *Ec/Io* in dB where E_c denotes the energy density of the pilot signal, I_0 denotes the noise level. The diagram has a fixed y-axis scale of –35 dB to –0 dB. The update rate of the diagram depends on the mobile.

Offset / Level [dB] The fields to the right of the device list show the current time offset and the corresponding strength of the current signal. If a marker is switched on, it is placed to the current signal.

Marker If the box is checked, a marker line is displayed in the diagram. The time offset and the strength of the marked signal is indicated in the corresponding fields. The marker line can be shifted to the left and to the right by means of the cursor keys or by varying the *Offset* in the toolbar. Besides, a double-click places the marker on a particular bar.

Legend If the box is checked, a legend showing the colors denoting locked and unlocked fingers is displayed below the diagram. A locked finger means that a distinct multipath component could be unambiguously detected.

The *CDMA Finger View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

CDMA Power View

The *CDMA Power View* shows the (relative) TX and RX power at the CDMA mobile and related power levels as a function of time. The diagram is empty unless the *Sparse ACP power control* checkbox in the *Define Measurement* tab of the CDMA configuration menu is enabled.

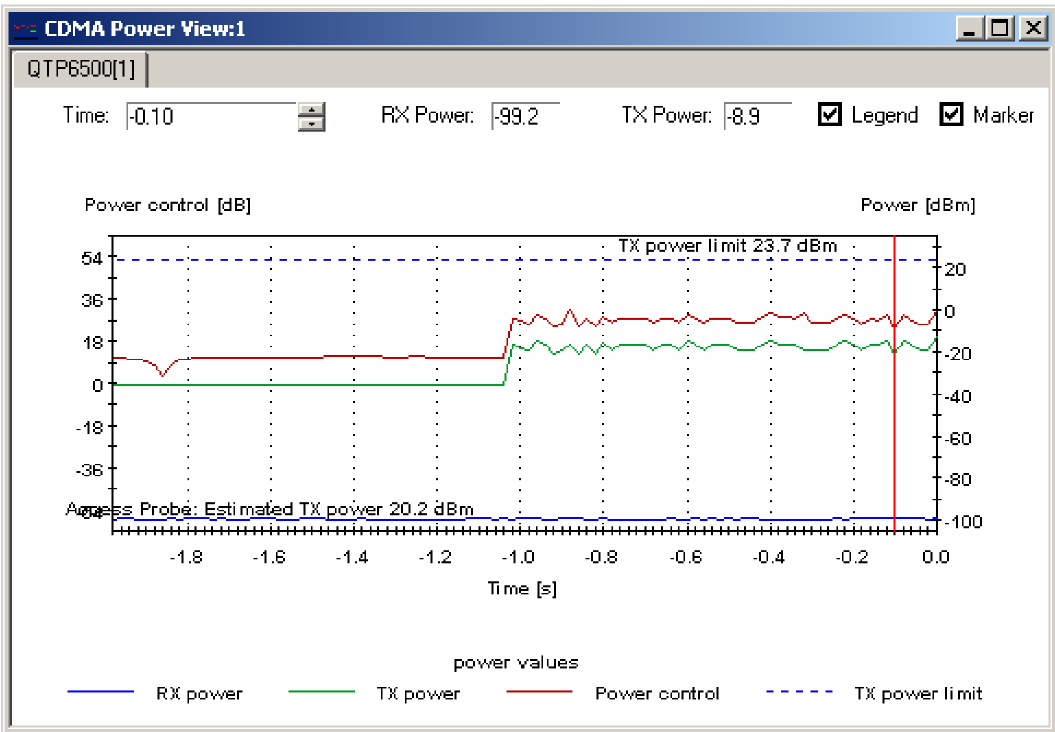


Fig. 4-111 CDMA Power View

Diagram

The diagram shows three traces, representing the evolution in time of three different quantities:

RX power	Absolute received power at the CDMA mobile (in dBm)
TX power	Absolute output power of the CDMA mobile (in dBm)
Power control	Information on the dynamic power control of the CDMA mobile (in dB; accumulated power control bits). If power control works correctly, the shape of the power control curve is similar to the TX power curve.

In addition, the diagram shows the (absolute) maximum output power that the mobile is allowed to transmit under its current operating conditions (closed loop power control, *TX power limit)* and the allowed output power that the mobile estiates from its RX power (open loop control, *Access Probe: Estimated TX power;* this quantity is available only if the *Access probe info* box in the *Define Measurement* tab of the CDMA configuration menu is checked).

The time display range is –2 s to 0 s. The update rate of the diagram depends on the mobile.

Time / RX Power / TX Power

The fields below the tab of the diagram show the current x-axis value (time) and the current RX and TX power of the mobile. If a marker is switched on, it is placed to the current x-axis value.

Marker If the box is checked, a marker line is displayed in the diagram. The time and the mobile RX and TX power at the marker position are indicated in the corresponding fields. The marker line can be shifted to the left and to the right by means of the cursor keys or by incrementing/decrementing the value in the *Time* field. Besides a double click places the marker to the desired position.

Legend If the box is checked, a legend showing the indicated powers together with the line colors is displayed below the diagram:

The *CDMA Power View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

CDMA Searcher View

The *CDMA Searcher View* shows the CDMA mobile searcher information, i.e. the relative strength of the different multipath components of the pilot signal as a function of their time offset. The diagram is empty unless the *Searcher info* checkbox in the *Define Measurement* tab of the CDMA configuration menu is enabled.

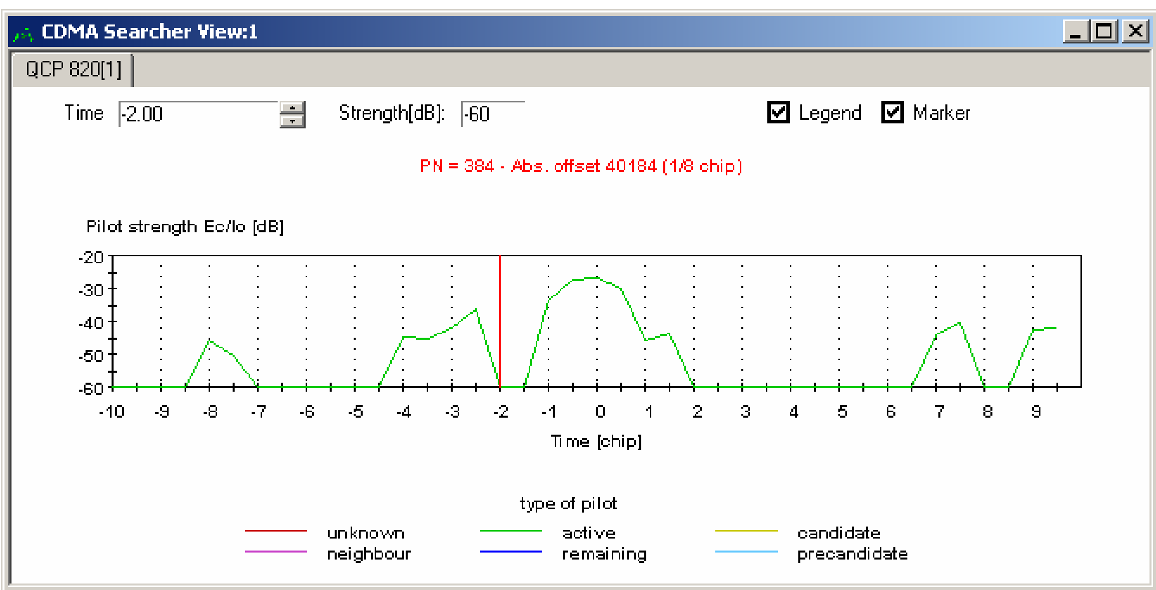


Fig. 4-112 CDMA Searcher View

Diagram The diagram shows the strength of the different components of the pilot signal as a function of their time offset. The time offset is expressed in units of chip periods; its display range depends on the mobile. The center of the x-axis (Time (chip) = 0) corresponds to the strongest component (maximum signal power). The pilot strength is expressed as the ratio *Ec/Io* in dB where E_c denotes the energy density of the pilot signal, I_0 denotes the noise level. The diagram has a fixed y-axis scale of –60 dB to –20 dB. The update rate of the diagram depends on the mobile.

Diagram header The current pilot number *(PN)* and the corresponding absolute offset time are indicated in the diagram header. *Not referenced !* after the *PN* means that the timing information, which is equivalent to the PN, is questionable.

Time / FER The fields below the diagram tab show the current x-axis value (time) and the current pilot strength rate. If a marker is switched on, it is placed to the current x-axis value.

Marker If the box is checked, a marker line is displayed in the diagram. The time and the frame error rate at the marker position are indicated in the corresponding fields in the toolbar. The marker line can be shifted to the left and to the right by means of the cursor keys or by incrementing/decrementing the value in the *Time* field. Besides a double click places the marker to the desired position.

Legend If the box is checked, a legend showing the different possible types of pilot channels together with the line colors is displayed below the diagram:

unknown
Not identified

active
Pilot channel of a current serving cell

(pre)candidate
Channel considered as a possible future pilot

neighbor
Neighbor cell channel

remaining
Channel fits in none of the previous categories.

The *CDMA Searcher View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

CDMA Frame Error Rate View

The *CDMA Frame Error Rate View* shows the frame error rate, i.e. the percentage of erroneous CDMA frames detected and reported by the CDMA mobile station. The diagram is empty unless the *Temporal Analyzer* checkbox in the *Define Measurement* tab of the CDMA configuration menu is enabled.

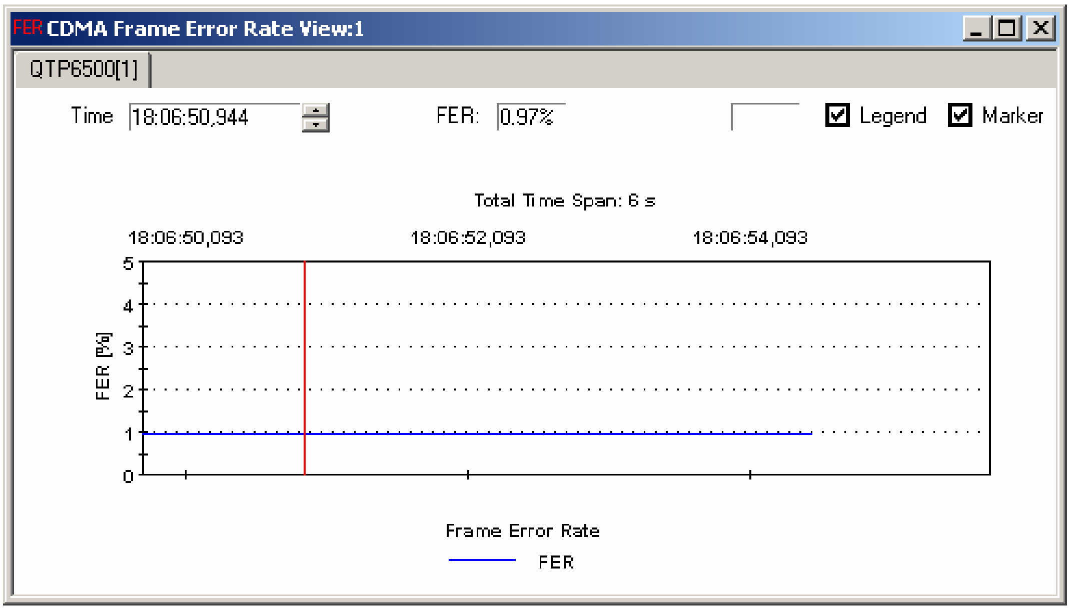


Fig. 4-113 CDMA Frame Error Rate View

Diagram

The diagram shows the CDMA frame error rate as a function of time. The time information stored in the measurement file provides the x-axis scaling. The total time span of the diagram (i.e. the x-axis display range) can be changed in the configuration menu; see below.

The curves are plotted from the left to the right at the pace of the measurement or replay. If the end of the display range is reached while the measurement or replay is still going on, the whole diagram is shifted to the left by one full time span so the curves can be continued. This may occur repeatedly until the end of the measurement (file) is reached.

Time / FER

The fields above the diagram show the current x-axis value (time) and the current frame error rate. If a marker is switched on, it is placed to the current x-axis value.

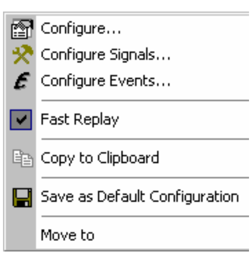
Marker

If the box is checked, a marker line is displayed in the diagram. The time and the frame error rate at the marker position are indicated in the corresponding fields in the toolbar. The marker line can be shifted to the left and to the right by means of the cursor keys or by incrementing/decrementing the value in the *Time* field. Besides a double click places the marker to the desired position.

Legend

If the box is checked, a legend showing the two displayed curves together with the line colors is displayed below the diagram.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu is analogous to *the CDMA Vocoder Rate View Configuration* menu described on page 4.185.

CDMA Vocoder Rate View

The *CDMA Vocoder Rate View* shows the data rate (full rate, ½ rate, ¼ rate, or $^1/_8$ rate) generated and received by the voice coders (vocoders) of the CDMA mobile station vs. time. The diagram is empty unless the *Temporal Analyzer* checkbox in the *Define Measurement* tab of the CDMA configuration menu is enabled.

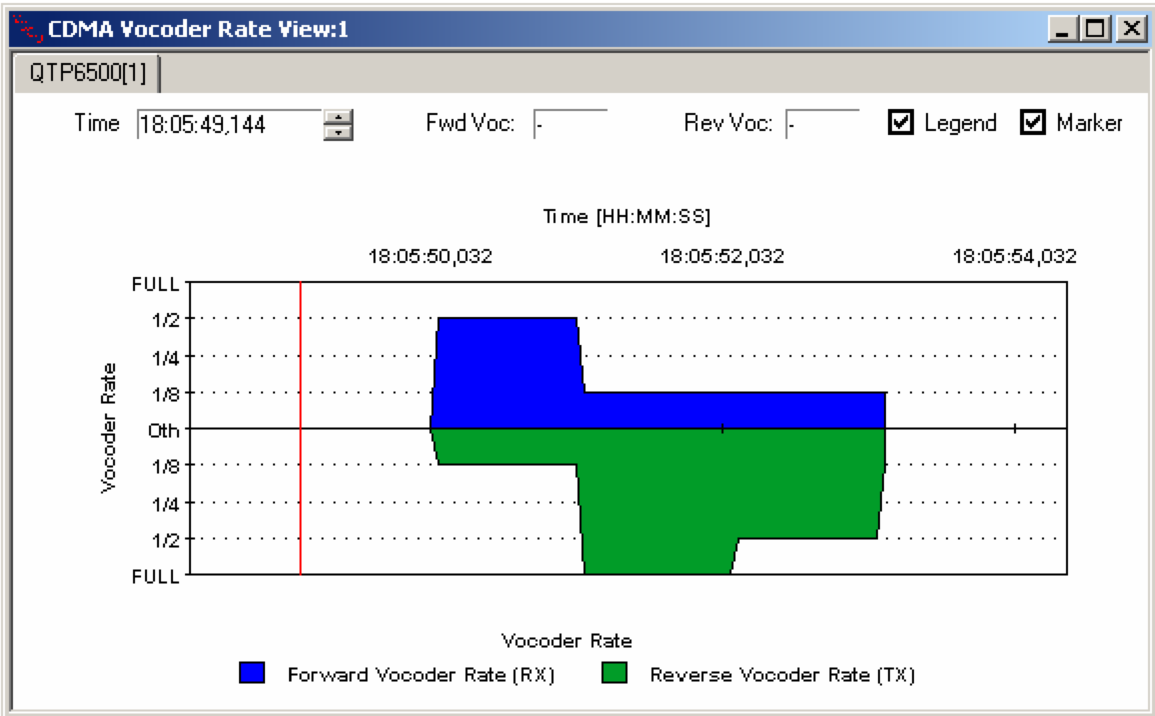


Fig. 4-114 CDMA Vocoder Rate View

Diagram

The diagram is split into an upper and a lower part, showing the vocoder rate in the forward channel (mobile station receiver) and in the reverse channel (mobile station transmitter), respectively. The time information stored in the measurement file provides the x-axis scaling. The total time span of the diagram (i.e. the x-axis scale) can be changed in the configuration menu; see below. While the vocoders encode/decode a particular channel (full rate, ½ rate, ¼ rate, or $^1/_8$ rate), the curves are at the corresponding level. Level 0^{th} (or no curve) denotes that the vocoder is not active.

The curves are plotted from the left to the right at the pace of the measurement or replay. If the end of the display range is reached while the measurement or replay is still going on, the whole diagram is shifted to the left by one full time span so the curves can be continued. This may occur repeatedly until the end of the measurement (file) is reached.

Time / Fwd Voc / Rev Voc

The fields below the diagram tab show the current x-axis value (time) and the current forward and reverse vocoder rates. If a marker is switched on, it is placed to the current x-axis value.

Marker

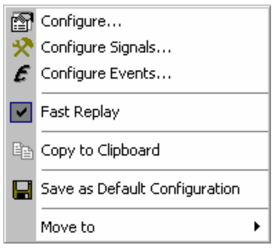
If the box is checked, a marker line is displayed in the diagram. The time and the two vocoder rates at the marker position are indicated in the corresponding fields in the toolbar. The marker line can be shifted to the left and to the right by means of the cursor keys or by incrementing/decrementing the value in the *Time* field. Besides a double click places the marker to the desired position.

Legend

If the box is checked, a legend showing the two displayed curves together with the line colors is displayed below the diagram.

Context menu

A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.



CDMA Vocoder Rate View Configuration

The *CDMA Vocoder Rate View* configuration menu defines the timespan of the diagram and shows information on the current view version. It is opened via a right mouse click on a point inside the *CDMA Vocoder Rate View* or via the *Configuration – Settings* command (see chapter 3).

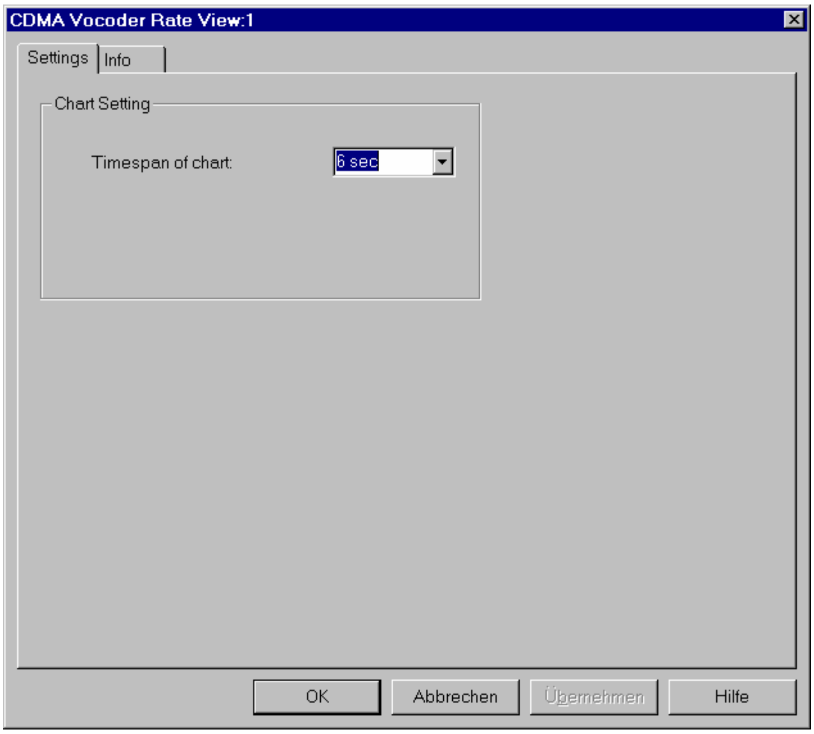


Fig. 4-115 CDMA Vocoder Rate View configuration

Timespan of chart

The *Timespan ...* input field defines the total time span of the *Vocoder Rate View*, i.e. the time interval corresponding to the full diagram width. Either 6 s or 1 minute can be selected from the pull-down list.

CDMA Markov Statistic View

The *CDMA Markov Statistic View* displays a statistical evaluation of the call provided by the mobile. The diagram is empty unless an appropriate *Service Option* is set in the *Define Measurement* tab of the CDMA configuration menu; see chapter 6.

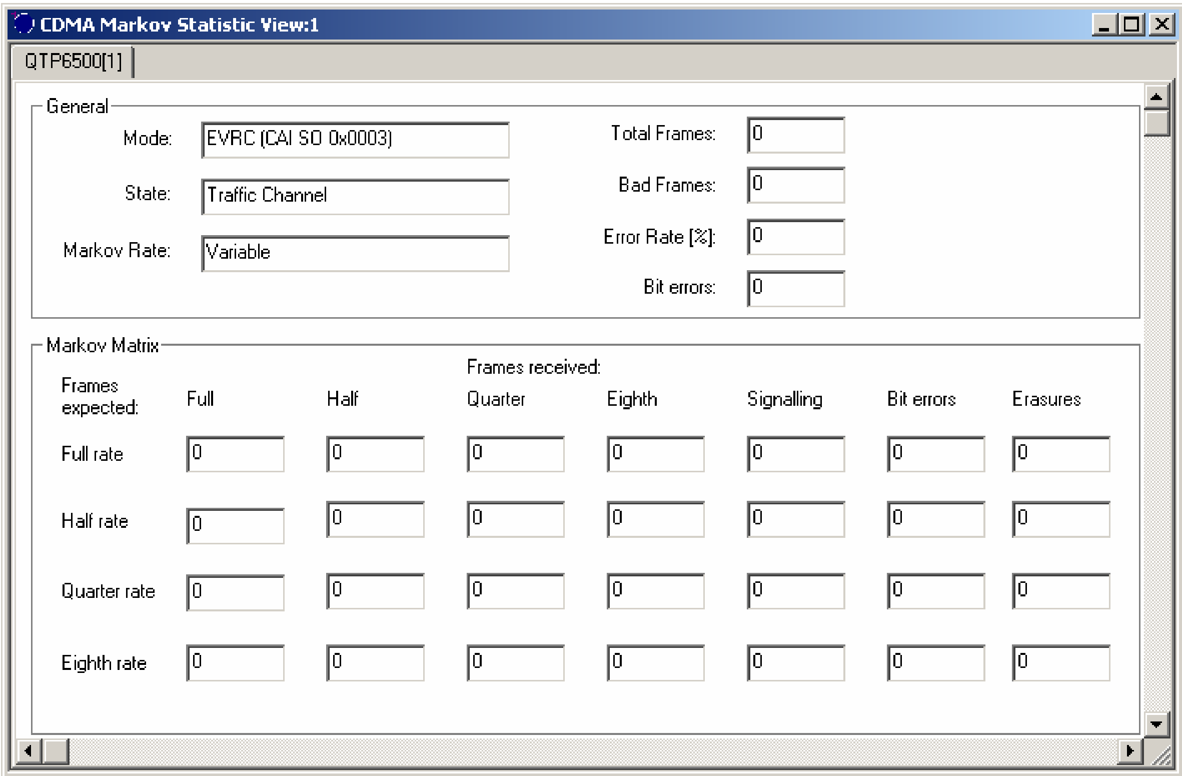


Fig. 4-116 CDMA Markov Statistic View

General

The *General* output fields indicate the following information describing the Markov statistics evaluation:

Mode	RX software mode (service option)
State	Receive task state
Markov Rate	Rate for Markov processing
Total Frames	Total number of Markov frames
Bad Frames	Total number of bad frames (erasures and full rate with bit errors)
Error Rate [%]	Percentage of wrong bits
Bit errors	Total number of bit errors

The *CDMA Markov Statistic View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

CDMA PN Grid View

The *CDMA PN Grid View* shows the forward channel PN offsets 0 to 511 as a matrix with 16 offsets in a row. Within this grid, the PN offsets in the currently active set are marked in shades of pink (default), the candidate set is marked in shades of green (default) and the neighbor set is marked in shades of blue (default).

Depending on the defined energy limits of the sets, the darker color shade is defined per default to show limit shortfalls, the lighter color shade shows limit exceedance.

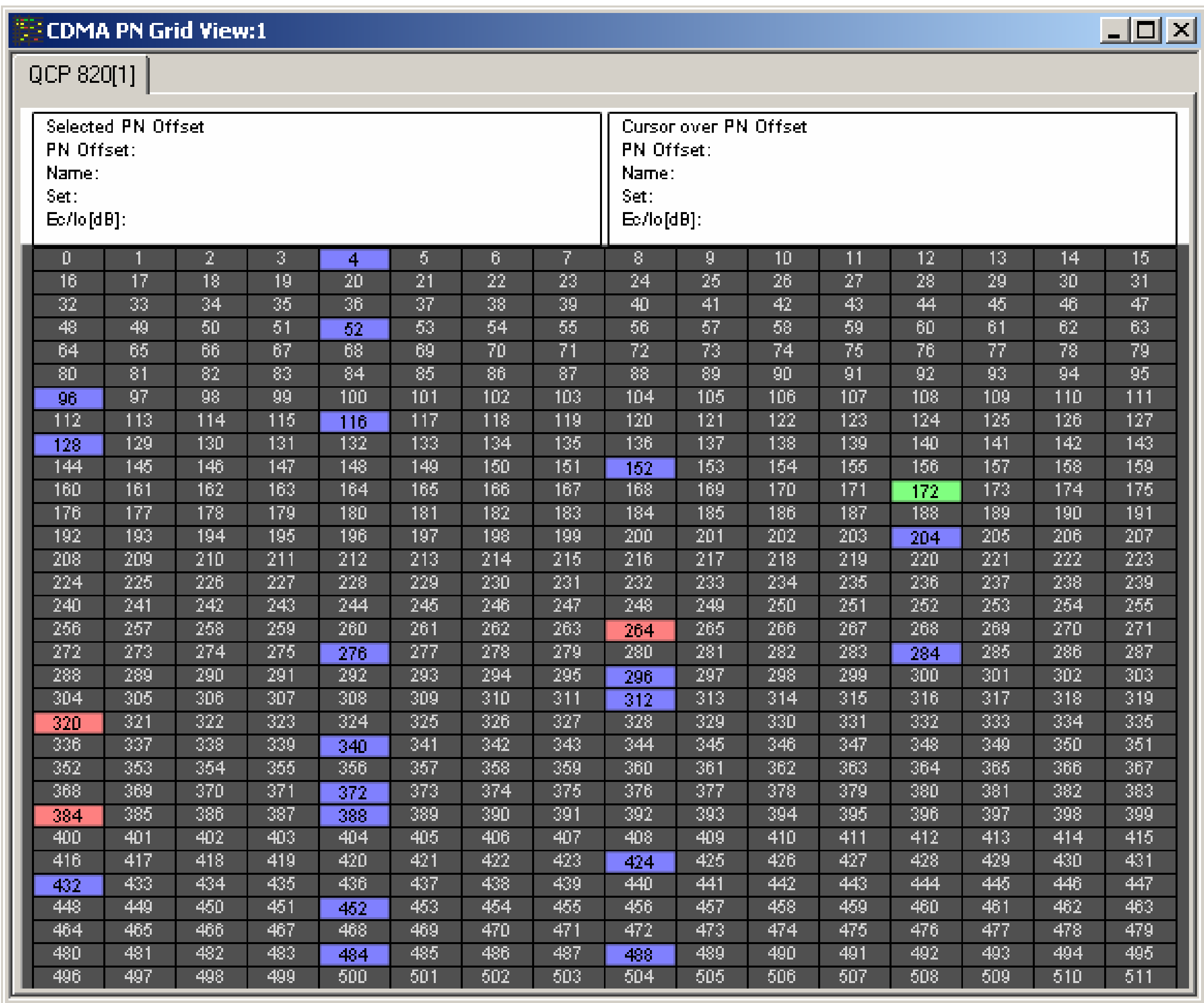


Fig. 4-117 CDMA PN Grid View

Grid Header

The header above the grid is divided into two halves, the first one displaying information of the currently selected PN offset grid element. Any grid element can be selected by clicking on it. The other half shows the corresponding information of the grid element over which the mouse cursor is currently hovering, which allows the direct comparison between any two PN offset grid elements.

PN Offset The number of the current grid element is displayed.

Name Here the name of the current grid element is displayed, if applicable. If no name is available, "---" is shown. In some cases, this field also displays auxiliary information, e.g. "No GPS" if this is the case during the measurement.

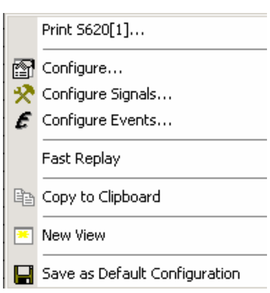
Set The current set (active / candidate / neighbor) of the selected PN offset grid element is shown.

Ec/Io [dB] The ratio of the average power of the forward channel to the total power comprised of signal plus interference, within the signal bandwidth. It is expressed in dB units.

PN Offset Grid

The PN Offsets from 0 to 511 are arranged as a grid with 16 elements in a row. With the corresponding grid cell background colors for active, candidate, and neighbor set energy limits it is quickly possible to see the related sets of the individual PN offsets.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

CDMA PN Grid View Configuration

The *CDMA PN Grid View* configuration menu sets the energy limits for the active, candidate, and neighbor sets for the PN offsets displayed in the PN grid view.

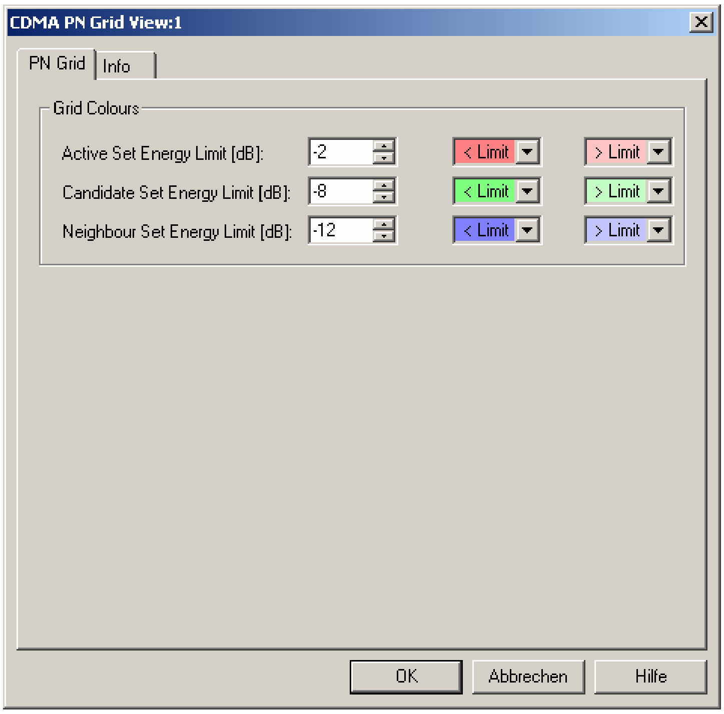


Fig. 4-118 CDMA PN Grid View: Configuration

Grid Colors

The *Grid Colors* option fields define the energy limits and the corresponding background colors for the PN offsets of the cell sets in the grid view.

Active / Candidate / Neighbor Set Energy Limit [dB]

These list boxes allow the definition of the energy limits for the grid display of the active, candidate, and neighbor sets in a range from –20 to +20 dB. The default values are:

–2 dB for the Active Set,
–8 dB for the Candidate Set, and
–12 dB for the Neighbor Set.

< Limit

Opening this list box shows a color selection dialog, where a background color for the PN Offset grid elements can be selected. The grid cell will show the background color defined here when the measured active / candidate / neighbor set energy limit falls short of the defined value.

> Limit

Opening this list box shows a color selection dialog, where a background color for the PN Offset grid elements can be selected. The grid cell will show the background color defined here when the measured active / candidate / neighbor set energy limit exceeds the defined value.

GPRS Views

The *GPRS Views* display parameters of the operating state of GPRS-supporting mobile phones, related parameters contained in the layer messages, Packet Data Protocol (PDP) parameters, Radio Link Control/Medium Access Control parameters, a statistical evaluation of the number of timeslots (TS) that are active in the connection, exchanged RLC/MAC block header information, control and physical parameters of a GPRS/EGPRS connection, and the RLC or MAC Release indicators,

The GPRS views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *GPRS Views*.

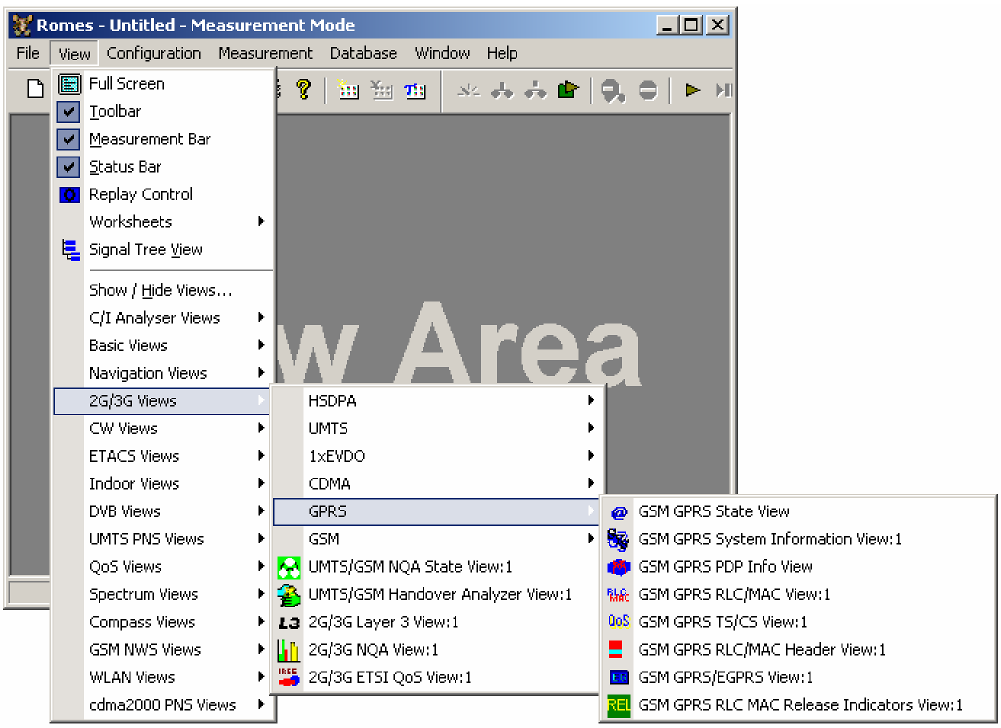


Fig. 4-119 GPRS views

Mobiles to provide GPRS Parameters

The GPRS views described in this section require corresponding mobiles. The following test mobiles are known to provide GPRS parameters (but no EGPRS parameters):

- SAGEM (OT 96-M GPRS, OT190 GPRS, OT 290 GPRS) and Siemens (S55, S55-R) mobiles must be used in *Data/Trace* mode and the splitter box must be connected to provide two COM ports (see chapter 6).
- Nokia test mobiles (Nokia 6230/6500/6630/6650/7600), Qualcomm test mobiles (TM6200/6250/6275), and Qualcomm-compatible test mobiles such as Samsung Z105, Z107, Z130 are connected via USB interface.

GSM GPRS State View

The *GSM GPRS State View* displays parameters characterizing the operating state of mobile phones supporting GPRS. The parameters are shown for all mobiles that are used in the current measurement or recorded in the replayed measurement file.

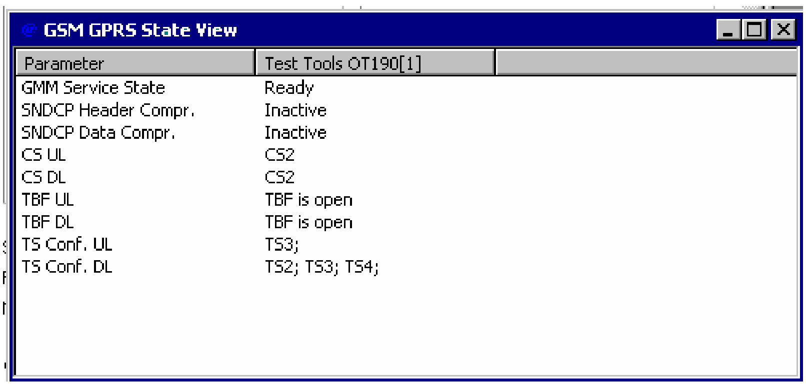


Fig. 4-120 GSM GPRS State View

For each mobile, the state parameters are arranged in a table with 2 columns. The width of the columns can be varied with a drag-and-drop mechanism in the header of the table. Part of the information is also displayed in the *GSM GPRS RLC/MAC View;* see p. 4.194.

GMM Service State GPRS Mobility Management service state: *Ready, Idle* or *Stand-by*.

SNDCP Header Compr. Compression information from the Subnetwork Dependent Convergence Protocol: Header compression *Used* or *Not used*.

SNDCP Data Compr. Compression information from the Subnetwork Dependent Convergence Protocol. Data compression *Used* or *Not used.*

CS UL / CS DL Channel coding scheme (CS1 to CS4) used in uplink (UL) and downlink (DL) direction.

TBF UL / TBF DL Status of the Temporary Block Flow (TBF) in uplink (UL) and downlink (DL) direction: open (during data transfer) or closed.

TS Conf. UL / DL Timeslot configuration in uplink (UL) and downlink (DL) direction.

The *GSM GPRS State View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

GSM GPRS System Information View

The *GSM GPRS System Information View* displays a selection of GPRS-related parameters contained in the layer 3 messages *System Information Type 1* to *System Information Type 13*. The parameters are shown for all mobiles that are used in the current measurement or recorded in the replayed measurement file.

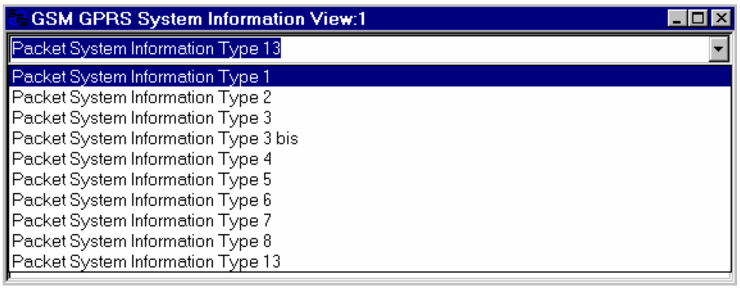
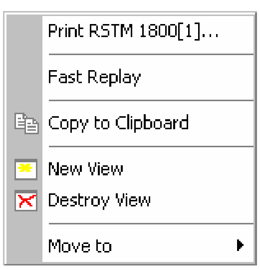


Fig. 4-121 GSM GPRS System Information View

The system information for each mobile is displayed in a separate column. Moreover, the system information type can be selected in a pull-down list.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *GSM GPRS System Information View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

GSM GPRS PDP Info View

The *GSM GPRS PDP Info View* displays important Packet Data Protocol (PDP) parameters of mobile phones supporting GPRS. The parameters are shown for all mobiles that are used in the current measurement or recorded in the replayed measurement file.

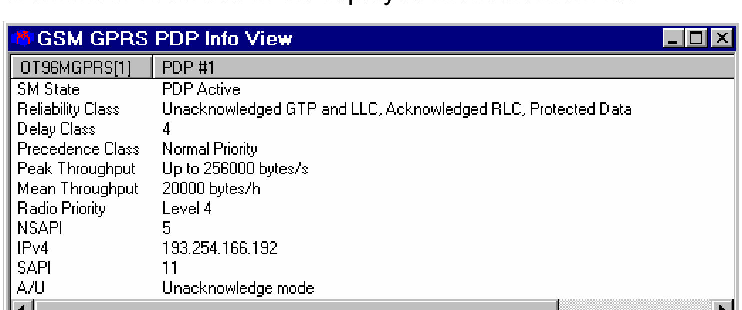


Fig. 4-122 GSM GPRS PDP Info View

For each mobile, the PDP parameters are arranged in a table with 2 columns. The width of the columns can be varied with a drag-and-drop mechanism in the header of the table.

SM State One of the four values PDP Active, PDP Active Pending, PDP Inactive, PDP Inactive Pending. If SM State = PDP Inactive or PDP Active Pending, then some of the other parameters of the view are invalid.

The following five parameters indicate the Quality of Service (QoS) of the PDP:

Reliability Class The reliability class indicates the probability of loss, duplication, mis-sequencing or corruption of Service Data Units (SDU). This translates into the transmission characteristics that are required by an application. The reliability classes are as specified in GSM 04.08:

Acknowledged GTP, LLC, and RLC, Protected data

Unacknowledged GTP, Acknowledged LLC and RLC, Protected data

Unacknowledged GTP and LLC, Acknowledged RLC, Protected data

Unacknowledged GTP, LLC and RLC, Protected data

Unacknowledged GTP, LLC and RLC, Unprotected data

Delay Class Defines the maximum delay to be incurred by the transfer of data through the GPRS network. Four delay classes 1 (smallest delay) to 4 (largest delay; maximum delay not specified) are defined.

Precedence Class Indicates the relative priority of maintaining the service. The following three precedence classes are defined:

High Priority
Service commitments will be maintained ahead of all other priority levels.

Normal Priority
Service commitments will be maintained ahead of low priority users.

Low Priority
Service commitments will be maintained after the high and normal priority commitment have been fulfilled.

Peak Throughput Maximum user data throughput (bit rate) requested by the user.

Mean Throughput Mean user data throughput (bit rate) requested by the user, including periods in which no data is transmitted.

Radio Priority Radio priority of the requested TBF; one of the levels between *Level 1* (highest priority) and *Level 4* (lowest priority, corresponding to the highest throughput).

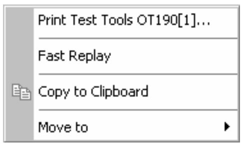
NSAPI Network layer Service Access Point Identifier; integer number that, together with the Temporary Logical Link Identity (TLLI), is used for network layer routing.

IPv4 Internet Protocol address according to the IETF convention.

SAPI Network Service Access Point Identifier. An integer value in the range [0; 15], identifying a PDP context belonging to a specific MM Context ID.

A/U *Acknowledge mode* or *Unacknowledge mode*.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see *Context menu* description on p. 4.2.

The *GSM GPRS PDP Info View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

GSM GPRS RLC/MAC View

The *GSM GPRS RLC/MAC View* displays important Radio Link Control/Medium Access Control parameters of mobile phones supporting GPRS. The parameters are shown for all mobiles that are used in the current measurement or recorded in the replayed measurement file.

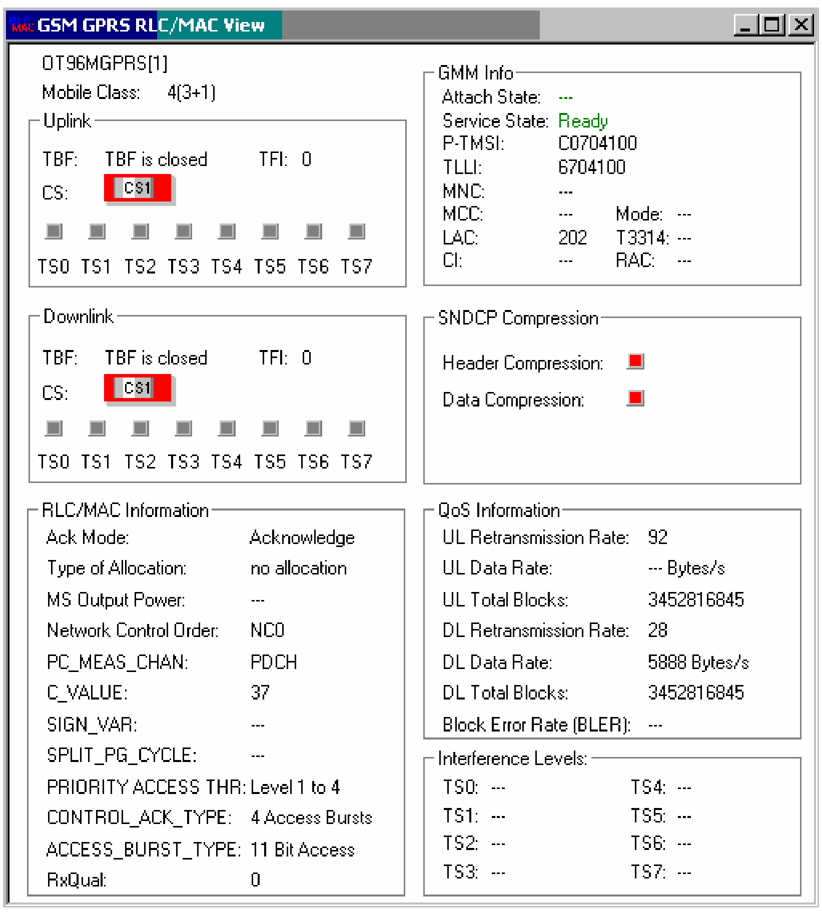


Fig. 4-123 GSM GPRS RLC/MAC View

For each mobile, the RLC/MAC parameters are arranged in six panels. The mobile type and its power class are indicated above the *Uplink* panel.

Uplink / Downlink

The *Uplink* and *Downlink* panels monitor the Temporary Block Flow (TBF) in uplink (mobile station towards base station) and downlink (base station towards mobile station) direction, respectively. The TBF is a temporary physical connection between the mobile and the base station that is maintained only for the duration of the data transfer.

TBF
Status of the TBF: open (during data transfer) or closed.

TFI
Temporary Flow Identity. Together with the direction (uplink or downlink), the TFI uniquely identifies a RLC data block.

CS
GPRS channel coding scheme (CS1 to CS4) or EDGE modulation and coding scheme (MCS1 to MCS9). A diagram makes it easy to notice changes of the coding scheme. In the configuration menu, it is possible to adjust the diagram for GPRS or EDGE coding schemes.

TS
Timeslot used for the TBF. The LED symbols light while the TBF occupies one or several of the timeslots 0 to 7.

RLC/MAC Information

The *RLC/MAC Information* panel displays the following information:

Ack Mode
RLC mode: Acknowledge mode or Unacknowledge mode.

Type of Allocation
MAC mode; medium access method to be used during the TBF: *Dynamic allocation*, *Fixed allocation* or *No allocation*

MS
Output Power Output power of the mobile station in dBm.

Netw. Control Order
Current value of the NETWORK_CONTROL_ORDER parameter defined in GSM 05.08. This parameter controls the measurement reports provided by the mobile and its cell re-selection. Possible values are:

NC0	Normal MS control: MS performs autonomous cell re-selection
NC1	Normal MS control with measurement reports
NC2	Network control. MS sends measurement reports but does not perform autonomous cell re-selection

RESET
The MS returns to the broadcast parameters. Only sent on PCCCH or PACCH

PC_MEAS_CHAN
Channel where the measurements for power control are made: BCCH or PDCH.

C_VALUE
Value of the C parameter calculated by the mobile station; relevant for the channel quality report.

SIGN_VAR
Value of the signal variance parameter calculated by the mobile station; relevant for the channel quality report.

SPLIT_PG_CYCLE
Optional parameter specified in GSM 05.08 controlling the occurrence of paging blocks on CCCH or PCCCH belonging to the mobile station in DRX (Discontinuous Reception) mode.

PRIORITY_ACCESS_THR
Control parameter indicating whether packet access is allowed and for which priority level it is allowed.

CONTROL_ACK_TYPE
Default format of the PACKET CONTROL ACKNOWLEDGMENT message: either *4 Access Bursts* or *RLC/MAC Control Block*.

ACCESS_BURST_TYPE
Access burst format: *8 Bit Access Bursts* or *11 Bit Access Bursts.*

RxQual
Received signal quality reported by the mobile; see section *GSM Measurement Report View* on page 4.212.

GMM Info

The *GMM Info* panel displays the following GPRS Mobility Management information:

Attach State
GPRS operating mode of the mobile: – (not available), Attached, IMSI Attached, Combined Attached, Not Attached

Service State
GPRS operating mode of the mobile: – (idle/not available), Stand By or Ready.

P-TMSI
Packet TMSI of the mobile, transferred to the network during a GPRS attach.

TLLI
Temporary Logical Link Identity, code number to identify the mobile at the RLC/MAC layer.

MNC
Mobile Network Code

MCC
Mobile Country Code

LAC
Location Area Code

CI
Cell Identity

Mode
Network mode of operation 1, 2, or 3.

T3314
Ready timer used in the MS and in the network for each assigned P-TMSI to control the cell updating and paging process.

RAC
Routing Area Code; fixed length code (of 1 octets) identifying a routing area within a location

SNDCP Compression

The *SNDCP Compression* panel indicates whether or not the mobile uses compression of the Subnetwork Dependent Convergence Protocol (SNDCP) information (GSM 04.65). Protocol control information compression is an optional SNDCP feature that helps to improve channel efficiency.

The TCP/IP *Header Compression* and *Data Compression* is indicated in separate boxes. A red box indicates that compression is enabled.

QoS Information

The *QoS Information* panel indicates parameters describing the user data throughput and reliability of the GPRS connection. The parameters characterize the quality of service (QoS); see GSM 02.60.

UL Retransmission Rate
Number of unacknowledged uplink (UL) frames that the mobile had to retransmit for error recovery

UL Data Rate
UL data rate in bytes/s

UL Total Blocks
Total number of UL data blocks transferred

DL Retransmission
Rate Number of unacknowledged downlink (DL) frames that the base station had to retransmit for error recovery

DL Data Rate
DL data rate in bytes/s

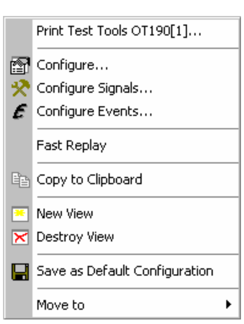
DL Total Blocks
Total number of DL data blocks transferred

Block Error Rate
Ratio of blocks received in error at the mobile to total number of received blocks (GSM 11.10).

Interference Levels

Carrier to Interference ratio C/I in dB and for each timeslot (TS0 to TS7) provided by the mobile. The result is invalid (---) if the mobile does not provide any C/I result or if the timeslot is not active. The *C/I* is provided by the Sagem test mobile OT190 and newer types.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM GPRS RLC/MAC View Configuration

The *GSM GPPRS RLC/MAC View Configuration* tab of the configuration menu selects the diagram type that is used to visualize the GPRS or EDGE coding schemes.

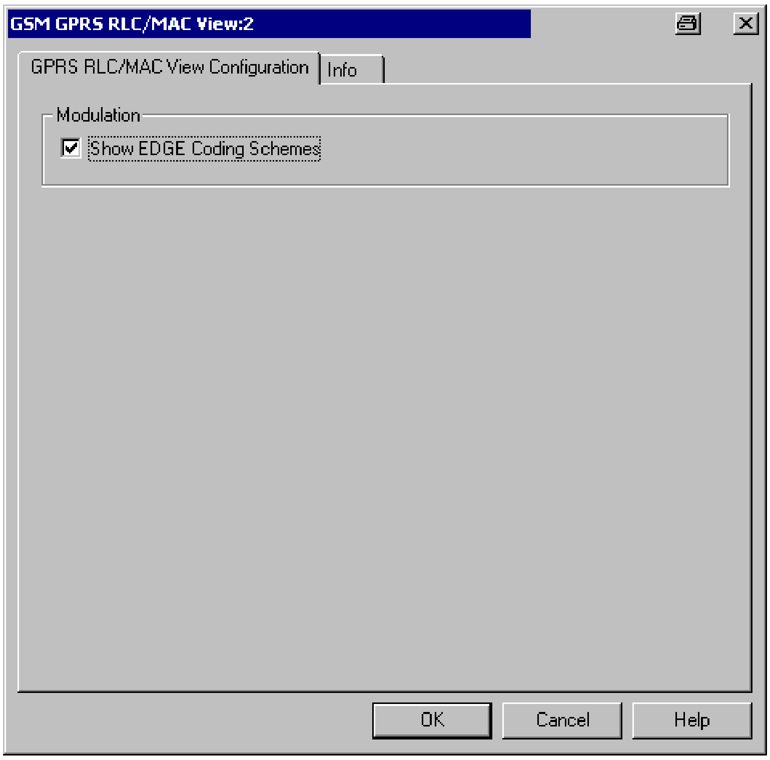
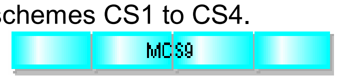


Fig. 4-124 GSM RLC/MAC View: GPRS RLC/MAC View Configuration

Modulation

In the *Uplink* and *Downlink* panels of the *GSM GPRS RLC/MAC View,* the channel coding schemes can be visualized with two different types of diagrams:

- The EDGE diagram *(Show EDGE Coding Schemes* selected) consists of 9 bars, corresponding to the modulation and coding schemes MCS1 to MCS9.


- The GPRS diagram consists of 4 bars, corresponding to the coding schemes CS1 to CS4.


The actual uplink and downlink coding schemes are indicated irrespective of the selected diagram type.

GSM GPRS TS/CS View

The *GSM GPRS TS/CS View* provides a statistical evaluation of the number of timeslots *(TS)* that are active in the connection and of the Coding Scheme *(CS)* that is used for the transmission of radio blocks. Both parameters are shown for the uplink and downlink.

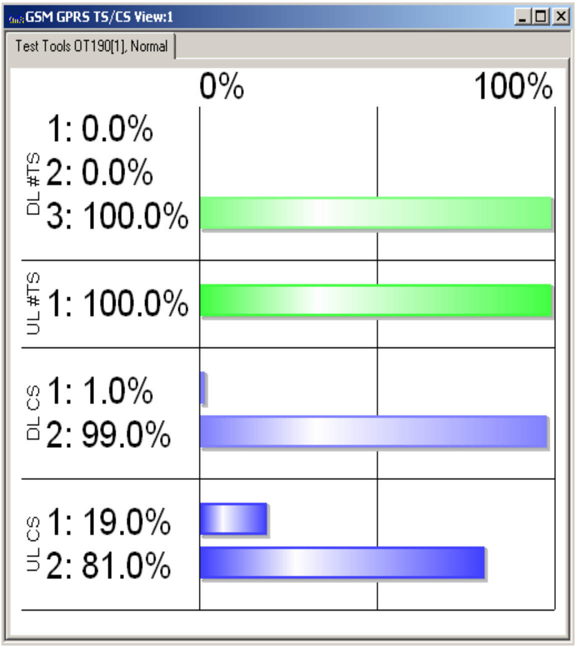


Fig. 4-125 GSM GPRS TS/CS View

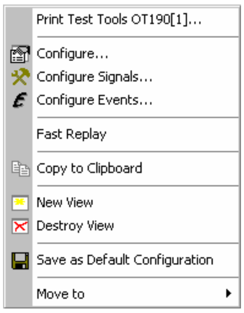
UL TS / DL TS Distribution in time of the number of timeslots used in the connection: Ratio of the time during which each number of timeslots is active to the total connection time. The ratios are expressed as percentages and visualized with colored bars. The length of the bars is proportional to the percentages; the sum of all percentages adds up to 100 %.

The maximum number of timeslots displayed can be selected in the configuration menu.

UL CS / DL CS Distribution in time of the coding scheme used in the connection: Ratio of the time during which each coding scheme is used to the total connection time. The ratios are expressed as percentages and visualized with colored bars. The length of the bars is proportional to the percentages; the sum of all percentages adds up to 100 %.

The maximum CS number displayed can be selected in the configuration menu.

Context menu A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.



GSM GPRS TS/CS View Configuration

The *GSM GPRS TS/CS View Configuration* tab of the configuration menu defines the contents of the view.

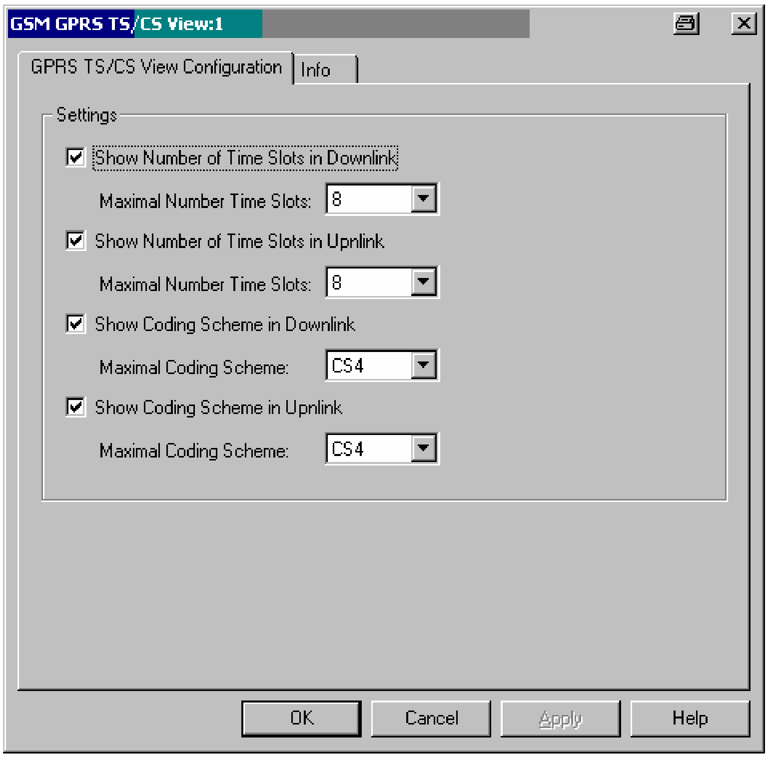


Fig. 4-126 GSM TS/CS View: GPRS TS/CS View Configuration

Settings

Clearing one of the *Show Number of Time Slots…* or *Show Coding Scheme…* boxes entirely hides the corresponding diagram in the view.

In addition, it is possible to simplify the diagrams by restricting the maximum number of time slots to less than 8 or the coding scheme number to less than 4. This makes it easier to read the diagram, especially if the maximum number of TS and maximum CS is known.

GSM GPRS RLC/MAC Header View

The *GSM GPRS RLC/MAC Header View* shows the exchanged RLC/MAC block header information. The RLC/MAC header contents depend on the transmission direction (UL/DL); they are described in standard 3GPP TS 44.060.

Moreover, recording of the *RLC/MAC Headers* must be enabled in the *General Settings* tab of the SAGEM x6 driver configuration menu.

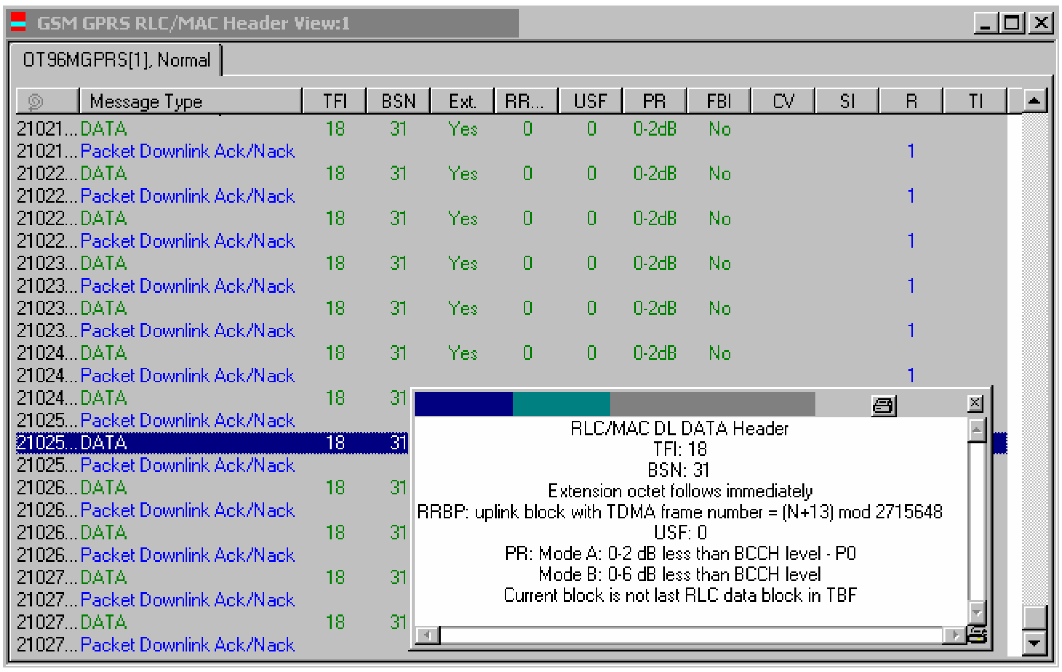


Fig. 4-127 GSM GPRS RLC/MAC Header View

For each mobile, the RLC/MAC header information is arranged in a table. The width of the columns can be varied with a drag-and-drop mechanism in the header of the table.

Table entries

Each RLC/MAC header forms a table row with the entries described below. Some of the values are only available for a particular direction (uplink or downlink).

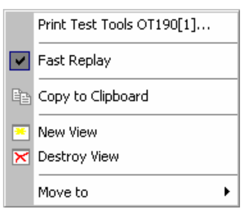
@	Timestamp assigned to the header
Message Type	Data block or message type transmitted in the RLC/MAC block
TFI 5-bit	Temporary Flow Identity, identifies the Temporary Block Flow (TBF) to which the RLC data block belongs.
BSN	Block Sequence Number, carries the sequence absolute Block Sequence Number (BSN) modulo Sequence Number Space (SNS) (128 in GPRS and 2 048 in EGPRS) of each RLC data block within the TBF.
Ext.	Extension bit, indicates the presence of an optional octet in the RLC data block header (0: Extension octet follows immediately; 1: No extension octet follows).
RRBP	Relative Reserved Block Period, specifies a single uplink block in which the mobile station shall transmit either a PACKET CONTROL ACKNOWLEDGEMENT message or a PACCH block to the network.
USF	Uplink State Flag, sent in all downlink RLC/MAC blocks, indicates the owner or use of the next uplink radio block on the same timeslot.
PR	Power Reduction field, indicates the power level reduction of the current RLC block.
FBI	Final Block Indicator, indicates whether the downlink RLC data block is the last RLC data block of the downlink TBF.
CV	4-bit Countdown Value, sent by the mobile station to allow the network to calculate the number of RLC data blocks remaining for the current uplink TBF.
SI	Stall Indicator bit, indicates whether the mobile's RLC transmit window can advance (i.e. is not stalled, value 0) or can not advance (i.e. is stalled, value 1).
R	Retry bit, indicates whether the mobile station transmitted the CHANNEL REQUEST message, PACKET CHANNEL REQUEST message, or EGPRS PACKET CHANNEL REQUEST message one time or more than one time during its most recent channel access.
TI	TLLI Indicator bit, indicates the presence of an optional TLLI field within the RLC data block.

Detailed information

An upper case D appears to the right of the cursor arrow when it is placed in the active (gray) zone of the view. This symbol indicates that there is detailed information to be retrieved for the current RLC/MAC header. A double-click opens the detailed information window; see *Fig. 4-127 above*.

The detailed information window is totally independent of the GSM GPRS RLC/MAC Header View, so you can move, resize and scroll it as you like. Click the printer symbol in the lower right corner to generate a hardcopy of the detailed information. Alternatively, you can write the detailed information into the table (e.g. if you wish to create a hardcopy), see the …Messages tabs of the configuration menu.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *GSM GPRS RLC/MAC Header View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

GSM GPRS/EGPRS View

The *GSM GPRS/EGPRS View* shows control and physical parameters of a GPRS and EGPRS connection.

The Nokia 6230 test mobile provides both GPRS and EGPRS parameters.

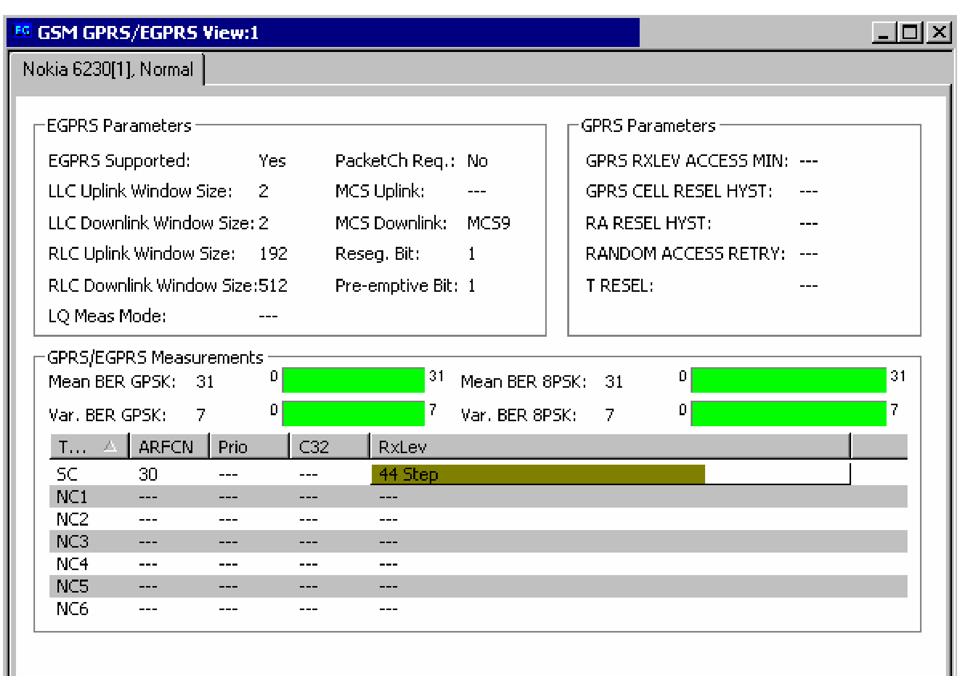


Fig. 4-128 GSM GPRS/EGPRS View

For each mobile, the GPRS and EGPRS parameters are arranged in two panels and a table below.

EGPRS Parameters

The upper left panel shows the following EGPRS-related control parameters:

EGPRS Supp.
EGPRS capability of the mobile phone *(Yes* or *No).* Most of the following parameters are only available if EGPRS is supported.

LLC Uplink/Downlink Window Size
LLC window size, i.e. the maximum number of sequentially-numbered uplink/downlink I frames that may be outstanding at any time. The window size is in the range 1 through 255 (see standard 3GPP TS 04.64).

RLC Uplink/Downlink Window Size
RLC window size (no. of RLC data blocks) that the network selects for the uplink/downlink, depending on the number of timeslots allocated (see standard 3GPP TS 44.060). For GPRS, a fixed window size of 64 is used.

LQ Meas. Mode
Link Quality Measurement Mode (0 to 3), see standard GPP TS 04.60, subclause 11.2.7.2.

PacketCh Req.
EGPRS packet channel request supported in serving cell (Yes/No).

MCS Uplink/Downlink
GPRS channel coding scheme (*CS1 to CS4)* or EGPRS modulation and coding scheme *(MCS1 to MCS9)* used in the uplink and downlink.

Reseg. Bit
Value of the resegment bit sent in the PACKET UPLINK ACH/NACK message, indicating whether or not the transmitted RLC blocks shall be resegmented (see standard 3GPP TS 51.010).

Pre-emptive Bit
Value of the pre-emptive transmission bit sent in the PACKET UPLINK ACH/NACK message, indicating whether or not pre-emptive transmission shall be used.

GPRS Parameters

The upper left panel shows a list of GPRS-related control parameters. The parameters are relevant for cell reselection and described in standard 3GPP TS 04.60 and related standards.

GPRS RXLEV ACCESS MIN
Minimum received signal level at the MS required for access to the system (value range: 0 to 63).

GPRS CELL RESEL HYST
Additional hysteresis applied in *Ready* state for cells in the same Routing Area (value range: 0 dB, 2 dB,..., 14 dB).

RA RESEL HYST
Additional hysteresis applied for cells in different Routing Areas (value range: 0 dB, 2 dB,..., 14 dB).

RANDOM ACCESS RETRY
: 1-bit value, if set to 1, it indicates that the mobile station is allowed to try to access another cell if available.

T RESEL
: Delay time before a mobile is allowed to reselect a cell after an abnormal release of the connection to this cell. *T RESEL* can be set to 8 discrete values between 5 seconds and 300 seconds.

GPRS/EGPRS Measurements

In the lower half the *GSM GPRS/EGPRS View* presents an evaluation of physical parameters of the GPRS/EGPRS connection that the mobile reports to the network (see standard 3GPP TS 04.60 and related standards).

Mean BER
: Mean value of the Bit Error Probability of the channel averaged over all timeslots in the TBF. Range 0 to 31; see 3GPP TS 04.60 and 3GPP TS 05.08.

Var BER
: Variation coefficient for the Bit Error Probability averaged over all time slots of the TBF. Range 0 to 7; see 3GPP TS 05.08.

Type
: The table shows results from the serving cell *(SC)* and up to six neighbor cells *(NC1, …, NC6),* if available.

ARFCN
: Absolute Radio Frequency Channel Number used in the serving cell and the neighbor cells.

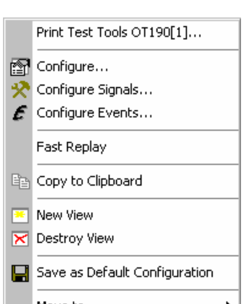
Prio
: GPRS priority class, 3-bit value to indicate the HCS priority for the call.

C32
: Flag indicating an exception rule for GPRS_RESELECT_OFFSET according to 3GPP TS 05.08.

RxLev
: RxLev of the serving cell and the neighbor cells

Context menu

A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.



GSM GPRS RLC MAC Release Indicators View

The *GSM GPRS RLC MAC Release Indicators View* shows control and physical parameters of the connection release information, such as the cause of the release, statistical parameters and the release indicator description, if supplied.

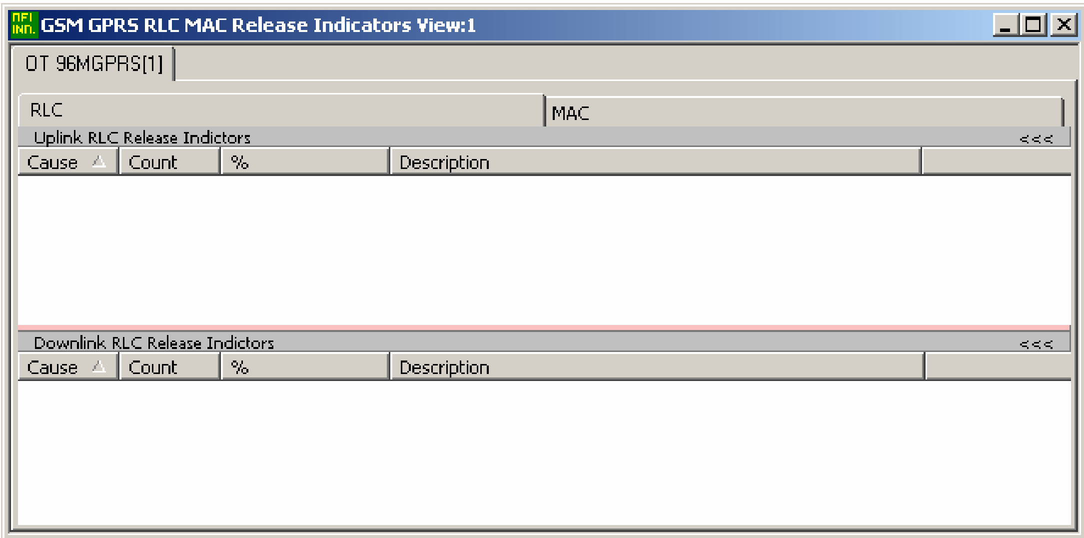


Fig. 4-129 GSM GPRS RLC MAC Release Indicators View

For each mobile, the RLC or MAC Release indicators are arranged in two lists. The width of the columns can be varied with a drag-and-drop mechanism in the header of the table.

Uplink / Downlink Table entries

Each RLC or MAC release indicator forms a table row with the entries described below.

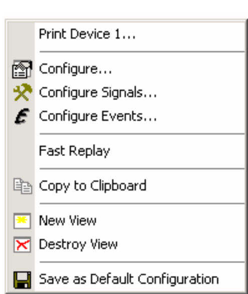
Cause
: The cause of the RLC/MAC release.

Count
: The number of measured release indicators of the current session.

%
: Percentage of the related cause

Description
: Release indicator description

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views; see *Context menu* description on p. 4.2.

GSM GPRS RLC MAC Release Indicators View Configuration

The *GSM GPRS RLC MAC Release Indicators View Configuration* tab of the configuration menu defines the contents of the view.

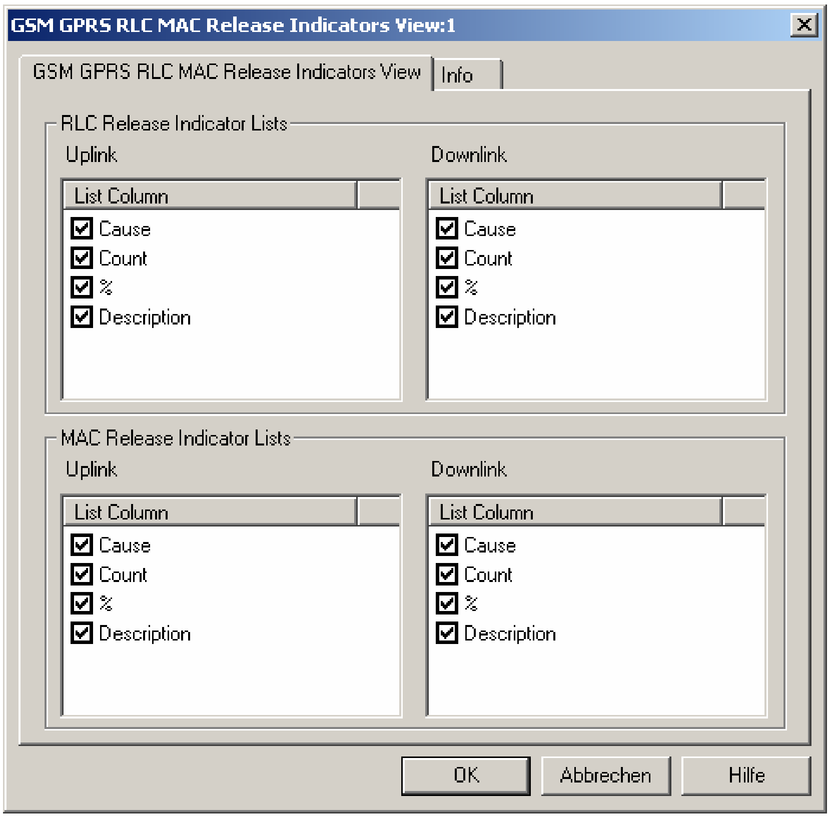


Fig. 4-130 GSM GPRS RLC MAC Release Indicators View: Configuration

RLC/MAC Release Indicator Lists The *Release Indicators Lists Settings* panel offer checkboxes to select the elements displayed in the release indicator view tables.

GSM Views

The *GSM Views* display GSM-specific information included in the measurement data. GSM data can be acquired using one of the GSM drivers described in chapter 6. Some of the views require a particular measurement mode or a GSM mobile supporting special features (e.g. GPRS).

The GSM views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *GSM*.

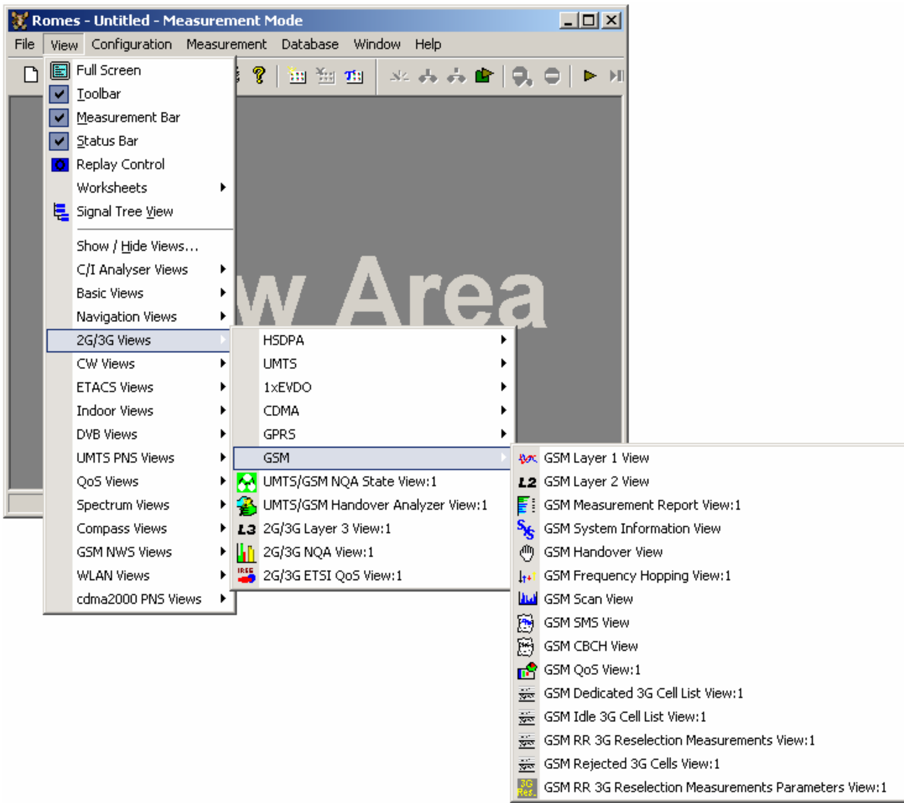
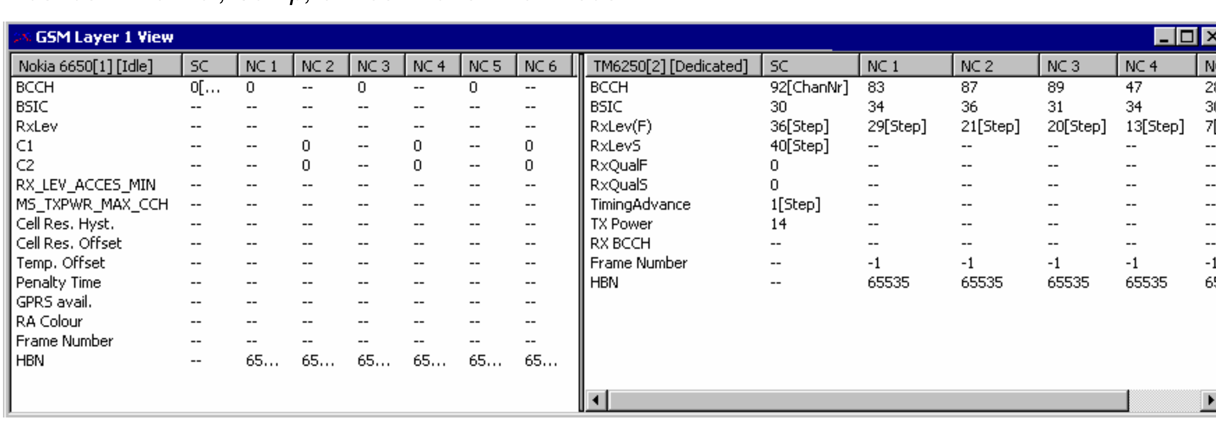


Fig. 4-131 GSM views

GSM Layer 1 View

The *GSM Layer 1 View* displays the values of layer 1 (physical layer) parameters that are constantly measured and transferred to the base station while the GSM mobile station operates in the network. The layer 1 parameters are shown for all mobiles used. They are not available in *Scan* mode; the mobile must be in *Normal, Camp,* or *Test Transmitter* mode.



GSM Layer 1 View

Nokia 6650[1] [Idle]	SC	NC 1	NC 2	NC 3	NC 4	NC 5	NC 6
BCCH	0[...	0	--	0	--	0	--
BSIC	--	--	--	--	--	--	--
RxLev	--	--	--	--	--	--	--
C1	--	--	0	--	0	--	0
C2	--	--	0	--	0	--	0
RX_LEV_ACCES_MIN	--	--	--	--	--	--	--
MS_TXPWR_MAX_CCH	--	--	--	--	--	--	--
Cell Res. Hyst.	--	--	--	--	--	--	--
Cell Res. Offset	--	--	--	--	--	--	--
Temp. Offset	--	--	--	--	--	--	--
Penalty Time	--	--	--	--	--	--	--
GPRS avail.	--	--	--	--	--	--	--
RA Colour	--	--	--	--	--	--	--
Frame Number	--	--	--	--	--	--	--
HBN	--	65...	65...	65...	65...	65...	65...

TM6250[2] [Dedicated]	SC	NC 1	NC 2	NC 3	NC 4	NC
BCCH	92[ChanNr]	83	87	89	47	28
BSIC	30	34	36	31	34	30
RxLev(F)	36[Step]	29[Step]	21[Step]	20[Step]	13[Step]	7[!
RxLevS	40[Step]	--	--	--	--	--
RxQualF	0	--	--	--	--	--
RxQualS	0	--	--	--	--	--
TimingAdvance	1[Step]	--	--	--	--	--
TX Power	14	--	--	--	--	--
RX BCCH	--	--	--	--	--	--
Frame Number	--	-1	-1	-1	-1	-1
HBN	--	65535	65535	65535	65535	65

Fig. 4-132 GSM Layer 1 View

The layer 1 parameters provided by each mobile are arranged in a separate list. The width of the individual lists can be varied with a drag-and-drop mechanism in the header of the table.

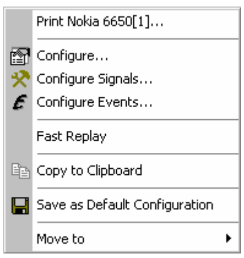
<Mobile type and number>

List of the layer 1 parameters provided by an individual mobile. The parameters to be displayed are selected in the *GSM Layer 1 Parameters* tab of the configuration menu, see below. Behind each mobile, its current mode (idle or dedicated) is indicated. The mode determines which type of layer 1 parameters can be measured, so the table and the parameter list is updated every time a mobile changes its mode.

SC, NC1 to NC6

Column *SC* contains the layer 1 parameters of the serving cell, columns *NC1* to *NC6* contain the layer 1 parameters of up to 6 neighbor cells. The number of neighbor cells can be set in the *GSM Layer 1 Parameters* tab of the configuration menu, see below.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM Layer 1 View Configuration

The *GSM Layer 1 View* configuration menu defines the parameters to be viewed and shows information on the current view version. It is opened via a right mouse click on a point inside *GSM Layer 1 View* or via the *Configuration – Settings* command (see chapter 3).

The *GSM L1 Parameters tab* selects the layer 1 parameters to be displayed.

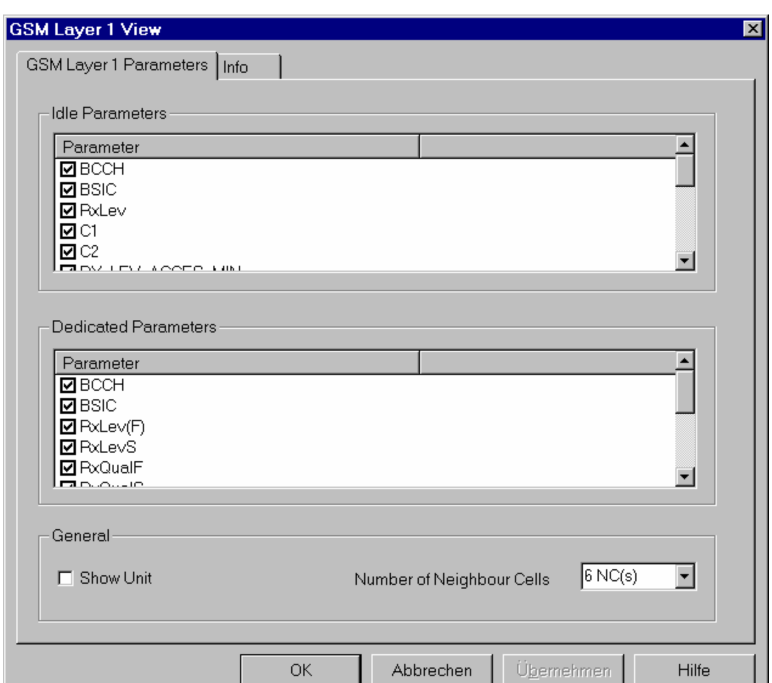


Fig. 4-133 GSM Layer 1 View: GSM Layer 1 Parameters

Idle Parameters List of layer 1 parameters that are available while the mobile is in idle mode. In this mode, no RR (Radio Resource) connection exists. The mobile is not allocated any dedicated channel; it listens to the CCCH and BCCH.

Dedicated Parameters List of layer 1 parameters that are available while the mobile is in dedicated mode. In this mode an RR connection exists that allows a point-to-point dialog between the mobile station and the network.

General The *General* settings configure the *Layer 1 View* table:

Show Unit
If the box is checked, the physical units of the layer 1 parameters are shown in the *GSM Layer 1 View* table. The units appear in angular brackets behind the parameter values. Exceptions are parameters with no or trivial units, e.g. the BSIC.

No of Neighbor C.
Selects a number of 0 *(No NC)* to 6 *(6 NC(s))* neighbor cells to be monitored in the *GSM Layer 1 View* table.

OK Apply all *GSM Layer 1 View* settings and close the configuration menu.

Cancel Discard all *GSM Layer 1 View* settings and close the configuration menu.

GSM Layer 2 View

The *GSM Layer 2 View* displays all layer 2 messages contained in the recorded data. The messages can not be configured; furthermore, recording must be enabled in the *Measurement Mode* or *General Settings* tab of the *Driver Configuration* menu (*Layer 2 messages* box, see section *GSM Mobile Drivers* in chapter 6).

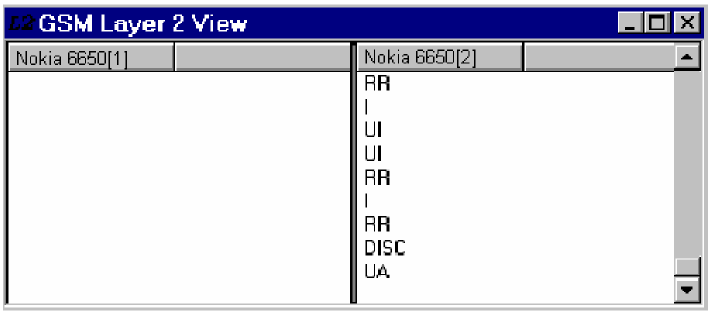
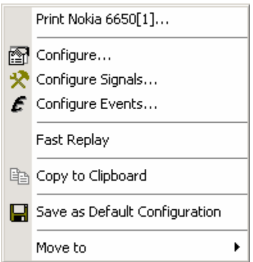


Fig. 4-134 GSM Layer 2 View

For each mobile, the layer 2 messages are arranged in its own table containing a maximum of 100 lines. After this limit is reached, every new message added deletes the oldest message in the table. The width of the individual tables can be varied with a drag-and-drop mechanism.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast re-play, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM Layer 2 View Configuration

The *GSM Layer 2 View* configuration menu switches the autoscroll mechanism on or off and shows information on the current view version. It is opened via a right mouse click on a point inside the *GSM Layer 2 View* or via the *Configuration – Settings* command (see chapter 3).

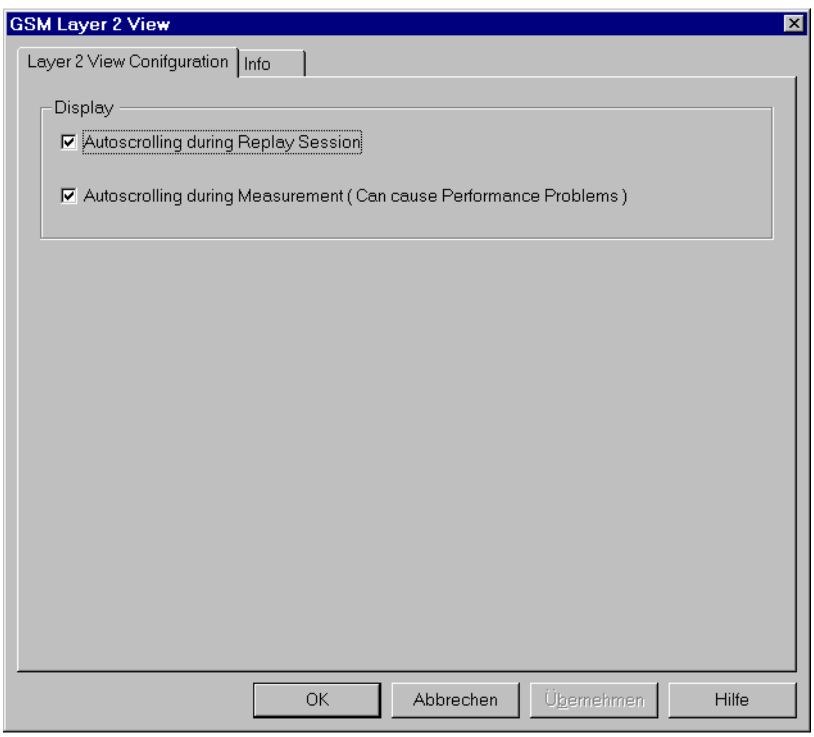


Fig. 4-135 GSM Layer 2 View configuration

Autoscrolling If the boxes are checked, the *GSM Layer 2* tables are scrolled down automatically as soon as the bottom of the view window is reached. Otherwise, the scrollbar can be used to move up and down in the table. Autoscrolling can be enabled/disabled separately for replay and measurement sessions.

GSM Measurement Report View

The *GSM Measurement Report View* gives an overview of the receiver reports of all used mobiles, i.e. the values of *RxQual* and *RxLev.* The number of the BCCH, the BSIC, the C1 and C2 parameters, and the name of the base station are displayed in addition. The data are shown for the serving cell and (except for RxQual) up to 6 neighbor cells N1 to N6. ROMES allows to open several independent *GSM Measurement Report Views* simultaneously.

Display of most results in the *GSM Measurement Report View* is optional; they can be switched off in the configuration menu.

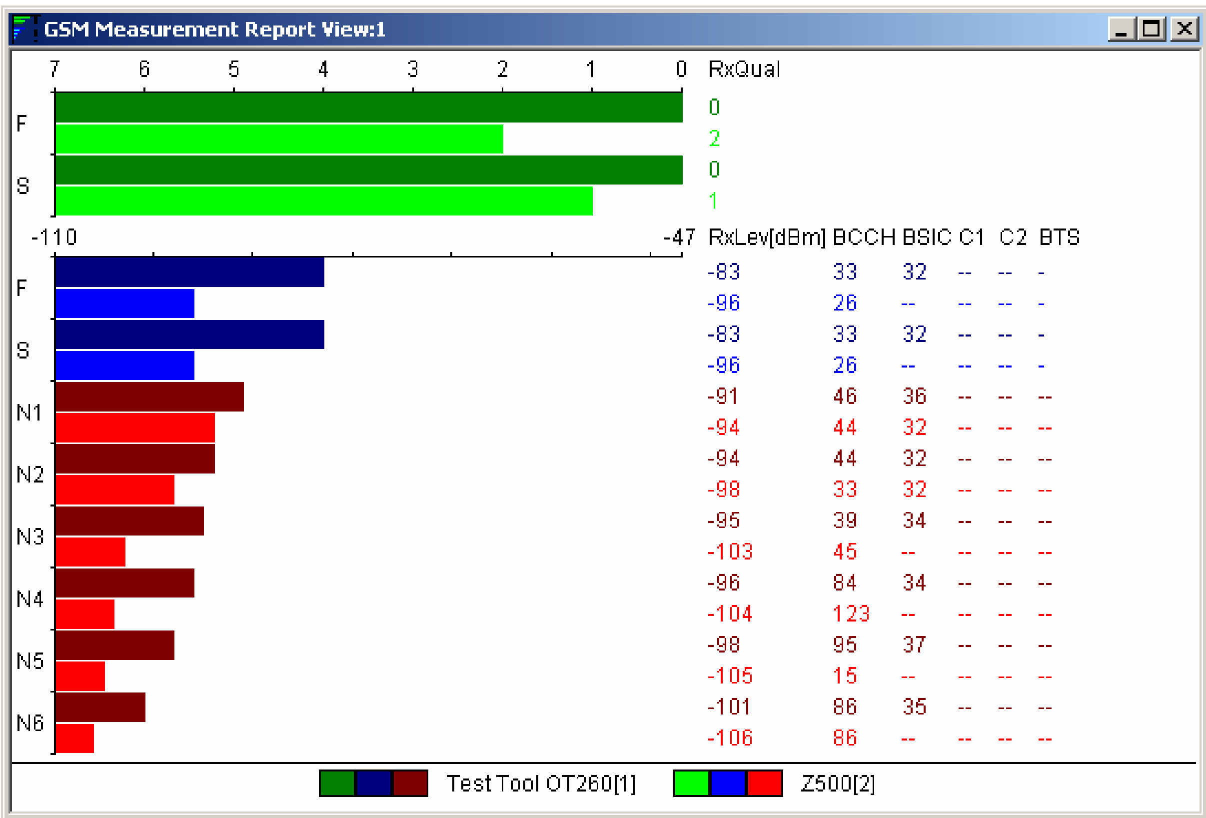


Fig. 4-136 GSM Measurement Report (for 2 test mobiles)

RxQual

The first group of bars represents the values of RxQual in the serving cell:

F

RXQUAL_FULL, assessed over the full range of TDMA frames within a SACCH block

S

RXQUAL_SUB, assessed over a subset of 12 TDMA frames

By definition, the RxQual values range from 0 to 7, 0 corresponding to the best received signal quality (see table in chapter 8). If the inverse scale is used to represent the values for RxQual a longer bar corresponds to a better signal quality (see *Show good RxQual* in the GSM measurement report configuration menu). The numeric values of RxQual are listed to the right of the bars. The scale can be inverted in the configuration menu, see below.

Downlink and uplink

A large difference between the RXQUAL_FULL and RXQUAL_SUB values indicates that the BTS (downlink) signal shows strong variations in time. One possi-

DTX mode

ble reason is that the BTS uses discontinuous transmission (DTX). In the DTX mode, the BTS transmitter is switched off during time periods where no information needs to be transferred. The relevant received signal quality is given by RXQUAL_SUB; the averaged parameter RXQUAL_FULL is generally larger (in extreme cases, RXQUAL_FULL can be equal to 7 while RXQUAL_SUB is equal to 0!) and underestimates the signal quality.

The current DTX mode of the GSM mobile station (uplink DTX) can be indicated in the *Alphanumeric View (used* or *not used)*. The *GSM System Information View* and the detailed information in the *2G/3G Layer 3* view show the DTX mode that the network commands the mobile station to use *(shall* or *shall not* or *may use DTX)*.

RxLev

The second group of bars represents the values of RxLev in the serving cell:

F
: RXLEV_FULL, assessed over the full range of TDMA frames within a SACCH block

S
: RXLEV_SUB, assessed over a subset of 12 TDMA frames

By default, the RxLev values range from 0 to 63, 63 corresponding to the highest received signal level (see table in chapter 8). This means that a longer bar corresponds to a better signal quality. The numeric values of RxLev are listed to the right of the bars. The RxLev values can be converted to absolute power units (dBm), see *Romes configuration – Available Signals* tab in chapter 3.

The received signal levels of neighbor cells 1 to k are labeled N1 to Nk. The total number k of neighbor cells displayed is set in the *Graph* panel of the configuration menu *(Number of shown neighbor cells)*.

BCCH

Number of the broadcast control channel of the cell and mobile.

BSIC

Base transceiver station (BTS) identity code. In this view, the BSIC is always octal (so that BSIC = ab where a is the NCC and b is the BCC), irrespective of the format selected in the *Available Signals* tab of the *Preferences* menu (octal/decimal/hex).

C1

C1 parameter, relevant for cell selection.

C2

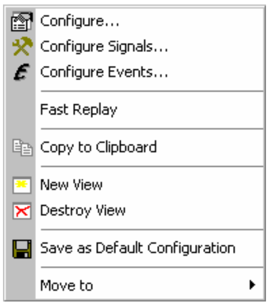
C2 (reselect) parameter, relevant for cell selection (GSM phase II).

BTS

Name of the base station. This parameter is displayed if a valid BTS list is available. Detailed information can be obtained by double-clicking the BTS name.

Note:
ROMES uses the BCCH and the BSIC to identify the BTS name. If the BTS assignment is ambiguous because several BTS with the same BCCH and BSIC are encountered, then a plus "+" sign preceeds the BTS name.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM Measurement Report Configuration

The *GSM Measurement Report* configuration menu defines the parameters to be viewed and shows information on the current view version. It is opened via a right mouse click on a point inside *GSM Measurement Report View* or via the *Configuration – Settings* command (see chapter 3).

The *Configuration* tab selects the devices and their parameters to be displayed.

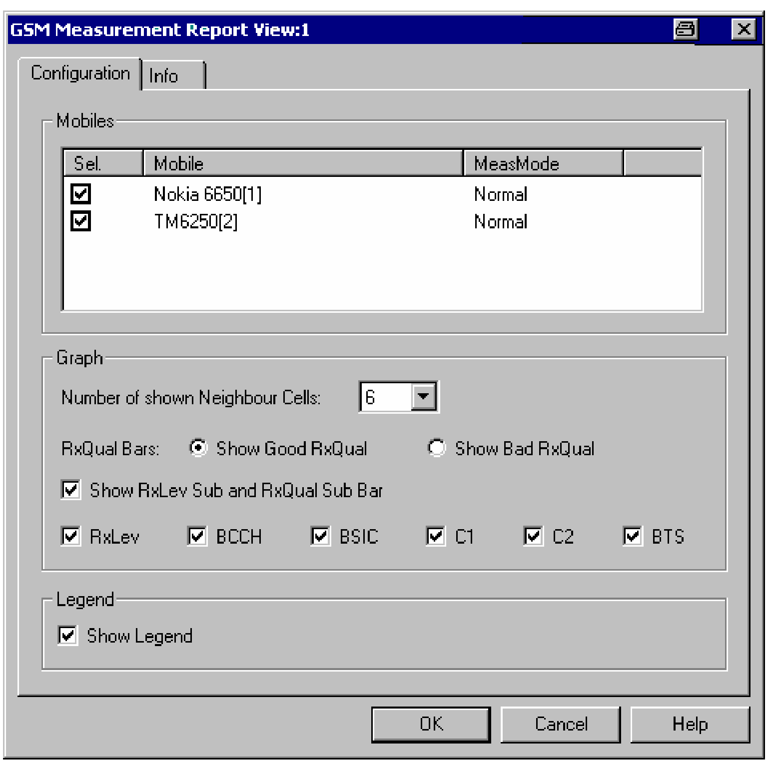


Fig. 4-137 GSM Measurement Report View: Configuration

Mobiles List of all mobiles measured with their measurement mode. An arbitrary number of mobiles can be selected from the list (click checkboxes). Only the receiver reports for selected mobiles are displayed in the *GSM Measurement Report View*.

Graph The *Graph* panel controls which type of measurement results are displayed. The number of neighbor cells must be in the range between 0 and 6. The *Show Bad RXQual* option button inverts the RxQual scale such that a long bar corresponds to a bad signal quality (0 is left, 7 is right). The checkboxes below switch the display of the corresponding measurement results on and off.

Legend To enlarge the diagram space, the legend below can be switched off.

OK Apply all *GSM Measurement Report View* settings and close the configuration menu.

Cancel Discard all *GSM Measurement Report View* settings and close the configuration menu.

GSM System Information View

The *GSM System Information View* displays a selection of GSM parameters contained in the layer 3 messages *System Information Type 1* to *6* sent by the BTS, according to GSM recommendation 04.08. The values are shown for all mobiles used.

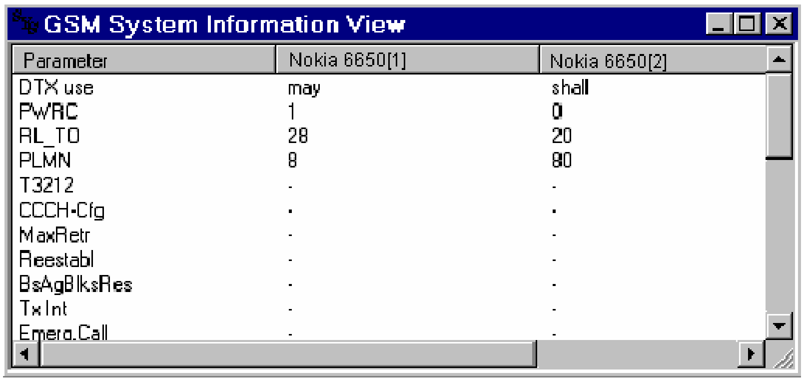
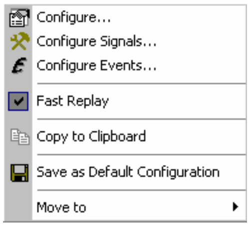


Fig. 4-138 GSM System Information View

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM System Information Configuration

The *GSM System Information View* configuration menu defines the parameters to be viewed and shows information on the current view version. It is opened via a right mouse click on a point inside the *GSM System Information View* or via the *Configuration – Settings* command (see chapter 3).

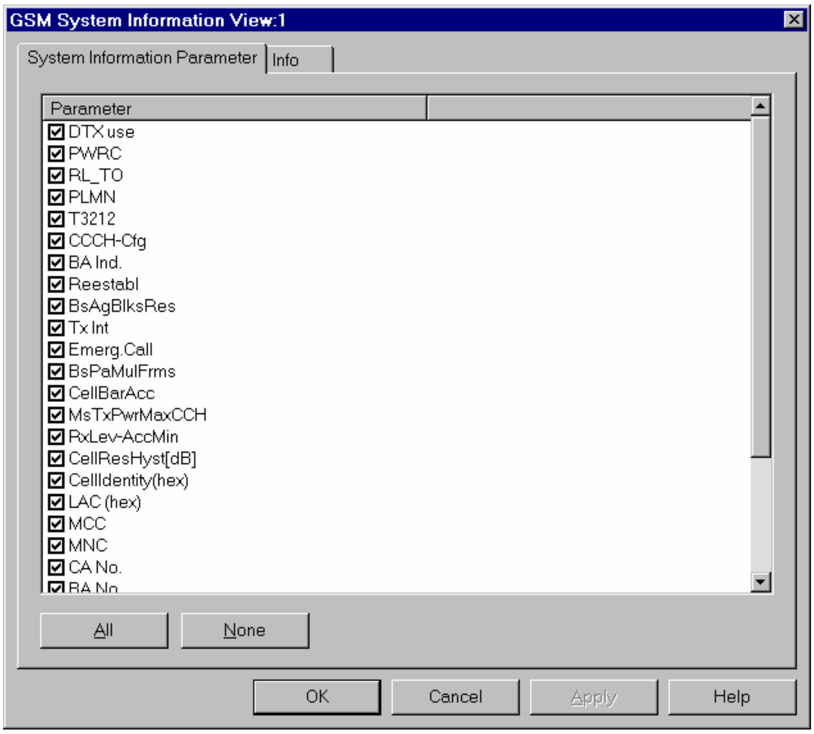


Fig. 4-139 GSM System Information View configuration: parameter list

In the *Parameters* list, the different types of information conveyed via layer 3 messages *System Information Type 1* to *6* can be selected by clicking the corresponding checkboxes. The list contains all parameters listed in the following table:

Table 4-2 GSM System Information Type 1 to 6 parameters

DTX	Discontinuous Transmission	**RxLev-AccMin**	Min. received signal level at a MS for access to a cell
PWRC	Power Control Indicator	**CellResHyst [dB]**	RxLev hyster. required for Cell Reselection
RL_TO	Radio Link Timeout	**CellIdentity [hex]**	Cell Identity code
PLMN	Public Land Mobile Network	**LAC [hex]**	Location Area Code
T3212	Timeout Value	**MCC**	Mobile Country Code
Reestabl	Reestablishment Indicator	**MNC**	Mobile Network Code
BsAgBlksRes	No. of blocks on each CCCH reserved for access grant messages	**CA No.**	RF channel number in a particular cell (Numbering in a Cell Allocation)
CCCH-Config	Common Control Channel Configuration	**BA No.**	BCCH Allocation Number
Tx Int	Number of slot to spread transm.	**BA Ind.**	BCCH Allocation sequence number indication
Emerg.Call	Emergency call permission	**CA ARFCN**	Cell Allocation ARFCN

BsPaMulFrms	Transmisson of the same paging messages to MSs of the same paging group	**BA ARFCN**	BCCH Allocation ARFCN
CellBarAcc	Cell Access Barred	**BA No. ext**	extended BCCH Allocation Number
MsTxPwrMaxCCH	Max. allowed transmitted RF power	**BA Ind. ext**	extended BCCH Allocation sequence number indication
		BA ARFCN ext	extended BCCH Allocation ARFCN

See also GSM abbreviations in chapter 8. The extended BA parameters are relevant for network operators who work with two GSM bands (GSM900 and GSM1800) identified by two parameter sets, respectively.

GSM Handover View

The *GSM Handover View* shows a list of the handover events performed by GSM mobile phones together with the GSM cell parameters.

TIP *The* GSM Handover *View shows the parameters for handovers between two GSM cells. To analyze handover procedures between GSM and UTRAN cells (inter-RAT handovers) use the* UMTS/GSM Handover Analyzer View*; see p. 4.252.*

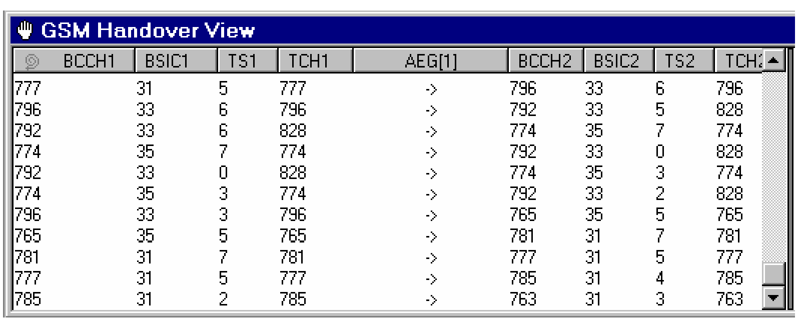
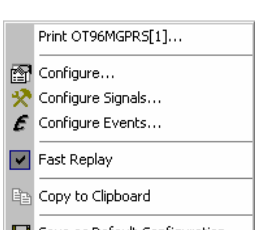


Fig. 4-140 GSM Handover View

For each mobile, the handover events are listed in a table with several columns. The width of the columns can be varied with a drag-and-drop mechanism in the header of the table. Their number and contents can be selected in the configuration menu; see below.

In a typical configuration, the current line in the handover list shows the channels, timeslot numbers and base station identity code of the previous cell (before the last handover, left side of the table) and of the current cell (after handover, right side of the table). The values on the right side of each line are therefore identical with the values on the left side of the next line. Failed handover events appear in red color.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM Handover View Configuration

The *GSM Handover View* configuration menu selects the information to be displayed in the *GSM Handover View*. It is opened via a right mouse click on a point inside the *GSM Handover View* or via the *Configuration – Settings* command (see chapter 3).

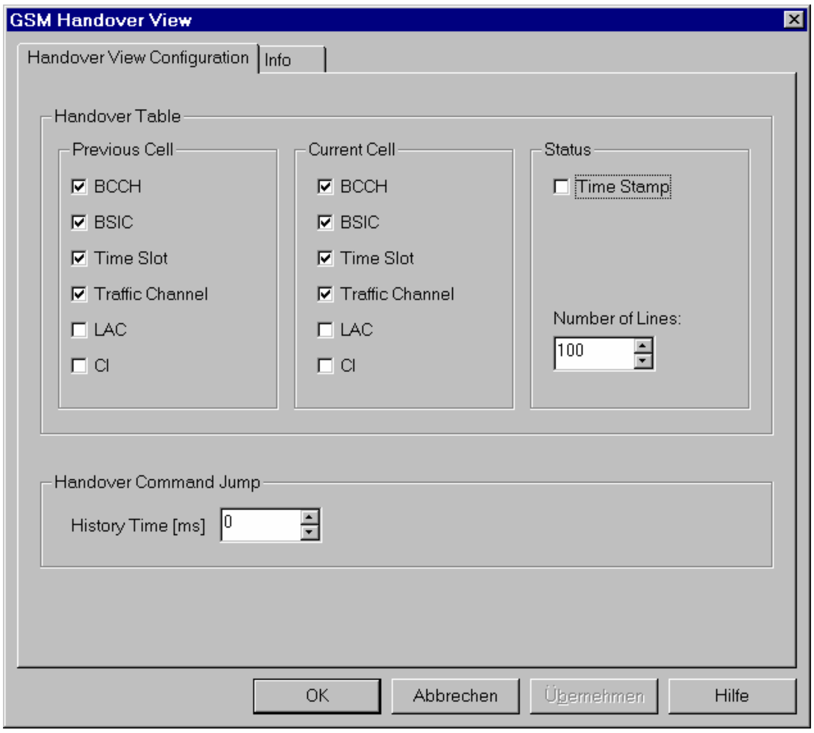


Fig. 4-141 GSM Handover View configuration

The contents of the *GSM Handover View* are defined in the *Handover Table* panel:

Previous Cell / Current Cell
The *Previous Cell (Current Cell)* panel defines which type of information is displayed on the left (right) side of the handover table. The *BCCH* carrier number, the Base Transceiver Station Identity Code *(BSIC)*, the *Time Slot* number, the *Traffic Channel* carrier number, the Location Area Code *(LAC)*, and the Cell Identity *(CI)* can be selected for display.

Status
The *Status* panel defines the first column and the size of the handover table:

Time Stamp
If the box is checked, the time stamp associated with each handover event is displayed in an additional first column of the handover table.

Number of Lines
Maximum number of lines/handover events displayed in the handover table. After this limit is reached, every new line deletes the oldest line in the table.

Handover Command Jump

The *Handover Command Jump* panel defines a time period in ms preceding a handover event *(History Time)*. During a replay session, the behavior of arbitrary GSM signals during the history time can be monitored in the following way:

➢ Pause the replay (select *Pause Replay* in the *Measurement* menu).

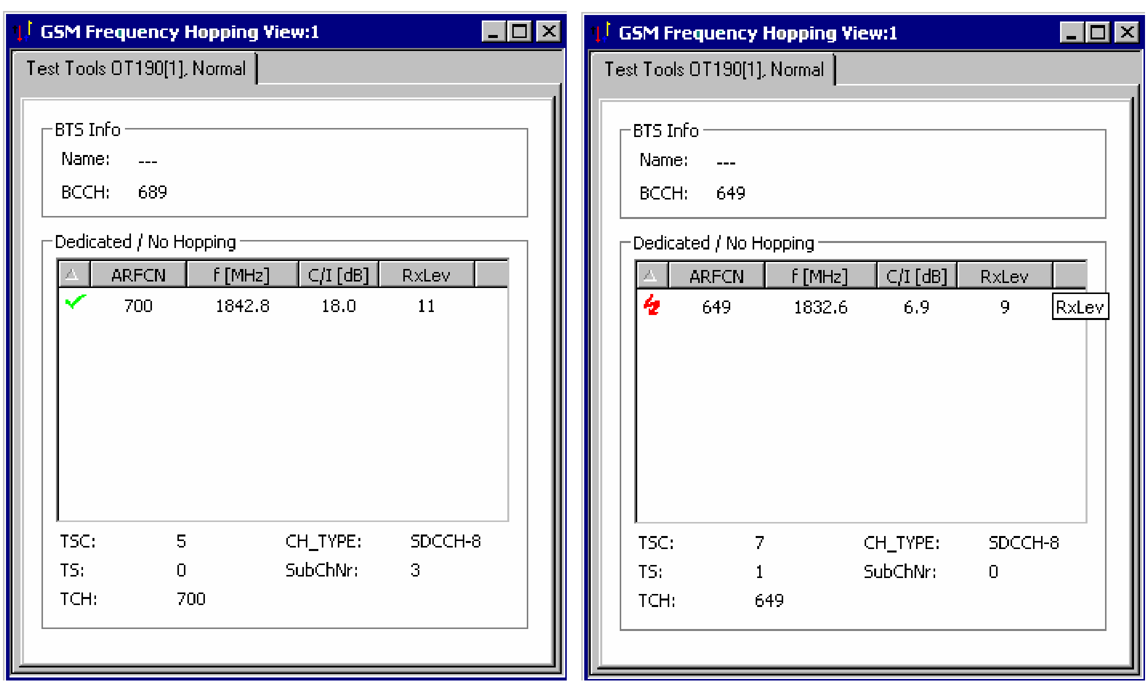
➢ Double-click a handover event line in the *GSM Handover View*.

The replay jumps to the time of the handover event minus the *History Time*.

➢ Use *Step One Data Set Forward* repeatedly to step through the history time. Monitor the parameters of interest in an arbitrary view, e.g., use the *2D Chart View* to display the behavior of RxLev and RxQual in the time preceding a failed handover attempt.

GSM Frequency Hopping View

The *GSM Frequency Hopping View* shows the channel information of a GSM connection that may or may not be operated in frequency hopping mode. The parameters are shown for all mobiles that are used in the current measurement or recorded in the replayed measurement file.



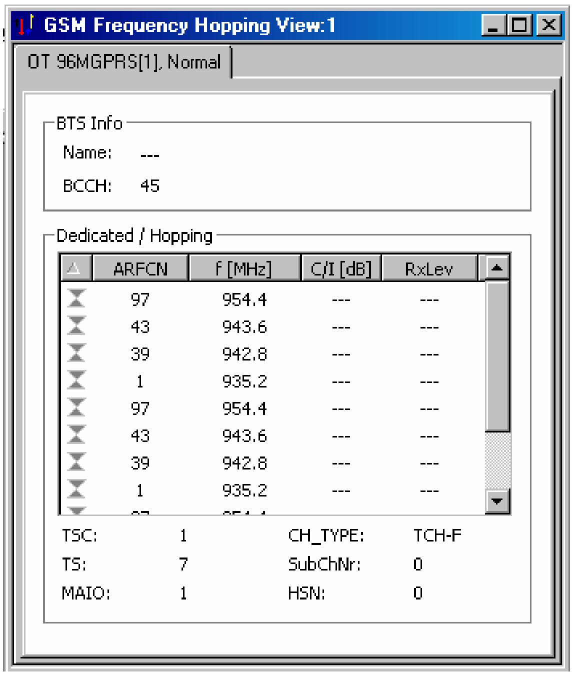


Fig. 4-142 GSM Frequency Hopping View

The hopping information provided by each mobile is displayed in a separate tab. Each tab is divided into two panels showing the properties of the BTS and the channel parameters of the RF connection, respectively.

BTS Info
The upper panel indicates the channel number of *the Broadcast Control Channel BCCH*) plus the base station name, if a BTS list is available.

Dedicated / Hopping
The panel below the *BTS Info* shows the parameters of the RF connection. The heading of the panel indicates the frequency hopping status:

Idle
MS is not connected to the network.

Dedicated / Hopping
MS maintains a dedicated connection with the BTS and is in frequency hopping mode

Dedicated / No Hopping
MS maintains a dedicated connection with the BTS but does not use frequency hopping

Channel list
The channel list shows the sequence of GSM channel numbers *(ARFCN)* and frequencies used, together with the carrier-to-interference ratio *(C/I)* and RxLev value for each hopping frequency. Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order.

Some of the parameters may not be provided by all test mobiles. The *C/I* is provided by the Sagem test mobile OT190 and newer types. The icons and denote C/I values below or above 10 dB; is displayed if no C/I value is available. If frequency hopping is off, the list consists of a single frequency.

Parameter list

The parameter list below the hopping channel list shows the properties of the dedicated connection. It is not shown while the connection is *Idle.* Some of the parameters may not be provided by all test mobiles.

TSC

Training sequence code of the RF channel.

TS

Traffic channel timeslot number of the connection.

MAIO

Mobile Allocation Index Offset in the range 0 to 63. The MAIO is only displayed if frequency hopping is on.

CH_Type

Channel type allocated for the connection: *TCH-F* (full-rate traffic channel), *TCH-H* (half-rate traffic channel), *SDCCH/4* or *SDCCH/8.*

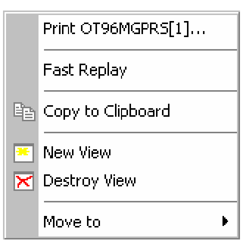
SubChNr

SDCCH sub-channel number as defined in section 7, tables 3 and 4 of standard 3GPP TS 05.02.

HSN

Hopping Sequence Number in the range 0 to 63. The HSN is only displayed if frequency hopping is on.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *GSM Frequency Hopping View* has no configuration menu. The *Info* tab can be accessed via the *Configuration – Settings* command.

GSM Scan View

The *GSM Scan View* contains a diagram showing the signal level of every mobile in all GSM channels measured. The channel range depends on the mobile type (GSM900/GSM-R/E-GSM/GSM1800/GSM1900; see channel tables in chapter 8, *GSM Channels and Power Classes)* and of a possible restriction made in the *Measurement Mode* menu – see section *GSM Mobile Drivers* in chapter 6.

Note:

This control window is only useful in the Scan(ning) mode where the signal level in each channel but no other information is recorded. The GSM Scan View is empty for mobiles which are not set to Scan(ning) mode. On the other hand, a mobile in Scan(ning) mode does not contribute any information to be viewed in the 2G/3G Layer 3 View or 2G/3G NQA View.

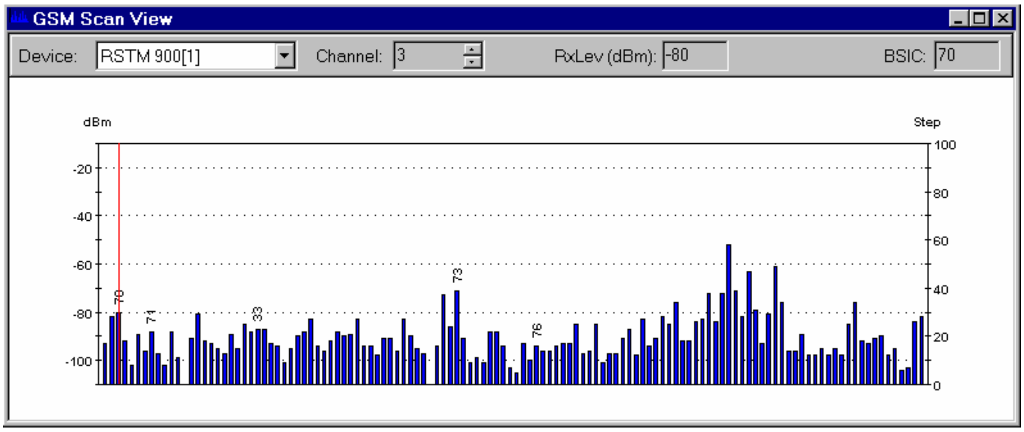


Fig. 4-143 GSM Scan View

Diagram

The diagram shows a colored bar for each channel and for the mobile indicated above. The channels are arranged in ascending order from the left to the right of the diagram; the length of each line corresponds to the signal strength recorded in the channel. The ordinate on the left side is labeled with a linear dBm scale defined in the configuration menu, the right ordinate with an inverse, linear step scale, 0 corresponding to –110 dB, 100 corresponding to –10 dB.

A red, vertical line marks the channel selected in the *Channel* input field above the diagram. The corresponding signal level is indicated in the *RxLev (dBm)* field. If available, the BSIC of the base station transmitting on the channel is indicated above the level bar.

Device list

The pull-down list on the left side above the diagram shows all mobiles measured. The signal power of the selected mobile is shown in the diagram.

Channel

The *Channel* field to the right of the mobile list is used to select a single channel the level of which will be displayed in the *RxLev (dBm)* field. The channel position in the diagram is marked with a red, vertical line.

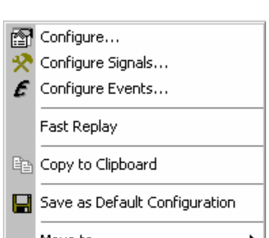
BSIC

The BSIC of the transmitting BTS can be decoded from each channel and displayed in the diagram (integer numbers on top of the bars). The BSIC of the selected channel is shown in the *BSIC* output box. This feature is available with RS TM, Sagem OT1xx, and Sagem OT2xx test mobiles provided that *Decode BSIC* (RS TM) or *BCCH Scan* (Sagem) is selected in the *Measurement Mode* tab of the driver configuration menus (see chapter 6).

To improve the decoding capability for RS TM mobiles, it is recommended to reduce the number of channels and rise the number of samples (see section *GSM Mobile Drivers*, *Measurement Mode* menu in chapter 6).

Context menu

A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.



GSM Scan View Configuration

The *GSM Scan View* configuration menu defines the y-axis scale, i.e. the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *GSM Scan view*. It is opened via a right mouse click on a point inside the *GSM Scan View* or via the *Configuration – Settings* command (see chapter 3).

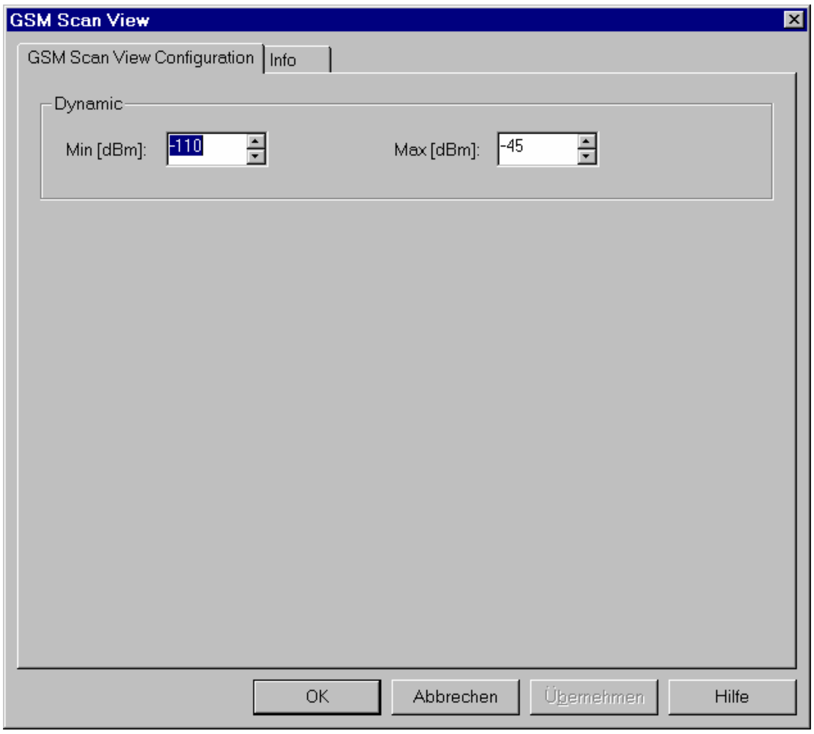


Fig. 4-144 GSM Scan View configuration: parameter list

GSM SMS View

The *GSM SMS View* displays the short messages sent or received during the measurement or contained in a measurement file being replayed. The messages are shown for all mobiles used. To create entries in the *GSM SMS View*, an RS TM mobile must be used and the *SMS Tester* option in the *Driver Configuration – SMS Tester* tab must be enabled (see chapter 6).

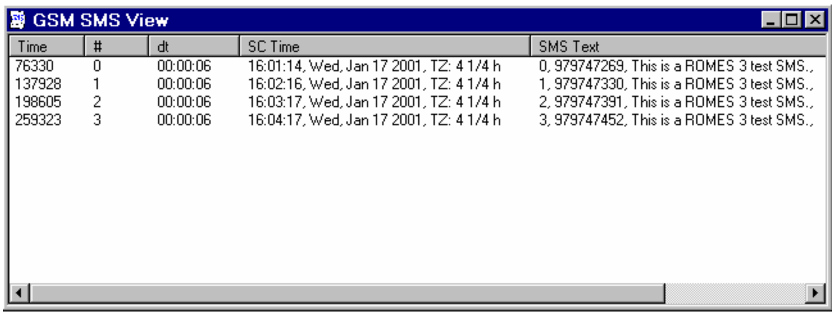
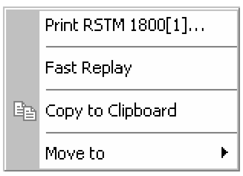


Fig. 4-145 GSM SMS View

For each mobile, the SMS messages are arranged in a table with five columns. The width of the columns can be varied with a drag-and-drop mechanism in the header of the table.

Time	Time stamp associated with the CBCH message.
#	Current number of the short message.
dt	Duration of the short message in the format hh.mm.ss.
SC Time	Time and date when the short message was received, time zone in ¼ h.
SMS Text	Short message text in the format:
	#,Universal Time Coordinated Time, This is a ROMES 3 test SMS.
Context menu	A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see *Context menu* description on p. 4.2.



Note:

In addition to the information in the GSM SMS View, a number of SMS-related parameters are available in the Available Signals tab of the ROMES Configuration menu. The parameters belong to the GSM branch of the data tree; see Fig. 4-146 below. These signals can be viewed in basic views such as the Alphanumeric View.

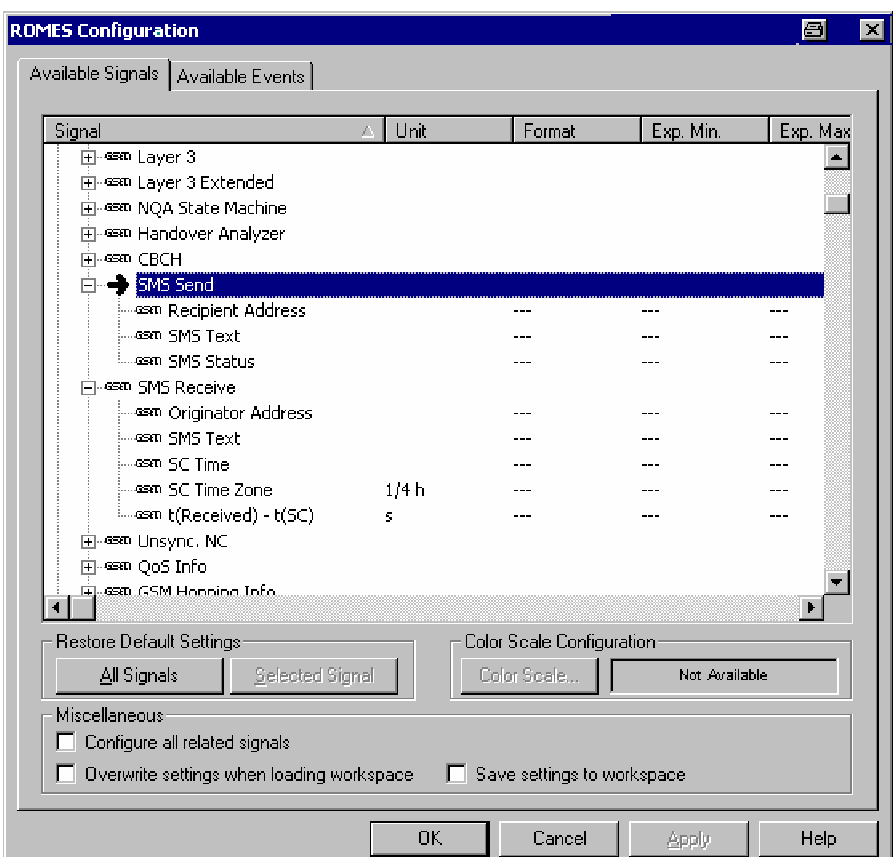


Fig. 4-146 SMS parameters in the Alphanumeric View

GSM CBCH View

The *GSM CBCH View* displays the cell broadcast messages recorded during the measurement or contained in a measurement file being replayed. The messages are shown for all mobiles used. To record cell broadcast messages, an RS TM mobile must be used and the *Decode CBCH* option in the *Driver Configuration – Measurement Mode* tab must be enabled (see chapter 6).

Note:

CB Messages are also displayed as Layer 3 Messages in the 2G/3G Layer 3 View, provided that they are selected in the Layer 3 Messages tab of the 2G/3G Layer 3 View Configuration menu.

Fig. 4-147 GSM CBCH View

For each mobile, the CBCH messages are arranged in a table with 7 columns. The width of the columns can be varied with a drag-and-drop mechanism in the header of the table.

Time	Time associated with the CBCH message in the format hh.mm.ss.
SN	Cell broadcast message (CBM) serial number (GSM 03.41)
ID	CMB message identifier (GSM 03.41) = Page Number of this CBM
C	Data coding scheme (GSM 03.41)
#	Current (sub-) page number in this CBM (GSM 03.41, Page Parameter)
P	Total number of (sub-)pages in this CBM (GSM 03.41, Page Parameter)

<Type> GSM Cell Broadcast Message text content (GSM 03.38). The GSM 03.38 default alphabet is used for display. It contains some special characters which are displayed in a symbolic form:

<LF> for 0x0A

<CR> for 0x0D

<DELTA> for 0x10

<PHI> for 0x12

<GAMMA> for 0x13

<LAMBDA> for 0x14

<OMEGA> for 0x15

<PI> for 0x16

<PSI> for 0x17

<SIGMA> for 0x18

<THETA> for 0x19

<CHI> for 0x1A

Note:
GSM 03.38 defines Carriage Return (0x0D) as pad character.

Context menu A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM QoS View

The *GSM QoS View* displays a statistical evaluation of important layer 3 (*Location Area Update, GSM Handover),* mobility management *(GPRS Attach/Detach, Routing Area Update)* and packet routing *(Activate/Deactivate PDP Context)* procedures performed by mobile phones supporting GPRS. The procedures are described in standard 3GPP TS 23.060.

The statistical evaluation is a measure for the Quality of Service of a packet data connection. It is made for all mobiles that are used in the current measurement or recorded in the replayed measurement file. Several types of GSM test mobiles provide GSM QoS data:

- To record GPRS data, SAGEM (OT 96-M GPRS, OT190 GPRS, OT 290 GPRS) and Siemens (S55, S55-R) mobiles must be used in *Data/Trace* mode and the splitter box must be connected to provide two COM ports (see chapter 6). Moreover recording of the RLC/MAC control messages must be enabled in the *QoS Statistics* tab of the driver configuration menu for the SAGEM mobiles supporting GPRS. The SAGEM mobiles also provide *GSM Handover* and *Location Area Update* information.
- To record GPRS data, Nokia test mobiles (Nokia 6230/6500/6630/6650/7600), Qualcomm test mobiles (TM6200/6250/6275), and Qualcomm-compatible test mobiles such as Samsung Z105, Z107, Z130 are connected via USB interface.

- To record *GSM Handover* and *Location Area Update* actions, an RS TM mobile can be used as well. Recording must be enabled in the QoS *Statistics* tab of the driver configuration menu.

TIP

In the QoS Tests *tab of the SAGEM x6 driver configuration menu, GPRS attach/detach, PDP context activate/deactivate and location area update can be set to be initiated periodically.*

The QoS parameters describing the data throughput of a GPRS connection can be displayed in other views; see e.g. section *GSM GPRS RLC/MAC View* on p. 4.194.

Fig. 4-148 GSM QoS View

Only actions that actually occur during the measurement are shown in the view (e.g. if no GSM handover is done, then the *GSM Handover* section is not displayed). Moreover, the view contents and the diagram size can be selected in the configuration menu.

The evaluation is analogous for all actions. The results are displayed in a diagram area and a table comprising three rows:

Diagrams

The diagram area is divided into two sections:

- The left diagram shows the total number of actions attempted by the GPRS mobile or the network *(blue, question mark),* the number of successful actions *(green, checkmark),* and the number of failed actions *(red, cross)*. In each category, the time statistics is visualized by means of a bar: The minimum, average, and maximum time needed to perform the actions corresponds to the bottom, the black horizontal line and the top of the bar. The time for mobile-initiated actions is measured from the time the mobile transmits the *... REQUEST* message to the time it receives the response from the network.

- The right diagram represents a pie chart showing the relative numbers of *Success* and *Failed* actions.

Short times indicate a good Quality of Service. The number of attempted actions *(Count)* equals to the sum of *Success, Failed* and *No Response* actions; see below.

Success

Number of actions that could be successfully terminated, together with the minimum *(Min. Time)*, average *(Avg. Time),* and maximum time *(Max. Time)* of all these actions, expressed in ms. A large percentage of actions in this category indicates a good Quality of Service.

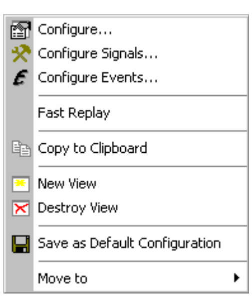
Failed

Number of actions that were started but had to be unsuccessfully terminated, together with the minimum *(Min. Time)*, average *(Avg. Time),* and maximum time *(Max. Time)* of all these actions, expressed in ms.

No Response

Number of actions that failed because the mobile could not get any response from the network.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2*.*

GSM QoS View Configuration

The *GSM QoS View Configuration* tab of the configuration menu selects the actions to be evaluated in the view and defines the size of the diagrams. It is opened via a right mouse click on a point inside the *GSM QoS View* or via the *Configuration – Settings* command (see chapter 3).

Clearing a procedure in the *Available QoS Actions* list hides the corresponding section in the view.

TIP

Restricting the viewed actions makes it easier to read the view if only a subset of the available actions is needed. To restrict the number of actions measured and enhance the system performance, use the settings in the driver configuration menu (see chapter 6).

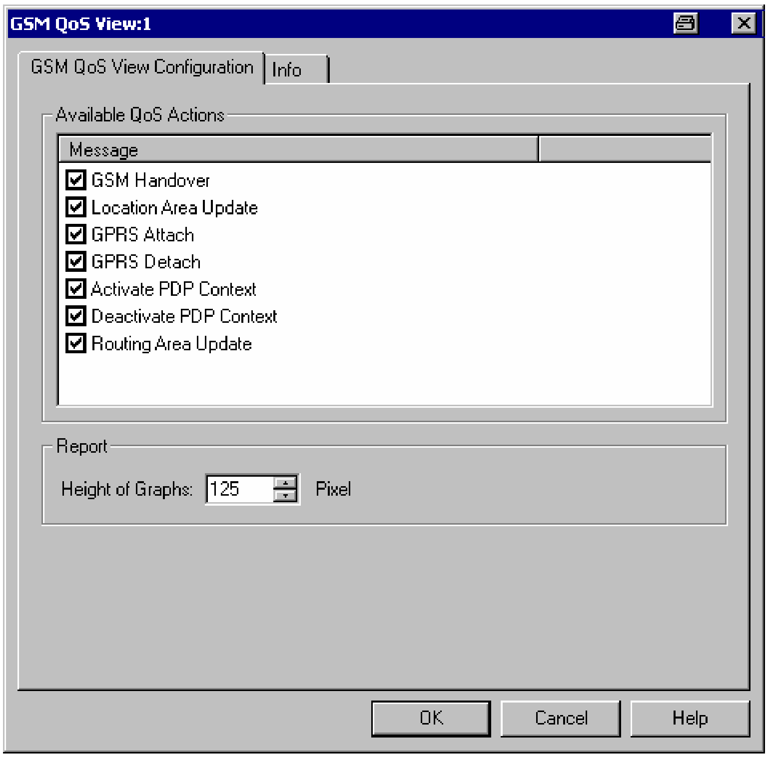


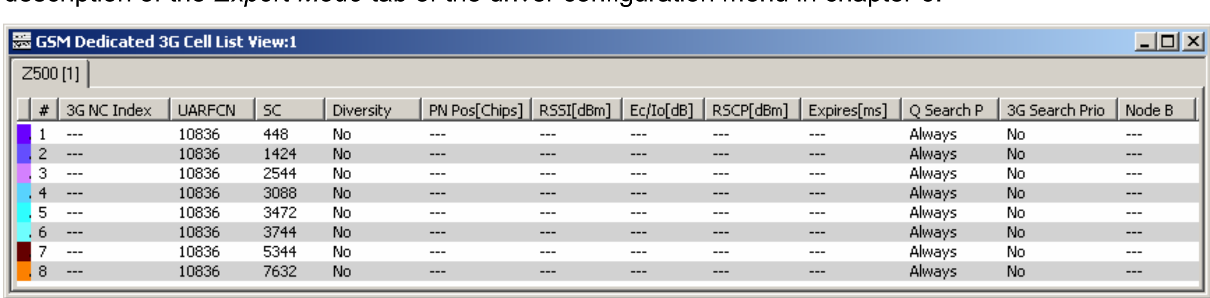
Fig. 4-149 GSM QoS View: GSM QoS View Configuration

Report - Height of Graphs Height of each graph in the range between 100 and 1000 pixels. The view can be scrolled if the height of the graphs and their number is increased.

GSM Dedicated 3G Cell List View

The *GSM Dedicated 3G Cell List View* shows an overview of the measured 3G cell parameters.

The view is empty unless the test mobile is configured to record the GSM 3G cell-related messages; see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.



#	3G NC Index	UARFCN	SC	Diversity	PN Pos[Chips]	RSSI[dBm]	Ec/Io[dB]	RSCP[dBm]	Expires[ms]	Q Search P	3G Search Prio	Node B
1	---	10836	448	No	---	---	---	---	---	Always	No	---
2	---	10836	1424	No	---	---	---	---	---	Always	No	---
3	---	10836	2544	No	---	---	---	---	---	Always	No	---
4	---	10836	3088	No	---	---	---	---	---	Always	No	---
5	---	10836	3472	No	---	---	---	---	---	Always	No	---
6	---	10836	3744	No	---	---	---	---	---	Always	No	---
7	---	10836	5344	No	---	---	---	---	---	Always	No	---
8	---	10836	7632	No	---	---	---	---	---	Always	No	---

Fig. 4-150 GSM Dedicated 3G Cell List View

The results for each mobile are arranged in a separate tab.

Cell List

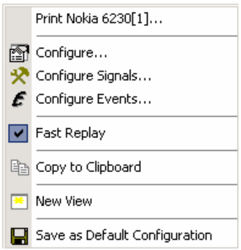
The cell list comprises the most important parameters of the serving cell and all other cells that are currently used for the connection; its members are permanently monitored and updated by the network.

Each table row represents a cell. Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order.

Color Symbol	Color code for the Primary SC as defined in the *Colors* tab of the configuration menu. The SC color codes are also described in the paragraph on scrambling code indication on p. 4.37.
#	Sequence number for the cell, assigned in chronological order and always starting with 1.
3G NC Index	Index of the cell in the 3G Neighborhood Cell List.
UARFCN	UTRAN Absolute Radio Frequency Channel Number (ARFCN) of the received DL signal. The carrier frequency is equal to *f = 0.2 MHz * UARFCN*
SC	Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.
Diversity	Downlink transmit diversity scheme for the CPICH: *STTD* (Space Time Transmit Diversity), *TSTD* (Time Switched Transmit Diversity), *SSDT* (Site Selection Diversity Transmit Power Control), or *No* Diversity
PN Pos. [Chips]	PN position in Chips, ranging from 0 to 38399.
RSSI [dBm]	The received signal strength indicator of the cell on the forward traffic channel, ranging from –109 to –21 dBm.
E_c/I_o *[dB]*	Ratio of the received energy per PN chip for the signal to the total received power spectral density on the P-CPICH. E_c/I_o is obtained in an unbiased measurement, i.e. the contribution of the noise floor to the powers is subtracted.
RSCP	CPICH Received Signal Code Power in dBm; the received power on one code, measured on the Primary CPICH.
Expires [ms]	Time until this cell loses its known status.
Q Search P	Quality threshold for reselection. L1 searches for 3G cells if the signal level is below or above the threshold value.
3G Search Prio	Flag indicating if the idle frames in dedicated or packet transfer mode can be used with priority for 3G measurements, when BSIC decoding is required.
Node B	Name of the node B, taken from the UMTS Node B database (if available).

The *SC* value for each active set element generates signals in the *UMTS – <Device> – Active Set* branch of the data tree.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM Dedicated 3G Cell List View Configuration

The *GSM Dedicated 3G Cell List View* configuration menu selects the columns in the view tables, defines the SC color scheme and displays information about the view version. It is opened via a right mouse click on a point inside *GSM Dedicated 3G Cell List View* or via the *Configuration – Settings* command (see chapter 3).

The *GSM Dedicated 3G Cell List View* tab displays the complete parameter set to be displayed in the *cell list* Clearing a parameter hides the column in the table.

Restricting the viewed results makes it easier to read the tables if only a subset of the available parameters is needed. To restrict the number of parameters measured and enhance the system performance, use the settings in the driver configuration menu (see chapter 6).

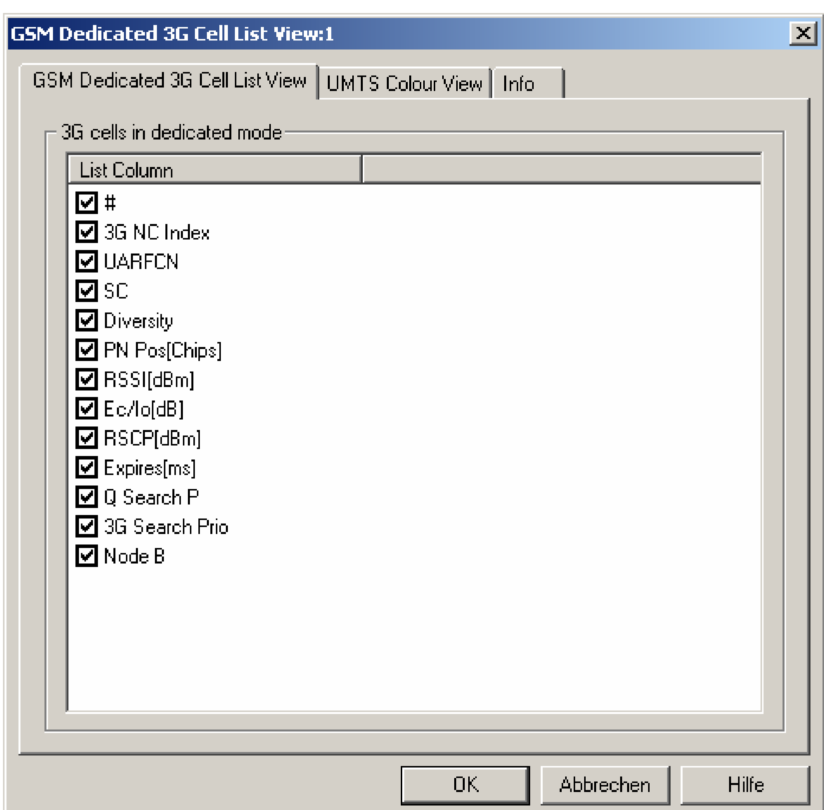


Fig. 4-151 GSM Dedicated 3G Cell List View: Configuration

The *GSM Dedicated 3G Cell List View* tab selects the list information to be displayed in the cell ist.

The *UMTS Color View* tab of the *GSM Dedicated 3G Cell List View* configuration menu is analogous to the *Color Settings* tab of the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

GSM Idle 3G Cell List View

The *GSM Idle 3G Cell List View* shows an overview of the 3G cell parameters for measured idle cells.

The view is empty unless the test mobile is configured to record the GSM 3G idle cell-related messages; see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.

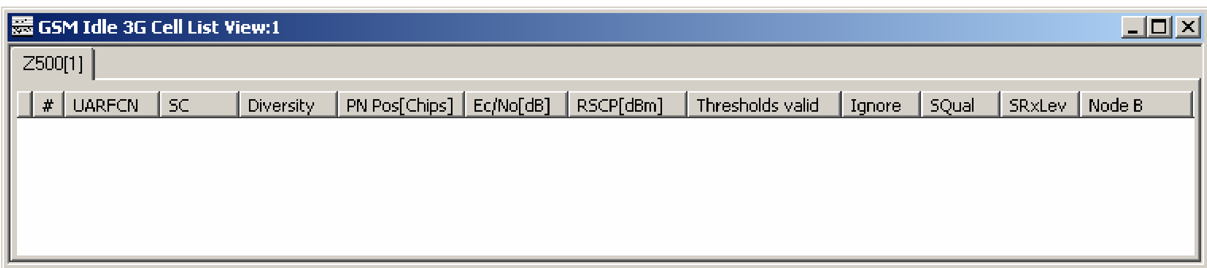


Fig. 4-152 GSM Idle 3G Cell List View

The results for each mobile are arranged in a separate tab.

Cell List The cell list comprises the most important parameters of the 3G cells that are currently available for the connection; its members are permanently monitored and updated by the network.

Each table row represents a cell. Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order.

Color Symbol Color code for the Primary SC as defined in the *Colors* tab of the configuration menu. The SC color codes are also described in the paragraph on scrambling code indication on p. 4.37.

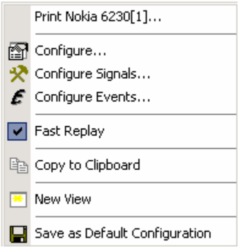
\# Sequence number for the cell, assigned in chronological order and always starting with 1.

UARFCN UTRAN Absolute Radio Frequency Channel Number (ARFCN) of the received DL signal.
The carrier frequency is equal to $f = 0.2\ MHz * UARFCN$

SC Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.

Diversity	Downlink transmit diversity scheme for the CPICH: *STTD* (Space Time Transmit Diversity)*, TSTD* (Time Switched Transmit Diversity), *SSDT* (Site Selection Diversity Transmit Power Control), or *No* Diversity
PN Pos. [Chips]	PN position in Chips, ranging from 0 to 38399.
E_c/N_o *[dB]*	Ratio of the received energy per chip to the total received power density in the band.
RSCP [dBm]	Unbiased Integral Received Signal Code Power for all measured peaks in dBm.
Thresholds valid	Indicates if GSM L1 should apply cell reselection criterion S to be reported to the RR layer (see standard 3GPP TS 25.304).
Ignore	Indicates if GSM L1 is not supposed to report this cell to the RR layer.
SQual	Cell Selection Quality quality value, this parameter is used in the cell reselection criterion S.
SRxLev	Cell Selection RxLevel value, this parameter is used in the cell reselection criterion S.
Node B	Name of the closest node B with the corresponding SC and ARFCN.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM Idle 3G Cell List View Configuration

The *GSM Dedicated 3G Cell List View* configuration menu selects the columns in the view tables, defines the SC color scheme and displays information about the view version. It is opened via a right mouse click on a point inside *GSM Dedicated 3G Cell List View* or via the *Configuration – Settings* command (see chapter 3).

The *GSM Dedicated 3G Cell List View* tab displays the complete parameter set to be displayed in the *cell list* Clearing a parameter hides the column in the table.

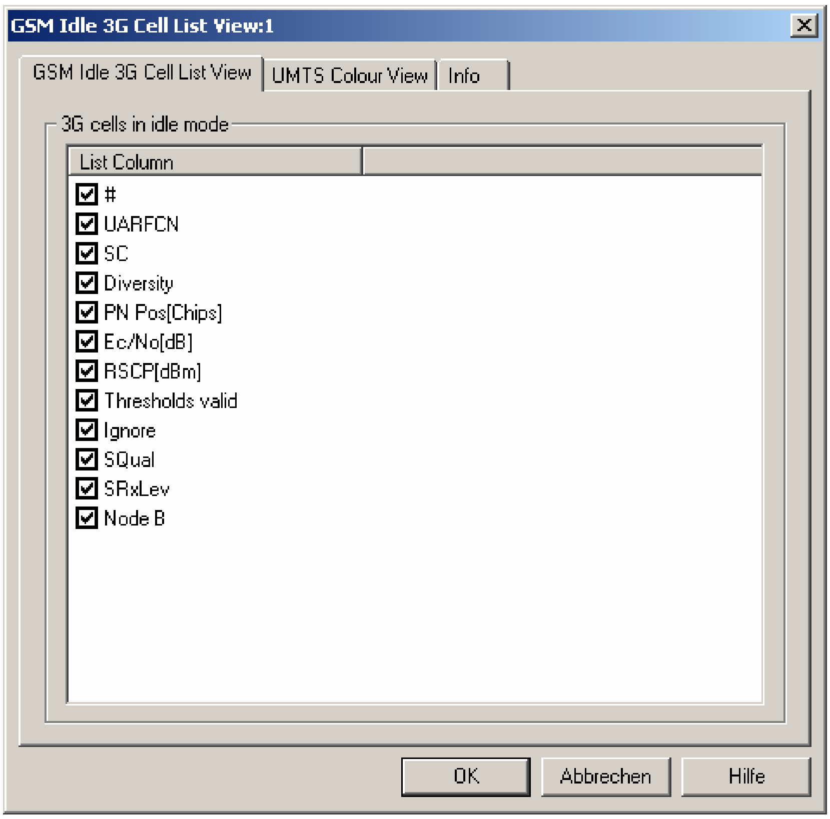


Fig. 4-153 GSM Idle 3G Cell List View: Configuration

The *GSM Idle 3G Cell List View* tab selects the list information to be displayed in the cell ist.

The *UMTS Color View* tab of the *GSM Idle 3G Cell List View* configuration menu is analogous to the *Color Settings* tab of the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

GSM RR 3G Reselection Measurements View

The *GSM RR 3G Reselection Measurements View* shows an overview of the measured Radio Resource 3G reselection parameters.

The view is empty unless the test mobile is configured to record the GSM RR-related messages; see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.

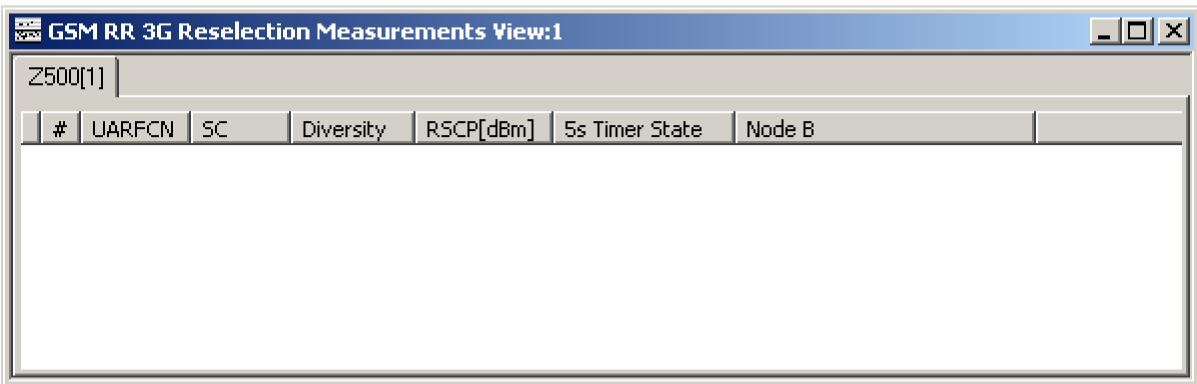


Fig. 4-154 GSM RR 3G Reselection Measurements View

The results for each mobile are arranged in a separate tab.

Cell List The cell list comprises the most important parameters of the 3G cells that are involved in layer 3 RR reselection measurements.

Each table row represents a cell. Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order.

Color Symbol Color code for the Primary SC as defined in the *Colors* tab of the configuration menu. The SC color codes are also described in the paragraph on scrambling code indication on p. 4.37.

\# Sequence number for the cell, assigned in chronological order and always starting with 1.

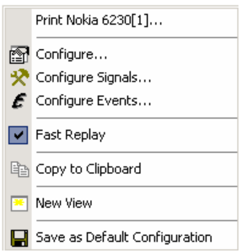
UARFCN UTRAN Absolute Radio Frequency Channel Number (ARFCN) of the received DL signal.
The carrier frequency is equal to $f = 0.2\ MHz * UARFCN$

SC Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.

Diversity Downlink transmit diversity scheme for the CPICH: *STTD* (Space Time Transmit Diversity), *TSTD* (Time Switched Transmit Diversity), *SSDT* (Site Selection Diversity Transmit Power Control), or *No* Diversity

RSCP [dBm]	Unbiased Integral Received Signal Code Power for all measured peaks in dBm.
5s Timer State	State of the 5s Timer (Stopped / Running / Expired)
Node B	Name of the closest node B with the corresponding SC and ARFCN.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM RR 3G Reselection Measurements View Configuration

The *GSM RR 3G Reselection Measurements View* configuration menu selects the columns in the view tables, defines the SC color scheme and displays information about the view version. It is opened via a right mouse click on a point inside *GSM RR 3G Reselection Measurements View* or via the *Configuration – Settings* command (see chapter 3).

The *GSM RR 3G Reselection Measurements View* tab displays the complete parameter set to be displayed in the cell list Clearing a parameter hides the column in the table.

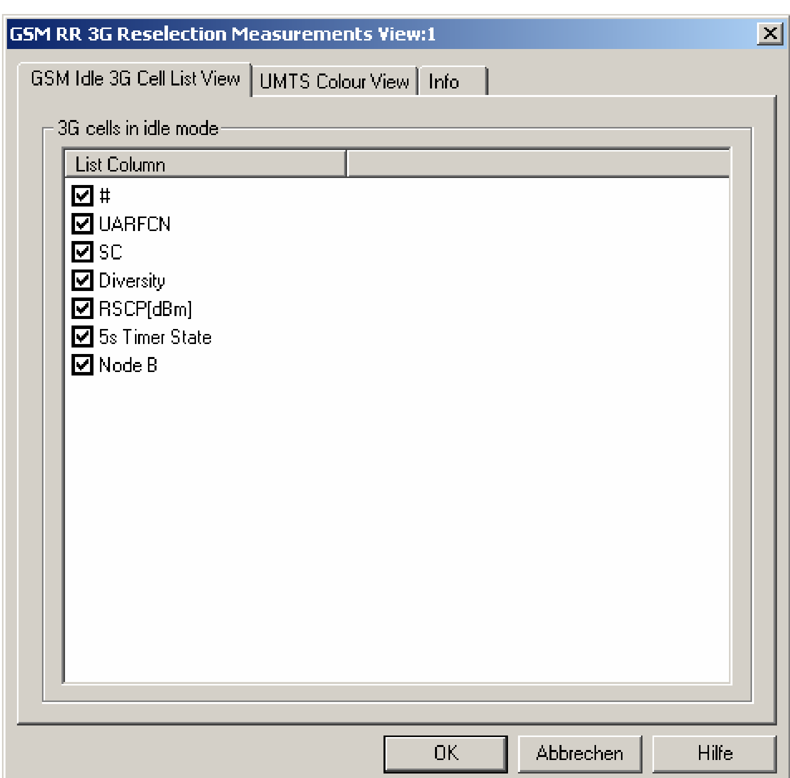


Fig. 4-155 GSM RR 3G Reselection Measurements View: Configuration

The *GSM RR 3G Reselection Measurements View* tab selects the list information to be displayed in the cell ist.

The *UMTS Color View* tab of the *GSM RR 3G Reselection Measurements View* configuration menu is analogous to the *Color Settings* tab of the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

GSM Rejected 3G Cells View

The *GSM Rejected 3G Cells View* shows an overview of the determined 3G cell parameters for rejected cells.

The view is empty unless the test mobile is configured to record the GSM L3 RR 3G rejected cell-related messages; see description of the *Expert Mode* tab of the driver configuration menu in chapter 6.

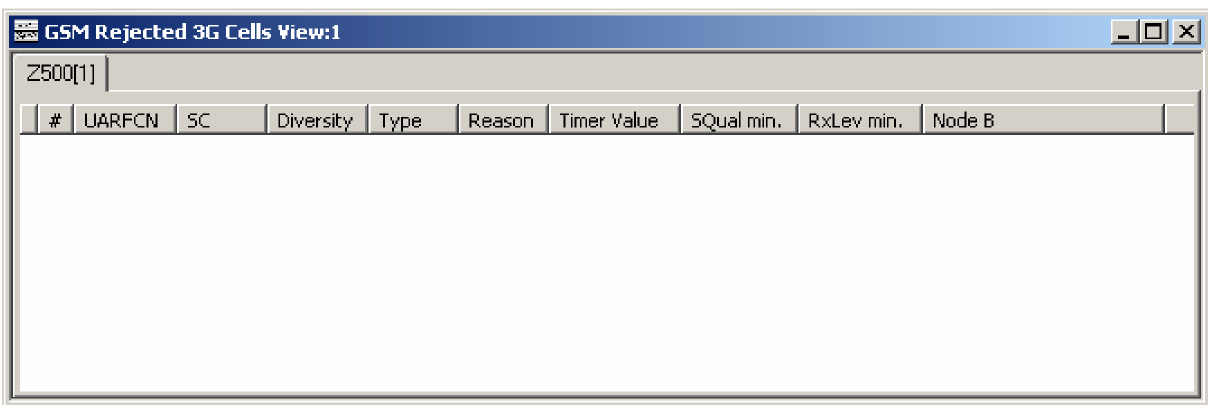


Fig. 4-156 GSM Rejected 3G Cells View

The results for each mobile are arranged in a separate tab.

Cell List

The cell list comprises the most important parameters of the 3G cells that have a registration result of "rejected"; its members are permanently monitored and updated by the network.

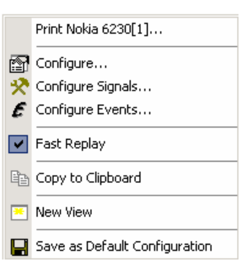
Each table row represents a cell. Clicking an entry in the table heading sorts the cells according to the corresponding parameter. A gray triangle in the heading pointing upward (downward) indicates that the table is sorted in ascending (descending) order.

Color Symbol — Color code for the Primary SC as defined in the *Colors* tab of the configuration menu. The SC color codes are also described in the paragraph on scrambling code indication on p. 4.37.

— Sequence number for the cell, assigned in chronological order and always starting with 1.

UARFCN	UTRAN Absolute Radio Frequency Channel Number (ARFCN) of the received DL signal. The carrier frequency is equal to *f = 0.2 MHz * UARFCN*
SC	Primary scrambling code of the signal in the format selected in the *TEC for UMTS Test Mobiles* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. The primary SC is used to identify the cell.
Diversity	Downlink transmit diversity scheme for the CPICH: *STTD* (Space Time Transmit Diversity), *TSTD* (Time Switched Transmit Diversity), *SSDT* (Site Selection Diversity Transmit Power Control), or *No* Diversity
Type	Reject type as defined by Radio Resource Control (RRC): *Threshold* (RRC delivered a threshold) or *Timer* (RRC delivered a timer value)
Reason	Reason for the rejection. Possible reasons include: NONE, INVALID_STATE, CELL_BARED, PLMN_MISMATCH, LOW_S_VALUE, AQUISITION_FAIL, SIBS_FAILED_LOWER_LAYERs, INVALID_SIBS, SIBS_TIMEOUT, SIBS_FAILED_OTHER, FORBIDDEN_LA, CELL_QUAL_FAILURE, CELL_NOT_SUITABLE, CELL_NOT_EVALUATED, or CELL_CHANGE_FAILURE
Timer Value	Time (in seconds) when the same cell should be reconsidered.
SQual min.	Minimum Cell Selection Quality value [dB], the parameter is used in the cell reselection criterion S for FDD cells.
RxLev min.	Threshold value [dBm] to be applied to Ec/No measurements
Node B	Name of the closest node B with the corresponding SC and ARFCN.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM Rejected 3G Cells View Configuration

The *GSM Rejected 3G Cells View* configuration menu selects the columns in the view tables, defines the SC color scheme and displays information about the view version. It is opened via a right mouse click on a point inside *GSM Rejected 3G Cells View* or via the *Configuration – Settings* command (see chapter 3).

The *GSM Rejected 3G Cells View* tab displays the complete parameter set to be displayed in the cell list Clearing a parameter hides the column in the table.

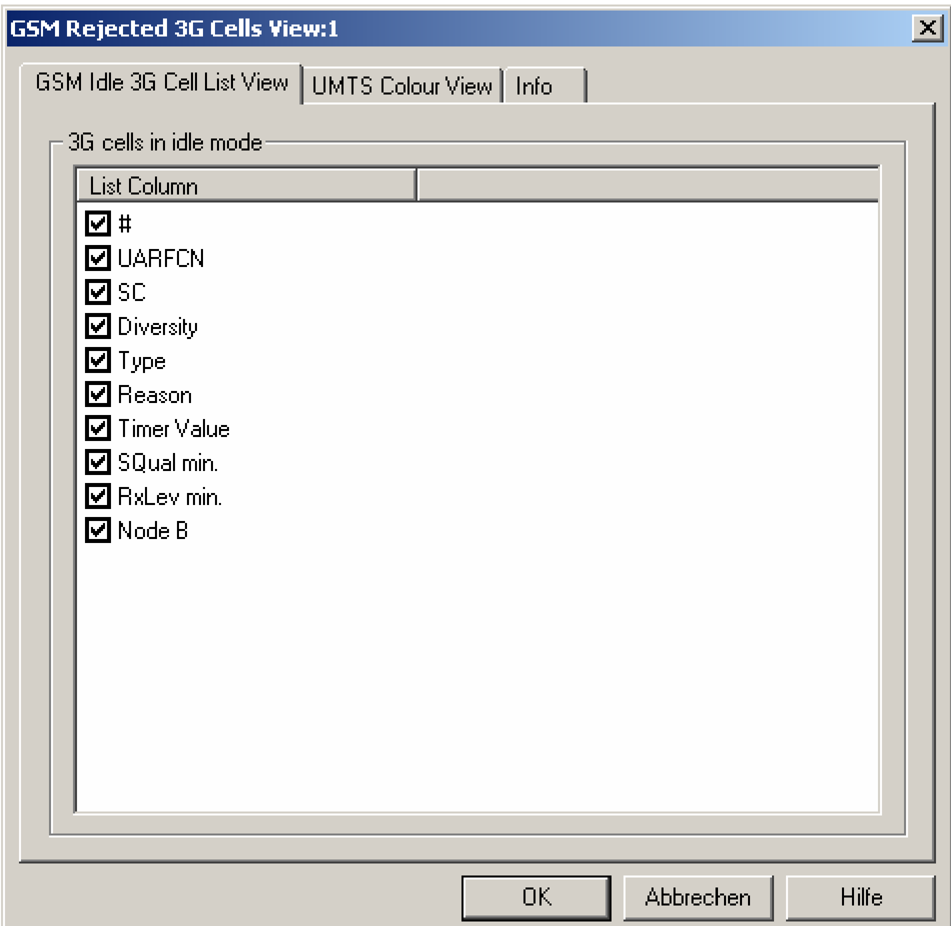


Fig. 4-157 GSM Rejected 3G Cells View: Configuration

The *GSM Rejected 3G Cells View* tab selects the list information to be displayed in the cell list.

The *UMTS Color View* tab of the *GSM Rejected 3G Cells View* configuration menu is analogous to the *Color Settings* tab of the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

GSM RR 3G Reselection Measurements Parameters View

The *GSM RR 3G Reselection Measurements Parameters View* shows the parameters used for the Radio Resource 3G Reselection measurements described in the previous sections.

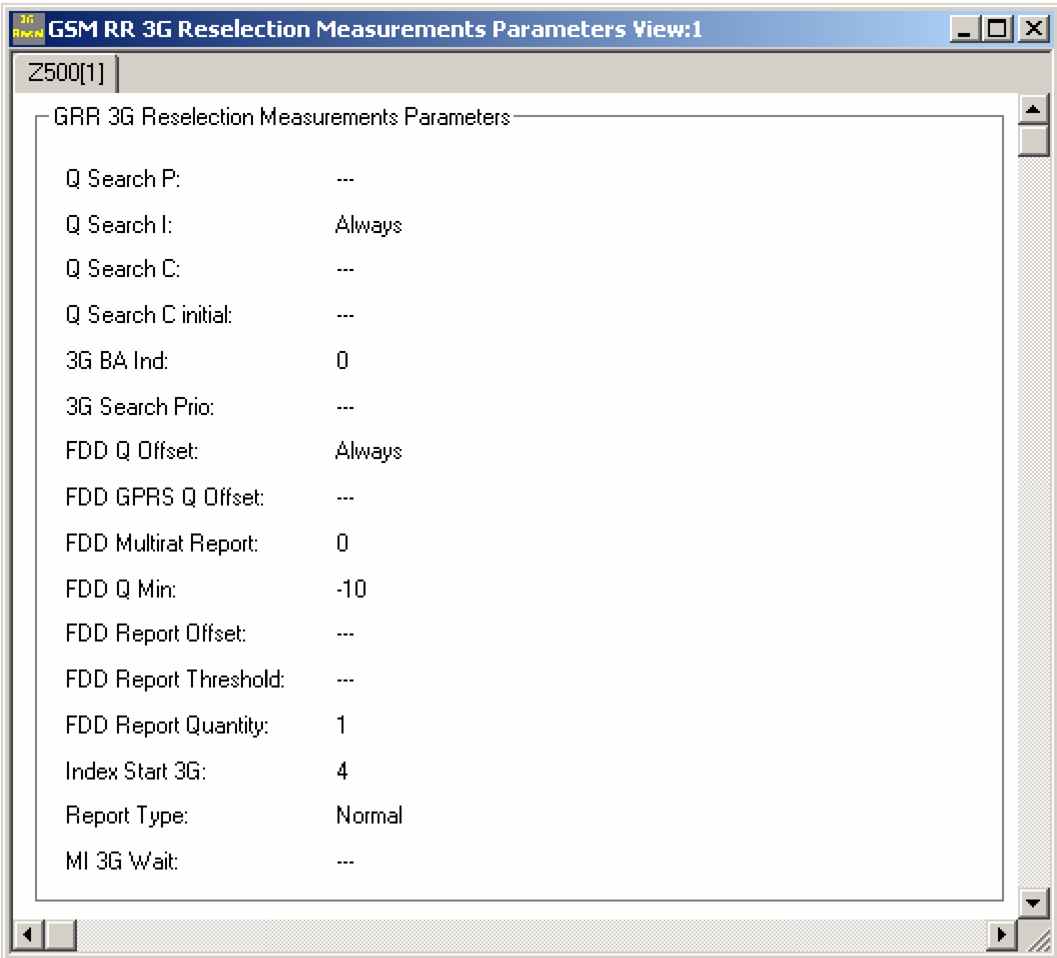


Fig. 4-158 GSM RR 3G Reselection Measurements Parameters View

GSM 3G Reselection Measurement Parameters

The *GSM RR 3G Reselection Measurements Parameters View* panel displays the parameters used for the Radio Resource 3G Reselection measurements described above. Additional information on these parameters is available in standard 3GPP TS 51.010.

Q Search P — Q Search P defines a threshold and also indicates whether these measurements shall be performed when RLA_P of the serving cell is below or above the threshold.

Q Search I — For a multi-RAT MS, cells or frequencies with other radio access technologies may be included in 3G Cell Reselection list (see 3GPP TS 04.18). The network controls the measurements for reselection of idle cells by the parameter Qsearch_I broadcast on BCCH. Qsearch_I defines a threshold and also indicates whether these measurements shall be performed when RLA_C of the serving cell is below or above the threshold. The value of 7 indicates to always search for neighboring 3G cells, a value of 15 disables the search. Search for 3G cells if signal level is below (0-7) or above (8-15) threshold

0 = - 98 dBm, 1 = - 94 dBm, … , 6 = - 74 dBm,
7 = ∞ (always), 8 = - 78 dBm, 9 = - 74 dBm, … ,
14 = - 54 dBm, 15 = ∞ (never).
Default value = ∞ (never).

Q Search C

As defined in 3GPP TS 45.008, the Q Search C parameter defines a threshold and also indicates whether the mobile measures 3G cells when the average signal level (RxLevel) of the BCCH carrier is below (0-7) or above the threshold (8-15). The value of 7 indicates to always search for neighboring 3G cells, a value of 15 disables the search.

Search for 3G cells if signal level below threshold (0-7):
- 98, - 94, … , - 74 dBm, ∞(always)
or above threshold (8-15):
- 78, - 74, … , - 54 dBm, ∞(never)

Q Search C initial

Indicates the Q Search Cvalue to be used in connected mode before Q Search C is received,
0 = use Q Search I, 1 = ∞(always).
Default value = use Q Search I.

3G BA Ind.

The 3G_BA_IND message type parameter is needed to identify set of 3G Neighbour Cell information used for reporting in dedicated mode. The value received is reflected in the Measurement Report and Enhanced Measurement Report messages as described in standard 3GPP TS 04.18.

3G Search Prio

This parameter indicates if 3G cells may be searched when BSIC decoding is required. With 3G Search Prio set to On, the MS attempts to demodulate the SCH on the BCCH carrier of as many surrounding cells as possible, and to decode the BSIC as often as possible, as a minimum at least once every 10 seconds. A multi-RAT MS is allowed to extend this period to 13 seconds, if the neighbour cell list contains cells from other RATs. With 3G Search Prio set to Off, the BSIC is also decoded, but only 2G neighbor cells are monitored.

FDD Q Offset

FDD Q min, *FDD Q Offset* and optionally *FDD RSCP min* and *FDD Qmin Offset* are broadcast on BCCH of the serving cell.

FDD Q Offset applies an offset to *FDD Q min* value:
0 = 0 dB, 1 = 2 dB, 2 = 4 dB, 3 = 6 dB,
4 = 8 dB, 5 = 10 dB, 6 = 12 dB, 7 = 14 dB.
Default value = 0 dB.

FDD GPRS Q Offset

Applies an offset to RLA_P for cell re-selection to access technology/mode: default is –12dB.

FDD MultiRAT Report	The parameter *FDD MultiRAT Report* indicates a number of cells to be reported in a measurement, e.g. "1" (one cell) report message and does not include the number of places taken by RSSI reporting in the measurement report message. If no measurements have been performed on a cell since last report, the cell shall not be included in the report. The *FDD MultiRAT Report* parameter is broadcast on BCCH and PBCCH. An MS attached to GPRS uses the parameter broadcast on PBCCH if it exists. In all other cases, the MS uses the parameters broadcast on BCCH.
FDD Q Min.	*FDD Q min* is defined as the minimum threshold for Ec/No for UTRAN FDD cell reselection, its default value is -12 dB.
FDD Report Offset	The *FDD Report Offset* parameter applies an offset to the reported value when prioritising the cells for reporting for GSM frequency band or access technology/mode FDD. Possible values are: 0 (0 dB), 1 (6 db), … , 7 (42 dB). The default value is 0 dB.
FDD Report Threshold	The *FDD Report Threshold* parameter applies priority reporting if the reported value is above the thus defined threshold for GSM frequency band or access technology/mode FDD. The default value is "always"
FDD Report Quantity	The parameter FDD Report Quantity is used to specify whether the MS reports the results of the P-CPICH level measurement of the neighboring 3G cells as RSCP or as E_c/N_o. e.g. 0 = RSCP, 1 = E_c/N_o
Index Start 3G	Each 3G Neighbour Cell Description received is added to the 3G Neighbour Cell list, starting with the index equal to the parameter *Index Start 3G*. If this parameter is not present then the value 0 is used. For each 3G Neighbour Cell Description, the cells are indexed in the following order: 1) UTRAN FDD cell ARFCNs are indexed in the order of occurrence in the 3G Neighbour Cell description. Then, for each FDD ARFCN, the cells are indexed in the order of increasing values of the decoded FDD_CELL_INFORMATION parameters. 2) UTRAN TDD cell ARFCNs are indexed in the order of occurrence in the 3G Neighbour Cell description. Then, for each TDD ARFCN, the cells are indexed in the order of increasing values of the decoded TDD_CELL_INFORMATION parameters. 3) CDMA 2000 cells are indexed in the order of occurrence in the 3G Neighbour Cell description.
Report Type	The condition for sending the Packet Enhanced Measurement Report message instead of the Packet Measurement Report message is based on the *Report Type* parameter and if the MS has received BSIC information

for all cells.

MI 3G Wait — The 3G Neighbour Cell list (either from SI2quater or from PSI3quater) is used for reporting when the MS enters dedicated mode, until the MS has received a given number of instances of Measurement Information (MI) messages that contain 3G Neighbour Cell Description. This number of instances is defined by the *MI 3G-Wait* parameter.

The *GSM RR 3G Reselection Measurements Parameters View* has no configuration menu. The *Info* tab can be accessed via the *Configuration – Settings* command.

GSM Neighborhood Analyzer View

The *GSM Neighborhood Analyzer View* shows the results of the neighborhood analysis of option ROMES-U1. The objective of this analysis is to reveal possible conflicts between the current serving cell and the transmitters in the neighborhood in order to assess the general condition of a UMTS / GSM network. To this end the neighborhood analyzer post-processes GSM test mobile, and GSM scanner data (e.g. TopN data) and compares them with the information stored in a BTS database (see description of ATD files in chapter 7, in particular the neighbor cell column 2GNC). In case of a mismatch between the detected BTSs and the BTSs in the database, an alarm is generated. The same holds if a missing neighbor of the serving cell is found.

The neighborhood analysis requires option ROMES-U1, *Handover and Neighborhood Analysis.*
PN scanner data recorded with a TSMx are needed. Data from a UMTS test mobile and GSM scanner data can be used in addition to refine and extend the analysis.

The neighborhood analyzer is a performance-critical tool which must be activated explicitly in the *GSM Neighborhood Analyzer View* configuration menu.

The UMTS/GSM Handover Analysis of inter-RAT handovers, which is also part of option ROMES-U1, is evaluated in the UMTS/GSM Handover Analyzer View; see p. 4.252.. GSM 2G/2G handovers are *evaluated in the GSM Handover View; see p. 4.217.*

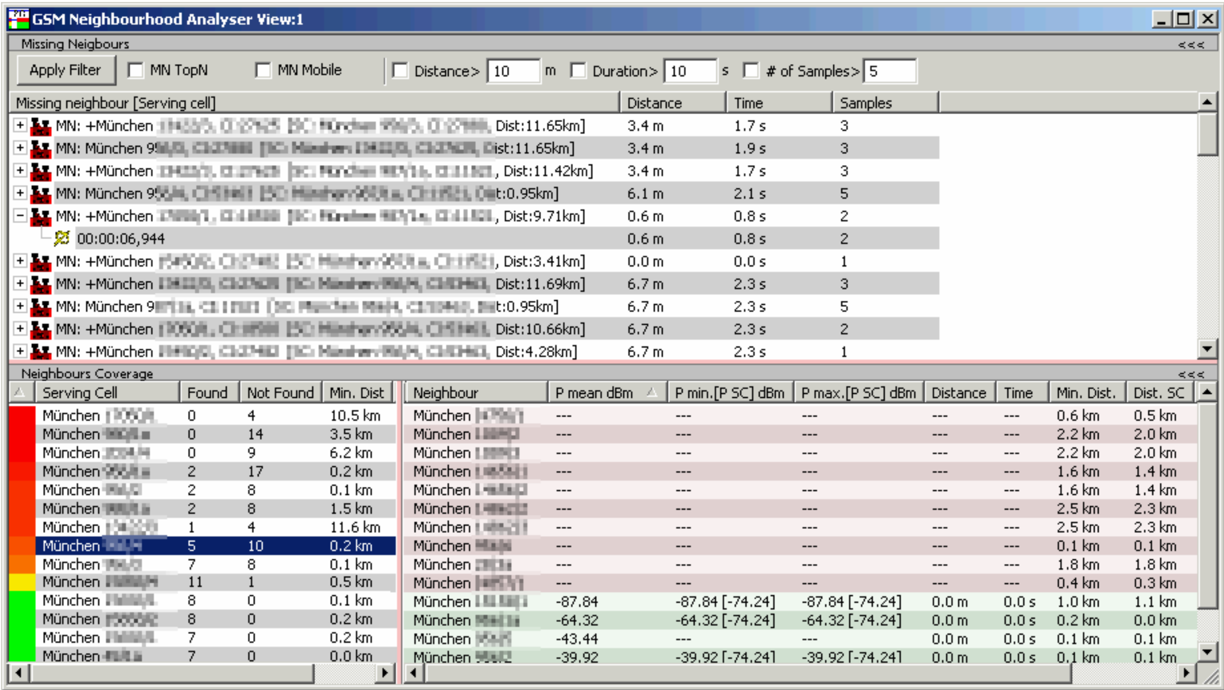


Fig. 4-159 GSM Neighborhood Analyzer View

Neighborhood analysis

The PN scanner results for a particular top N pool (configured in the GSM PNS driver configuration menu and selected for the neighborhood analysis using the *GSM Neighborhood Analyzer View)* provide the essential data for the neighborhood analysis. The analysis involves several steps:

- The top N pool member with the strongest PSCH level (1st top N member) is rated as the best server; its ARFCN, SC, and geographical position (and CI, if the PN scanner is able to decode it) is compared with the entries in the BTS database.
- If possible, the best server is determined, and the neighbors list is compared with the neighbors list in the BTS database.
- When a Top N serving cell is removed from the pool, the related nmissing neighbor conditions are dropped. For the remaining top N members the analyzer checks the related neighbor coverage; see below.

The results are updated whenever the top N pool members change. ROMES creates one of the events described below whenever a problem is detected. The conditions for the analysis can be modified in the *GSM Neighborhood Analyzer View.*

View

The view is divided into an upper *Missing Neighbors* and a lower *Neighbors Coverage* section. A click on one of the title bars shows or hides the corresponding section. A hidden section leaves more space for the other section. A hidden section is characterized by the symbol >>> (instead of <<<) in the title bar. On pausing on the title bar, the cursor displays a compress symbol.

Filter

The checkboxes across the top of the result tree define filter conditions for the missing neighbors displayed in the result tree.

Apply Filter updates the result tree in accordance with the current filter conditions.

Missing Neighbors

The missing neighbor result tree consists of the following columns:

Missing Neighbor [Serving Cell]

Name of the serving cell for which a missing neighbor was detected. GSM base stations are listed with their name, BCCH, and BSIC. Detailed information (e.g. the time when the missing neighbor was detected) is listed below the missing neighbor. It is possible to expand or collapse the detailed information for a single missing neighbor (click the + / – symbols or double-click the line) or all missing neighbors (use the context menu).

Distance

Covered distance during which a neighbor was classified as a missing neighbor. The accuracy depends on the time and distance trigger settings.

Time

Time during which a neighbor was classified as a missing neighbor. The accuracy depends on the time and distance trigger settings.

Samples

Number of samples acquired while a neighbor was classified as a missing neighbor.

Every row in the *Missing Neighbors* list has a starting time which can be used with the *Coupled Focus* functionality (see chapter 3) to sychronize with other views, e.g. with the *GSM NWS Top N View* and the *GSM Measurement Report View.*

Neighbors Coverage

The *Neighbors Coverage* panel is divided in two lists:

- The list on the left half of the panel shows a color code (ranging from red to green, depending on the ratio of measured to total neighbors), the related serving cell, the number of found neighbors (from the measurement) the number of neighbors not found (fron comparison with the BTS database) and the minimum distance of the Serving cell from the measurement route. A click on a row fills the Neighbor detail list on the right side, a double-click (when a Tooltip-"D" is visible on the mouse cursor) shows a popup window with the BTS cell information from the BTS database.
- The list on the right half of the panel shows all neighbor cells of the selected serving cell. The neighbors which were no found have a pale pink row background, the found neighbors have a pale green row background. The following values are displayed, if they were measured:

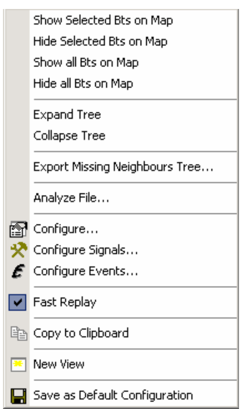
  Neighbor — Name of the neighbor GSM base station.

  P mean [dBm] — Averaged RxLev of the serving cell, calculated from the PNS scanner data.

  P min [P SC] dBm — Minimum measured RxLev of the serving cell at the current route position.

P max [P SC] dBm	Maximum measured RxLev of the serving cell at the current route position.
Distance	Covered distance during which a neighbor was classified as a missing neighbor.
Time	Time during which a neighbor was classified as a missing neighbor. The accuracy depends on the time and distance trigger settings.
Min. Dist.	Minimum distance between the cell and the route.
Dist. SC	Distance between the serving cell and the route.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, activate the fast replay mode, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2. The context menu provides the following additional, view-specific commands:

Show Selected BTS…
: Use the color code defined in the *GSM Neighborhood Analyzer View* configuration menu (see below) to visualize the best servers, potential interferers, and missing neighbors in the *Route Track* view. This feature is only available while a best server is selected in the result tree. The GSM BTS layer in the *Route Track* view must be visible to use this feature.

Hide Selected BTS…
: Remove the previous action, display the selected cell symbol with standard colors.

Show all BTS...
: Display all cell symbols with the color codes defined in the *GSM Neighborhood Analyzer View* configuration menu.

Hide all BTS…
: Display all cell symbols with standard colors.

Expand/Collapse Tree
: Show or hide the additional information for each serving cell in the *Results Tree*.

Export…
: Export the information in the result tree or in the message list to a *.csv export file that can be opened and processed by MS Excel.

Analyze File...
: With an active *Missing Neighbors* list, the measurement data in the current CMD file is analyzed and the results are displayed.

GSM Neighborhood Analyzer View Configuration

The *GSM Neighborhood Analyzer View* configuration menu enables the neighborhood analyzer, defines criteria for the analysis, and specifies the color scheme for the BTS symbols in the *Route Track View*. It is opened via a right mouse click on a point inside *GSM Neighborhood Analyzer View* or via the *Configuration – Settings* command (see chapter 3).

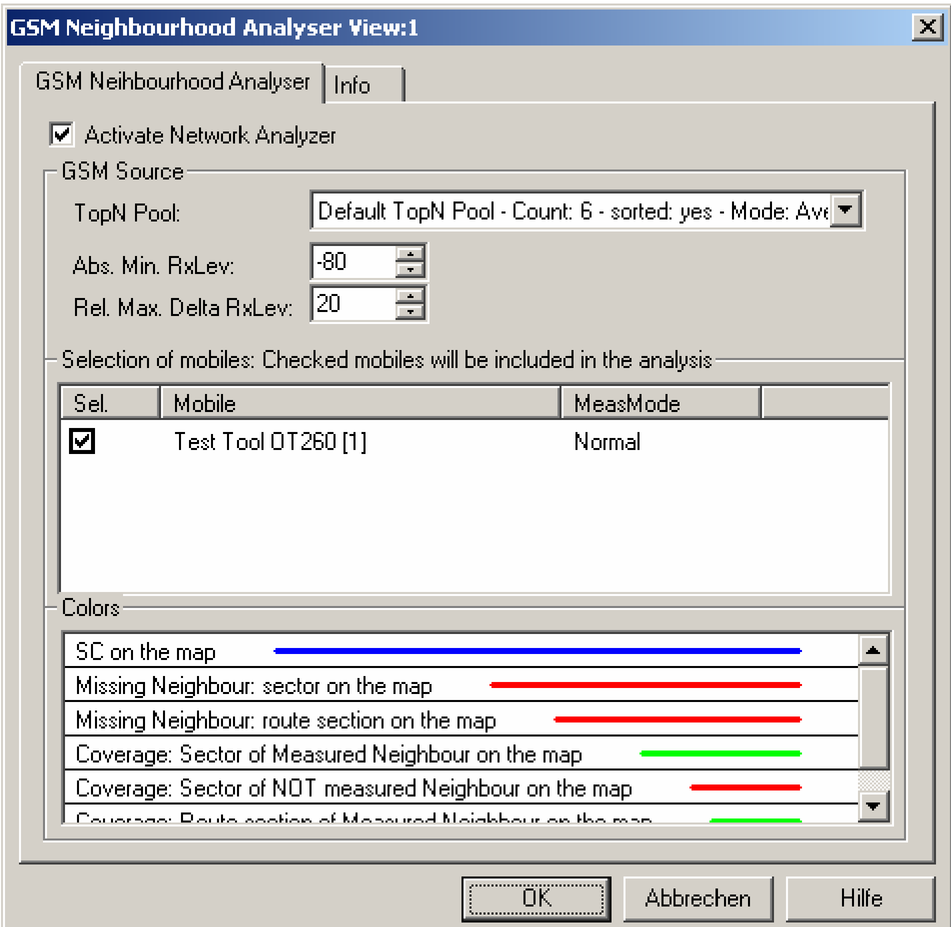


Fig. 4-160 GSM Neighborhood Analyzer View: Configuration

Activate Network Analyzer

The network analyzer must be enabled explicitly in order to post-process the measured data and obtain the results in the *GSM Neighborhood Analyzer View.* This holds for the data viewed during the measurement tour as well as for replayed measurement files. The *GSM Neighborhood Analyzer View* is empty if the neighborhood analyzer is disabled.

The necessary hardware drivers must be loaded or a measurement (.cmd) file must be open in order to enable the network analyzer, select the data sources, or define the criteria for the analysis. After starting up ROMES, only the *Route Track Settings* are accessible.

GSM Sources

The drop-down list in the *GSM Sourcs* panel contain all GSM test devices involved in the measurement. The list is populated when the device drivers are loaded or when a measurement file is opened for replay.

Note:
The neighborhood is automatically disabled when the selected data sources are no longer available, e.g. because a new measurement file is loaded.

Top N Pool
The neighborhood analysis requires a PN scanner with a *Top N* pool containing the N observed BTSs with the strongest signal level. The top N pools can be configured in the *GSM PNS* driver configuration menu as described in chapter 6.

Abs. Min. RxLev
BTSs measured with values below the defined *Abs. Min. RxLev* threshold are not considered in the neighborhood analysis scan.

Rel. Max. Delta RxLev
For every evaluated BTS serving cell it is checked whether or not the other members of the Top N pool as neighbors yield a better Delta RxLev than defined here. If such a BTS is found which is not declared as a neighbor cell, a list entry with al relevant data is created (similar to the entry of a Problem Node B in the UMTS Neighborhood analysis).

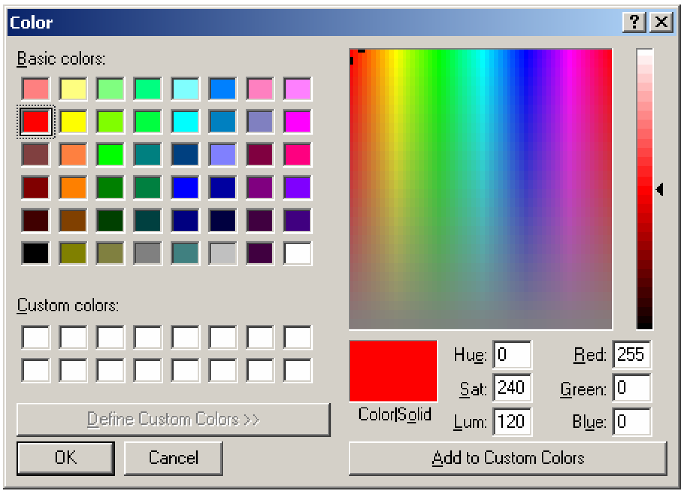
Note:
In addition to the measured data the neighborhood analysis requires a separate GSM BTS list with included neighbor cell information (see description of ATD files in chapter 7). The column 2GNC must contain the LAC, MNC, and MCC of each GSM BTS. The import of BTS list files is described in chapter 3.

Selection of mobiles

List of all mobiles measured with their measurement mode. An arbitrary number of mobiles can be selected from the list (click checkboxes). Only the measurement reports for selected mobiles are displayed in the *GSM Neighborhood Analyzer View*.

Colors

The *Colors* panel changes the colors of all display elements. Double-clicking an element of the list opens the *Colors* dialog (see p. 4.322) to modify the current display color.



The resulting elements are then colored accordingly in the related *Route Track* view (see p. 4.37)

UMTS/GSM NQA State View

The *UMTS/GSM NQA State View* tracks the NQA states and state transitions of each call in detail.

The view is empty unless the *Network Quality Analysis (NQA)* was active during recording. Moreover, it requires one of the measurement modes *NORMAL* or *CAMP* to be set and the *Autodial* function to be active. To obtain the complete information, a *Constant Call Pattern (ETSI Specification)* must be selected in the *Autodialing* tab of the driver configuration menu and the data must be recorded with a ROMES version V3.25 or higher. All driver settings and call classes are explained in chapter 6.

The *UMTS/GSM NQA State View* is complemented by the *2G/3G NQA View* (see p. 4.271), representing the call statistics during the entire measurement.

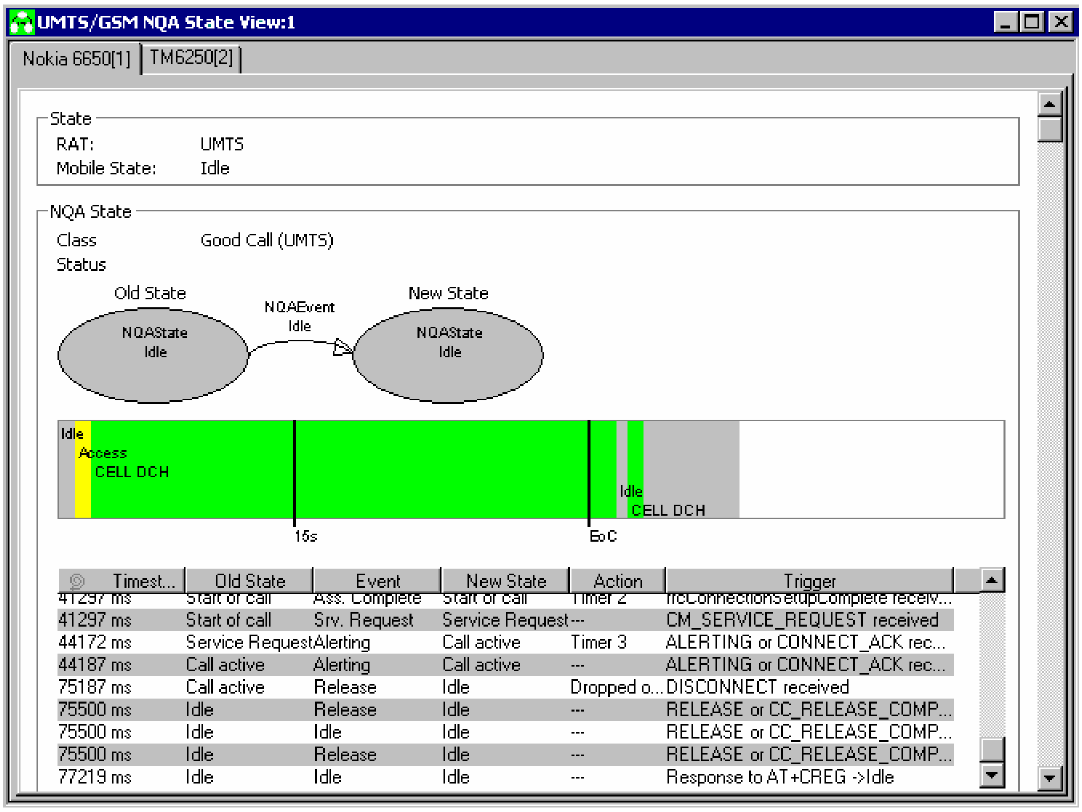


Fig. 4-161 UMTS/GSM NQA State View

State Current Radio Access Technology (RAT, either UMTS or GSM) and mobile state.

TIP *The mobile states correspond to the Phone Mode signal; see p. 4.13.*

NQA State Diagrams Call class of the current call *(Start of Call, Good Call, Dropped Call, Blocked Call, No Service Call;* see description of NQA driver settings in chapter 6) and status (no indication or *Noisy).*

The upper diagram displays the previous NQA state *(Old State)*, the NQA event that caused a state transition, and the current NQA state *(New State).* The contents of the diagram change after each mobile state transition.

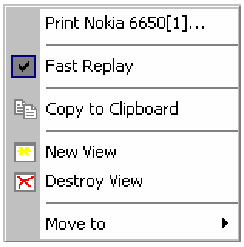
The lower diagram shows the evolution in time of the current call. The consecutive mobile states are plotted with different colors. The timing parameters are defined in the *Autodialing* tab of the driver configuration menu:

Time zero	Start of the call
First vertical line	*Max. Access Time*
Second vertical line	Expected end of the call = actual access time + *Call Duration*
Diagram width	Duration of the *Call Window*.

NQA State Table

All state transitions are listed in the table below the NQA state diagrams. Each table row describes one state transition. In addition to the information in the NQA state diagrams, the list also displays the exact reason for the state transition *(Action* and *Trigger* columns).

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *UMTS/GSM NQA State View* has no configuration menu. The *Info* tab can be accessed via *Configuration – Settings*.

UMTS/GSM Handover Analyzer View

The *UMTS/GSM Handover Analyzer View* shows a list of the UMTS (3G –> 3G), GSM (2G –> 2G), and inter-RAT (3G –> 2G) handover procedures attempted by UMTS or GSM mobile phones and provides a statistical evaluation. The list and the statistics are displayed in two alternative views. It is possible to open several *UMTS/GSM Handover Analyzer Views* simultaneously in order to observe the list and the statistical views in parallel.

The handover analysis requires option ROMES-U1, *Handover and Neighborhood Analysis.* The view is empty unless the test mobile records the *Layer 3 Messages*; see description of the *Expert Mode* or *Nokia Settings* tabs in the UMTS mobile driver configuration menus. Moreover, the handover analysis must be activated in the *HOA* tab of the driver configuration menu.

The UMTS/GSM Handover Analyzer View *shows the handover types that can occur between GSM cells and between GSM and UTRAN cells. To analyze handover procedures between two GSM cells and list the GSM cell parameters use the* GSM Handover View*; see p.* 4.217*.*

The UMTS Neighborhood Analysis, which is also part of option ROMES-U1, is evaluated in the UMTS Neighborhood Analyzer View*; see p.* 4.132*.*

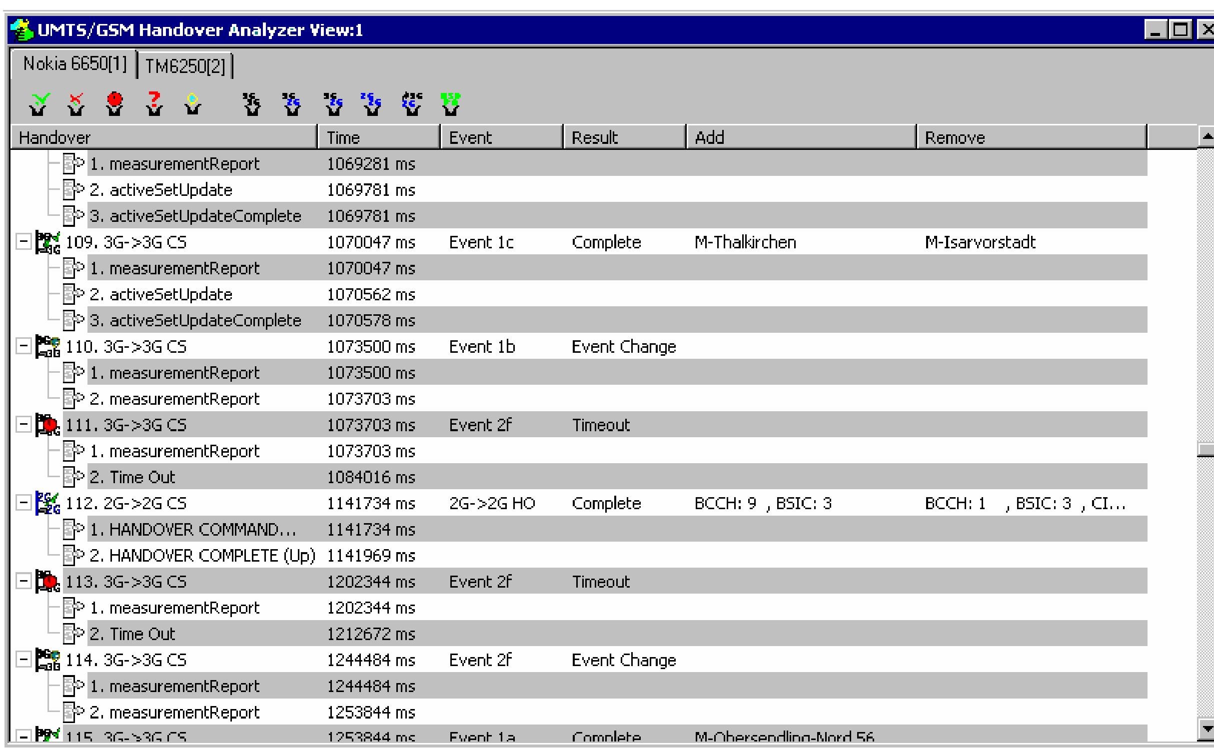


Fig. 4-162 UMTS/GSM Handover Analyzer View (list)

The complete list of the recorded handovers is selected via *Show List* in the context menu.

Handover List The handover list consists of the following columns:

Handover

Current number and handover type. The handover analyzer reports GSM (2G –> 2G), UMTS (3G –> 3G soft/softer handover) and inter-RAT (3G –> 2G) handovers. CS and PS denote the circuit switched and packet switched domains, respectively. 3G –> 3G hard handovers and 2G – > 3G handovers are not recorded in the current software version.
The following layer 3 messages which are relevant for the handover process are listed below the handover event:
3G –> 3G handovers (CS):
Measurement report with one of the events (1a, 1b, …, uplink) described below,
ACTIVE SET UPDATE (downlink),
ACTIVE SET UPDATE COMPLETE (uplink)
3G –> 3G handovers (PS):
CELL UPDATE (downlink),
CELL UPDATE CONFIRM (uplink)
3G –> 2G handovers (CS):
Measurement report with event 3a described below (uplink) or Cancel event,
HANDOVER FROM UTRAN COMMAND (to GSM, downlink),
HANDOVER COMPLETE (uplink)
2G –> 2G handovers (CS):
GSM HANDOVER COMMAND (downlink),
HANDOVER COMPLETE (uplink)
3G –> 3G handovers (HSDPA):
TRANSPORT CHANNEL RECONFIGURATION REQUEST / ACCEPT
The analysis of HSDPA handovers requires option ROMES-UM4.
It is possible to expand or collapse the messages for a single handover (click the + / – symbols or double-click the line) or all handovers (use the context menu). Double-click for a detailed analysis of the layer 3 messages. For a complete list of layer 3 messages use the *2G/3G Layer 3 View* described on p. 4.259.

Time

Handover start time, the time of the first layer 3 message (see above) which initiated the handover report.

Event

Handover type or one of the measurement reporting events that the UMTS test mobile received from the network. The events are used to notify a UMTS UE in which instance it should transmit a measurement report. They described in standard 3GPP TS 25.331:
Event 1a (for intra-frequency measurements: a primary CPICH enters the reporting range)
Event 1b (a primary CPICH leaves the reporting range)
Event 1c (a non-active primary CPICH becomes better than an active primary CPICH)
Event 1e (a primary CPICH becomes better than an absolute threshold)
Event 1f (a primary CPICH becomes worse than an absolute threshold)

Event 2d (for inter-frequency measurements: the estimated quality of the currently used frequency is below a certain threshold)
Event 2f (the estimated quality of the currently used frequency is above a certain threshold)
Event 3a (for inter-RAT measurements: the estimated quality of the currently used UTRAN frequency is below a certain threshold and the estimated quality of the other system is above a certain threshold)

Result

Status of the handover attempt: *Start, Pending, Complete* for successful handovers. *Timeout* indicates that the handover time exceeded the timeout specified in the *HOA* tab of the UMTS mobile driver configuration menu (see chapter 6). *Event Change* indicates that the network changed the measurement reporting event during the handover.

Add

GSM: BCCH and BSIC of the source base station.
UMTS: Name of a UTRAN cell added to the active set, taken from the node B database (if available). To monitor the complete active set and neighbor set, use the *UMTS CellSet View* (see p. 4.108).

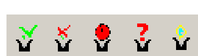
Remove

GSM: BCCH, BSIC, CI, and LAC of the target BTS and cell.
UMTS: Name of a UTRAN cell removed from the active set, taken from the node B database (if available).

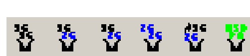
Filter options

The icons in the toolbar above the list display or hide handovers with specific results and handovers of different type. A colored icon means that the handover events are shown in the list, a unavailable icon means that they are hidden.

- The icons in the first group denote handovers with the following results: *Complete, Failed, Timeout, Error, Event Change.*

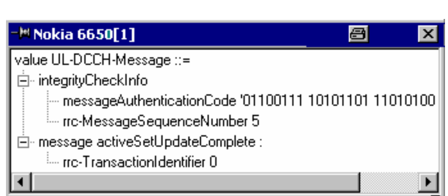


- The icons in the second group denote handovers of the following types: *3G –> 3G CS, 3G –> 2G CS, 3G –> 2G PS, 2G –> 2G CS, 2G –> 3G Reselection, 3G –> 3G HSDPA.*



Further analysis

An upper case D appears to the right of the cursor arrow when it is placed on a layer 3 message. This symbol indicates that there is detailed information to be retrieved for the current layer 3 message. The detailed information window is opened by double-clicking on the message, e.g.:



It is also instructive to monitor the measurement route and the node Bs / base stations in the *Route Track* view (see p. 4.37). The cells in the *Add* and *Remove* columns can be displayed with different colors using the *Show Node Bs/BTSs on Map* command in the context menu. The color code can be configured in the *UMTS/GSM Handover Analyzer* view configuration menu; see below.

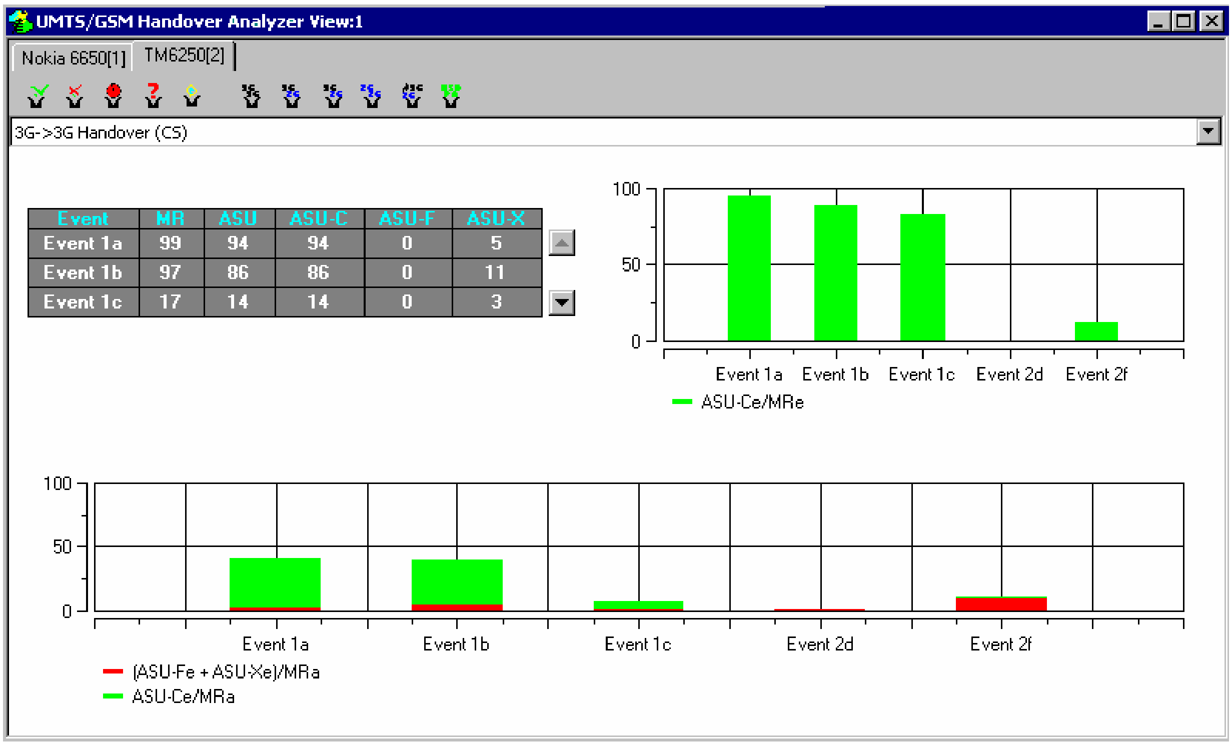


Fig. 4-163 UMTS/GSM Handover Analyzer View (statistics, 3G –> 3 G handover)

The statistical evaluation of the recorded handovers is selected via *Show Statistics* in the context menu. There are three versions of the statistics tab, corresponding to the three handover types *3G –> 3 G*, *3G –> 2G* (inter-RAT), *2G –> 2 G.* The versions are selected in the drop-down list across the top of the view.

The *3G –> 3 G Handover* tab shows the following results:

Event table

The table lists the total number of detected handovers with their measurement reporting event class and the handover result.

- Handovers with the same active event appear in the same row. The last row *(All)* shows the sum of all previous rows. *Event Change* handovers are classified according to the event at the start of the handover.
- Handovers with the same result appear in the same column. The following categories are defined: *MR* (Measurement Report; the sum of the *ASU, ASU-F,* and *ASU-X* columns), *ASU* (Active Set Update, handovers with an update of the active cell set), *ASU-C* (Active Set Update Complete, ASU handovers that could be completed without error), *ASU-F* (Active Set Update Failure, ASU handovers that failed before the timeout), *ASU-X* (all other handovers, e.g. the *Timeout* or *Event Change* handovers).

Overview of the GSM handovers and handovers between different Radio Access Technologies (inter-RAT handovers, 3G/UMTS –> 2G (GSM)).

SR

Success Rate, ratio of the successful handover attempts *(Result: OK)* to the total number of handover attempts for each handover type. A handover is classified successful if it could be achieved before the *Handover Timeout* defined in the configuration menu elapsed.

Attempts

Total number of handover attempts for each handover type.

The distribution of the duration of the handover procedures (i.e. the time between a HO command and a HO response) is shown in two bar graphs:

GSM Handover [s]

Time for GSM handovers.

Inter-RAT Handover [s]

Time for inter-RAT handovers including 3G –> 2G and 2G –> 3G handovers.

The diagram scales and the number of classes (bars) are fixed.

Successful handover distribution

The upper bar graph shows the percentage of successful (completed) handover attempts for each event class, i.e. the number of *ASU-C* handovers divided by the number of *MR* handovers. In the example of Fig. 4-163 above, all *Event 1a* and *Event 1b* handovers but none of the *Event 2f* handovers were successful.

The diagram scales and the number of classes (bars) are fixed.

General handover distribution

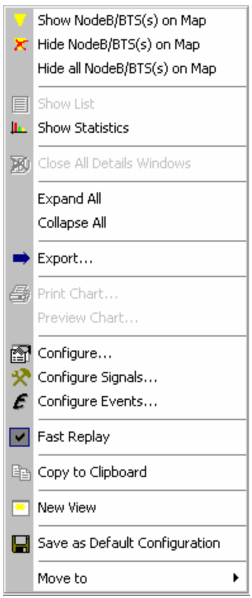
The lower bar graph shows the percentage of (completed and failed) handover attempts for each event class. The red portion of each bar corresponds to the failed, the green portion to the successful attempts. The added length of all bars is 100 %.

The *3G –> 2 G Handover* and *2G –> 2 G Handover* tabs are similar to the previous one. The following properties of the network standard simplify the tables and diagrams:

- An inter-RAT handover can only occur while the measurement reporting event 3a is active, so the *3G –> 2 G Handover* view only shows the percentage of successful and failed handovers within the event class 3a.

- No reporting events are defined for GSM (2G) networks, so the *2G –> 2 G Handover* view only shows the percentage of successful and failed handovers.

Context menu



A right mouse click on any point in the view opens the context menu to print or preview the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2. The context menu provides the following additional, view-specific commands:

Show Node B…
Use the color code defined in the *UMTS/GSM Handover Analyzer View* configuration menu (see below) to mark the UMTS/GSM cell for the selected handover in the *Route Track* view. This feature is only available while a handover process is selected in the handover list. The colored cells are the ones listed in the *Add* and *Remove* columns, respectively. The UMTS layer / GSM BTS layer in the *Route Track* view must be visible to use this feature.

Hide Node B…
Reverse the previous action, display the selected cell symbol with standard colors.

Hide all Node B…
Display all cell symbols with standard colors.

Show List/Statistics
Toggle between the list of the recorded handovers and the statistical evaluation.

Close all Details…
Remove all open details windows from the view. This action is convenient for removing several open windows pinned over the view; see section *General View Properties* on p. 4.1.

Expand/Collapse All
Show or hide the layer 3 messages for each handover in the list.

Export
Export the handover analyzer data to a *.csv export file that can be opened and processed by Excel. The file contains the information in the statistics view.

UMTS/GSM Handover Analyzer View Configuration

The *UMTS/GSM Handover Analyzer View* configuration menu defines the CMD file scanning behavior and the color scheme for the Node B / BTS symbols in the *Route Track View*. It is opened via a right mouse click on a point inside *UMTS/GSM Handover Analyzer View* or via the *Configuration – Settings* command (see chapter 3).

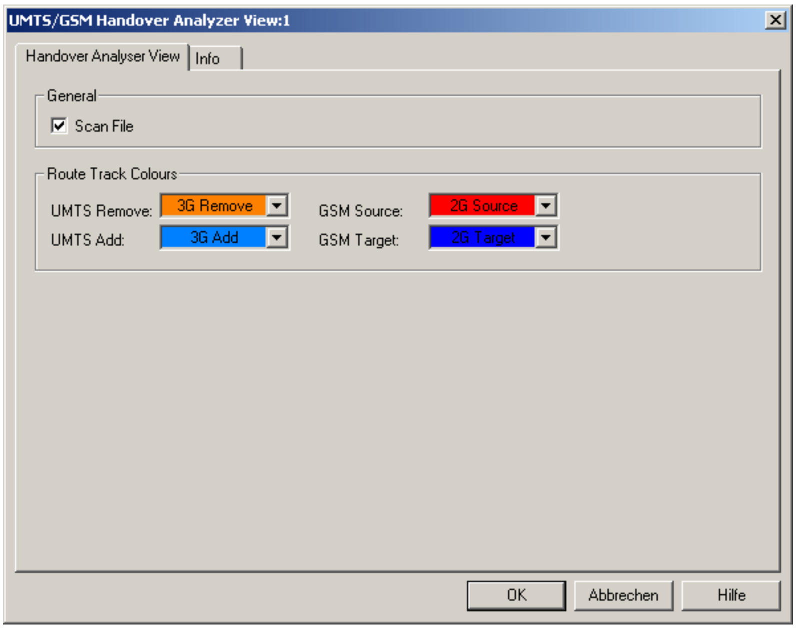


Fig. 4-164 UMTS/GSM Handover Analyzer View Configuration

General

The *Scan File* checkbox enables or disables the automatic scan for 2G/3G-related handover data in the active CMD file.

Route Track Colors

The colors distinguish the following UMTS Node Bs and GSM base stations:

UMTS Remove
UTRAN source cell of the handover

UMTS Add
UTRAN target cell of the handover

GSM Source
GSM target cell of the handover

GSM Target
GSM target cell of the handover

2G/3G Layer 3 View

The *2G/3G Layer 3 View* displays the recorded GSM Layer 3 messages, the GPRS RLC/MAC control messages, and the UMTS RRC messages. The messages are shown for all mobiles used. The messages are not available in *Scan* mode; the mobile must be in *Normal, Camp,* or *Test Transmitter* mode.

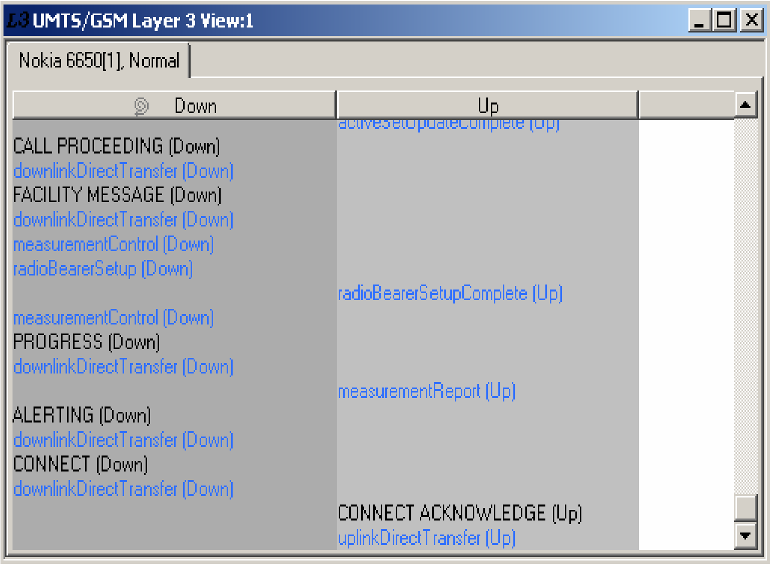
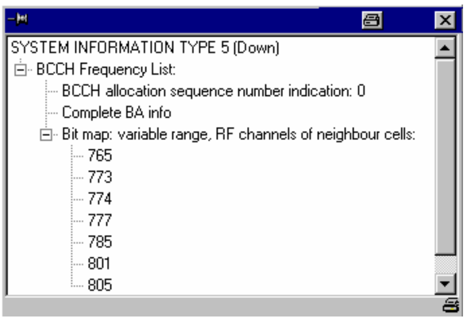


Fig. 4-165 2G/3G Layer 3 View

The layer 3 messages for each mobile are arranged in a separate list. Moreover, uplink and downlink messages appear in separate columns unless this feature is switched off in the configuration menu (see *Separate Up/Downlink Columns* parameter on page 4.262). The width of the individual lists can be varied with a drag-and-drop mechanism in the header of the table.

<Mobile type and number> List of the layer 3 messages of an individual mobile. The message types are selected in the *Layer 3 Messages* tab of the configuration menu, see below.

Detailed information: An upper case D may appear to the right of the cursor arrow when it is placed on a layer 3 message. This symbol indicates that there is detailed information to be retrieved for the current layer 3 message. The detailed information window is opened by double-clicking on the message, e.g.:



The detailed information window is totally independent of the 2G/3G Layer 3 View, so you can move, resize and scroll it as you like. Click the printer symbol in the lower right corner to generate a hardcopy of the detailed information. Alternatively, you can write the detailed information into the table (e.g. if you wish to create a hardcopy), see the …Messages tabs of the configuration menu.
A click on the pin symbol in the title bar of the detailed information window fixes the window so that you can open several windows at the same time.

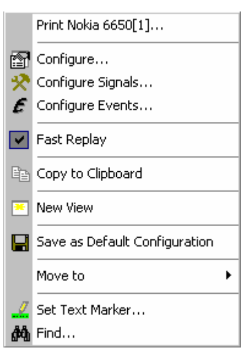
Stop display: Each individual list of layer 3 messages can be stopped and released at any time by left-clicking on its title bar. A stopped list is indicated by a red *STOP* symbol left of the mobile type.

Note:

Detailed messages are only displayed during a Replay session because of performance requirements during the measurement and during recording.

On the other hand switching between different L3 messages is also possible during Pause and even after Stop.

Context menu



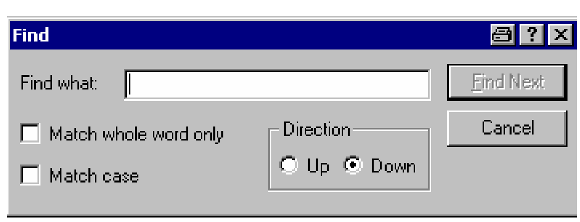
A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2. In addition the context menu provides the following menu commands:

Set Text Marker…

Opens a dialog to define a text marker using the selected message as a search text; see *Text Markers* on p. 4.262.

Find…

Opens a standard Windows *Find* dialog to search the entire message list for a keyword or an expression.



2G/3G Layer 3 View Configuration

The *2G/3G Layer 3 View* configuration menu selects the messages to be viewed or exported and shows information on the current view version. It is opened via a right mouse click on a point inside *2G/3G Layer 3 View* or via the *Configuration – Settings* command (see chapter 3).

The *Display* tab defines the display mode of the GSM L3, GPRS RLC/MAC, and UMTS RRC messages and controls the text markers and the detail filter.

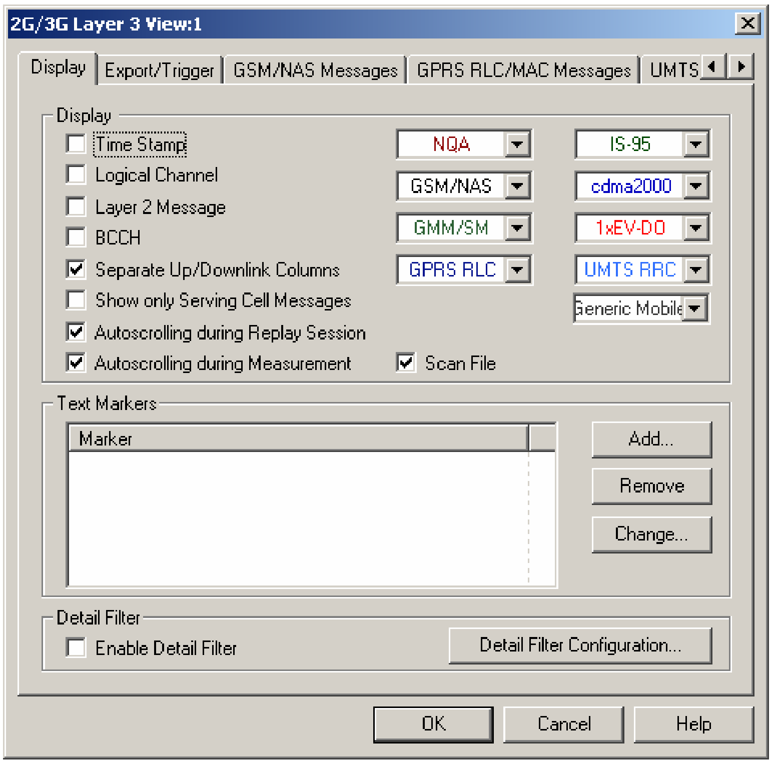


Fig. 4-166 2G/3G Layer 3 View Configuration: Display

Display The controls in the *Display* panel define which type of information is displayed in the *2G/3G Layer 3 View* and how the messages are displayed.

Time Stamp
If the box is checked, the time stamp associated with the message occupies the first column of the *2G/3G Layer 3 View* tables.

Logical Channel
If the box is checked, the logical channel associated with the message occupies the second column of the *2G/3G Layer 3 View* tables.

Layer 2 Message
If the box is checked, layer 2 messages associated with the layer 3 message are displayed in an additional column of the *2G/3G Layer 3 View* tables. Only RS TM mobile and some SAGEM devices are capable of recording layer 2 messages. Recording must be enabled in the *Measurement Mode* or *General Settings* tab of the *Driver Configuration* menu.

BCCH

If the box is checked, the BCCH associated with the layer 3 message is displayed in an additional column of the *2G/3G Layer 3 View* tables.

Separate Up/Downlink Columns

If the box is checked, uplink and downlink messages appear in separate columns of the *2G/3G Layer 3 View* as shown in *Fig. 4-165*. Otherwise, all messages from one mobile are written in a single column in chronological order. An (Up) or (Down) identifier after each message indicates which transmission direction the message belongs to.

Show only Serving Cell Messages

If the box is checked, layer 3 messages exchanged with the serving cell are displayed only. Otherwise, the *2G/3G Layer 3 View* shows all layer 3 messages recorded.

Autoscrolling

If the boxes are checked, the *2G/3G Layer 3 View* tables are scrolled down automatically as soon as the bottom of the view window is reached. Otherwise, the scrollbar can be used to move up and down in the table. Autoscrolling can be enabled/disabled separately for replay and measurement sessions.

Scan File

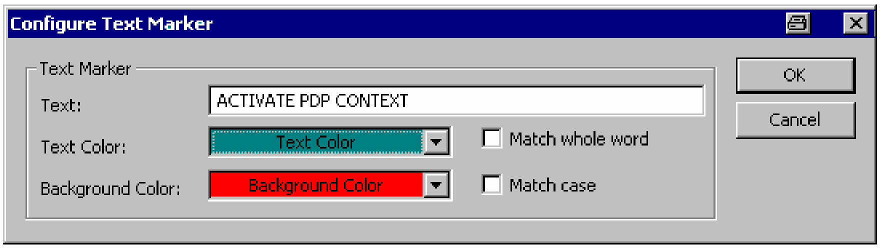
The *Scan File* checkbox enables or disables the automatic scan for *2G/3G Layer 3-related QoS* data in the active CMD file.

Color Scheme

The different message types *(NQA, GSM/NAS, GMM/SM, GPRS RLC, IS-95, cdma2000, 1xEV-DO, UMTS RRC, Generic Mobile)* can be displayed with different colors to be more easily distinguished. Each of the pull-down lists opens a *Colors* dialog; see p. 4.322.

Text Markers

The controls in the *Text Markers* panel define markers that can be used to highlight keywords or expressions in the list of displayed messages. *Add…* opens the following dialog:



The *Configure Text Marker* can be opened from the context menu of the *2G/3G Layer 3 View.* A text marker highlights the search text entered in the *Text* input field using the selected *Text Color* and *Background Color.* The options *Match whole word* and *Match case* refine the text selection.

It is possible to define several text markers with different attributes, *Remove* or *Change* a text marker.

Detail filter

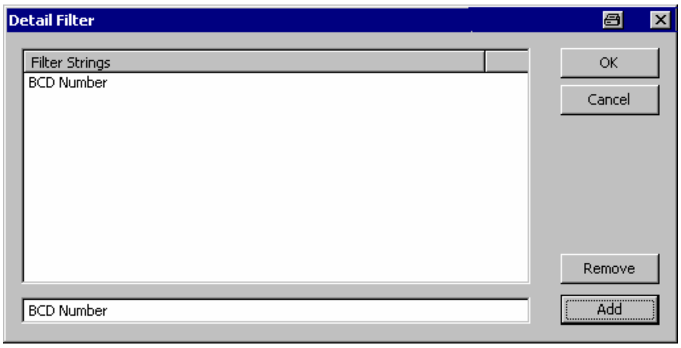
The detail filter filters the detailed information displayed in the view and can be used to limit the amount of information displayed and search for particular information types. To activate the filter, proceed as follows:

1. In one of the *Messages* tabs of the configuration menu, enable the details for a particular message (select *Yes* in the *Details* column, e.g. for the SETUP message in the *GSM L3 Messages* tab).

2. Replay the *(Measurement – Replay* or) measurement file and pause the replay *(Measurement – Replay Pause* or *)* as soon as the message details are displayed for the first time.

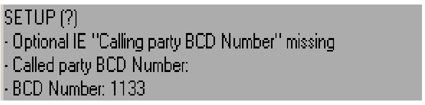
3. Open the *Display* menu of the configuration menu and press *Detail Filter Configuration.*

4. Enter the detailed information you wish to display into the dialog opened, e.g. type *BCD Number* into the line across the bottom and click *Add.*



5. Click *OK* to close the *Detail Filter* dialog, then click *Enable Detail Filter* and *OK* to close the configuration menu.

6. Continue the replay *(Measurement – Replay Pause* or). The next SETUP message is displayed with the *BCD Number* information only*.*



The *Export/Trigger* tab controls the export of data during a replay session and defines the trigger for selecting a range of messages to be displayed.

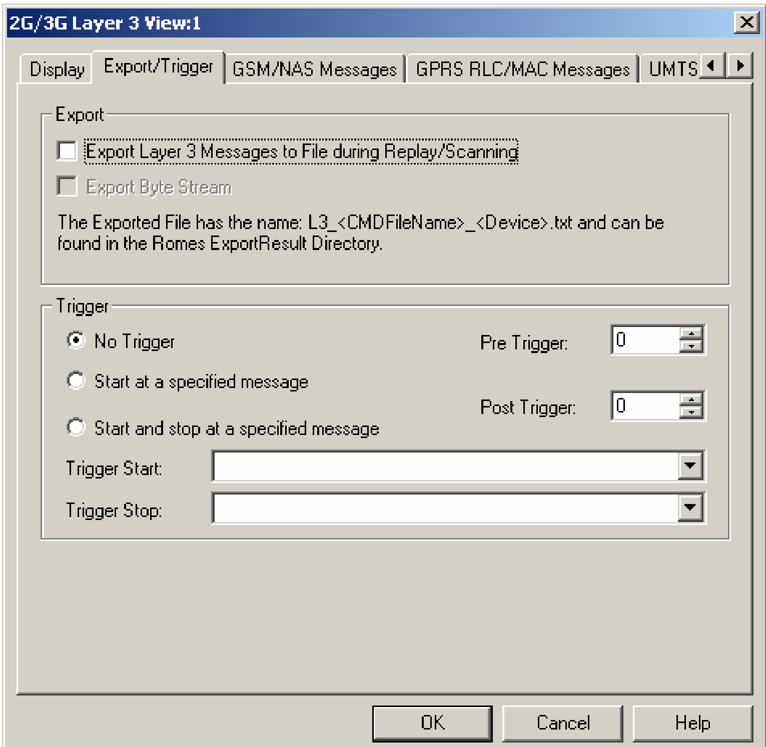


Fig. 4-167 2G/3G Layer 3 View Configuration: Export / Trigger

Export

The three checkboxes in the *Export* panel select one of the following export modes:

- No data export (upper box cleared, lower box unavailable): Data export during replay disabled.
- Export messages only (upper box checked, lower box cleared): A quasi-chronological record of the layer 3 messages is written to an ASCII text file named *L3_<CMDFileName>_<Device>*, located in the *ExportResult* subdirectory of the ROMES program directory.

```
2844 ms ; measurementControl (Down)
3719 ms ; IDENTITY REQUEST (Down)
3188 ms ; measurementReport (Up)
3203 ms ; securityModeCommand (Down)
3203 ms ; securityModeComplete (Up)
3500 ms ; measurementReport (Up)
3719 ms ; downlinkDirectTransfer (Down)
3750 ms ; IDENTITY RESPONSE (Up)
```

- Export messages and byte stream (upper and lower box checked): The export file also contains the raw bytes encoding the messages and their information elements.

```
2844 ms ; measurementControl (Down)
          HEX: 0x01ff09010d00208e81a01414220240ae231620
3719 ms ; IDENTITY REQUEST (Down)
          HEX: 0x0f0000000000032701000b00051803
3188 ms ; measurementReport (Up)
          HEX: 0x02ff0902130022500250019200452d05001940046cc8000528
3203 ms ; securityModeCommand (Down)
          HEX: 0x01ff11011000d08a2c110c0600018001481c300e6018
3203 ms ; securityModeComplete (Up)
          HEX: 0x02ff15020900d66707718d21000000
3500 ms ; measurementReport (Up)
          HEX: 0x02ff090218009a4dda771225a0250019200452ce5001940046cca0005280
3719 ms ; downlinkDirectTransfer (Down)
          HEX: 0x01ff06010b00f11c5f0e89400040a30060
```

Export files are overwritten when the replay is repeated.

Use the Details button in the GSM L3 Messages, GPRS RLC/MAC Messages or UMTS RRC Messages tabs to include the message details in the export file.

Layer 3 Message Trigger

Instead of listing all messages of a given type recorded during the measurement, it is possible to select a range of messages:

No trigger
All messages recorded are displayed

Start at ...
Display starts when the first *Trigger Start* message is detected and continues until the end of the measurement

Start and stop ...
Display starts when the first *Trigger Start* message is detected and stops at the first *Trigger Stop* message

Trigger Start
Pull-down list to select the message type triggering the start of the display

Trigger Stop
Pull-down list to select the message type triggering the stop of the display

PreTrigger
Number of messages displayed before the *Trigger Start* message

PostTrigger
Number of messages displayed after the *Trigger Stop* message

The *GSM/NAS Messages tab* selects the GSM/NAS layer 3 messages to be displayed.

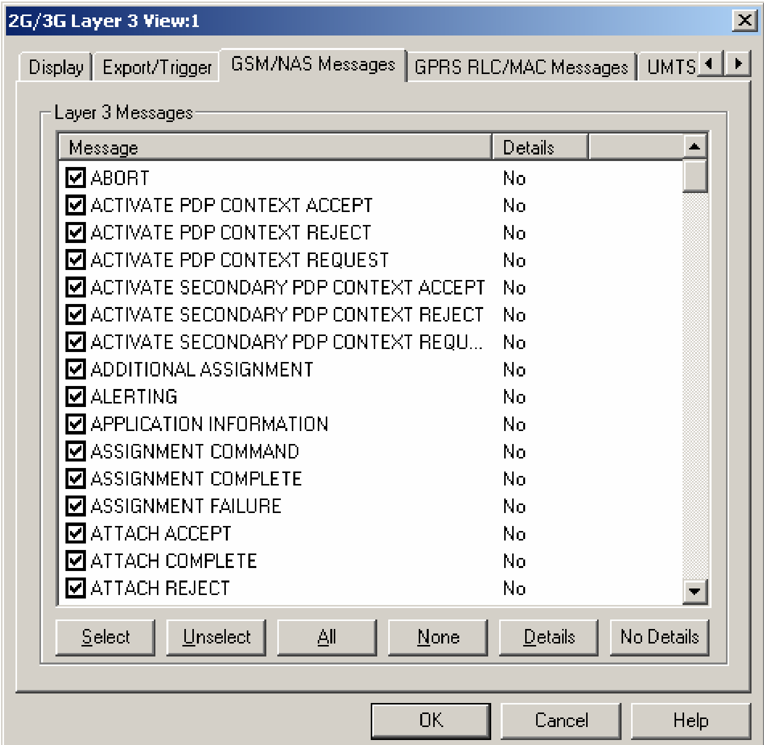


Fig. 4-168 2G/3G Layer 3 View Configuration: GSM/NAS Messages

Message list List of all layer 3 message types defined in GSM/NAS. The second column of the table indicates whether the detailed information concerning a message type is displayed in the *2G/3G Layer 3* view.

Select

Displays the selected, highlighted message type (left-click) in the *2G/3G Layer 3* view. As an alternative, the box on the left of the message type can be checked (left-click).

Unselect

Hides the selected, highlighted message type (left-click) in the *Layer 3* view. As an alternative, the box on the left of the message type can be cleared (left-click the checked box).

All

Display all layer 3 messages in the *2G/3G Layer 3* view.

None

Display no layer 3 messages in the *2G/3G Layer 3* view.

Details

Displays the detailed information concerning the selected message type in the *2G/3G Layer 3* view from where it can be printed.

No Details

Removes the detailed information from the *2G/3G Layer 3* view so that it can not be printed. The detailed information can still be retrieved on screen by double clicking an individual message.

TIP

Details selected for display will also be included in an export file generated during a replay; see Fig. 4-166 on p. 4.261 .

The *GPRS RLC/MAC Messages tab* selects the RLC/MAC control messages to be displayed.

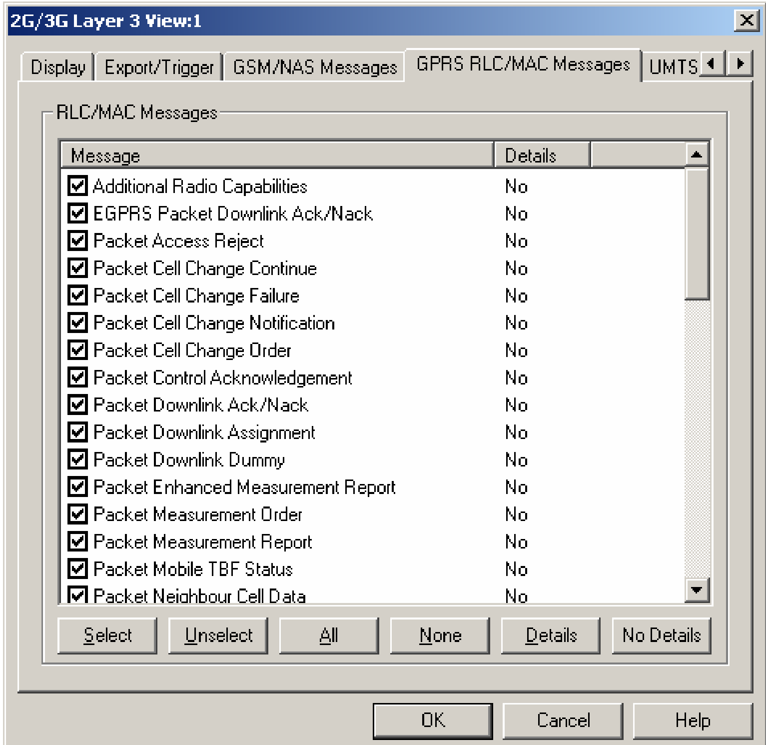


Fig. 4-169 2G/3G Layer 3 View Configuration: GPRS RLC/MAC Messages

Message list List of all RLC/MAC (Radio Link Protocol/Medium Access Control) control message types defined for GPRS. The second column of the table indicates whether or not the detailed information concerning a message type is displayed in the *2G/3G Layer 3* view.

The buttons below the table are the same as in the *GSM L3 Messages* tab; see above.

The *UMTS RRC Messages tab* selects the UMTS RRC control messages to be displayed.

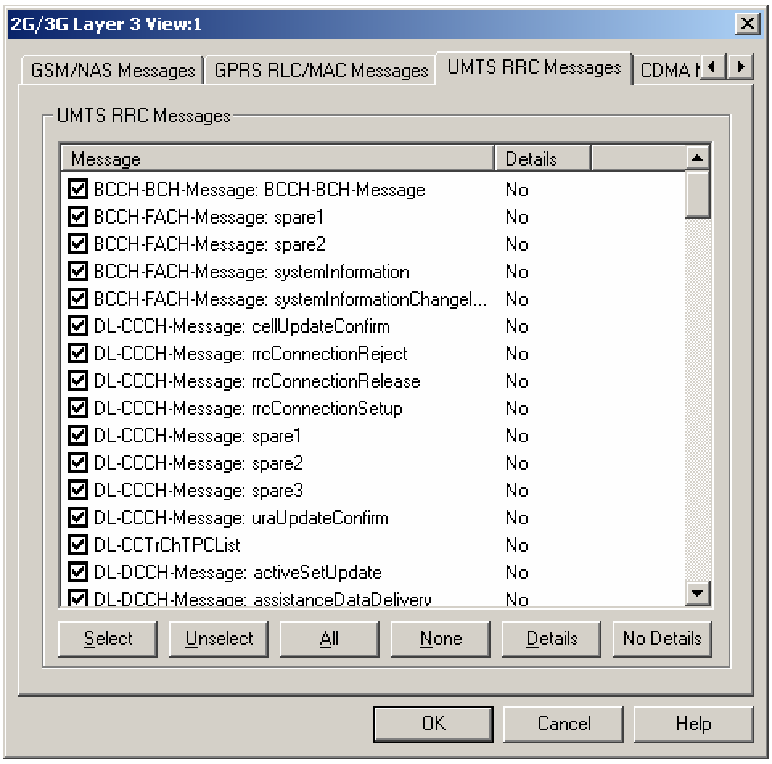


Fig. 4-170 2G/3G Layer 3 View Confguration: UMTS RRC messages

Message list List of all RRC (Radio Resource Control) message types defined for UMTS. The second column of the list indicates whether or not the detailed information concerning a message type is displayed in the *2G/3G Layer 3* view.

The buttons below the list are the same as in the *GSM L3 Messages* tab; see above.

The *CDMA Messages tab* selects the cdma2000 messages to be displayed.

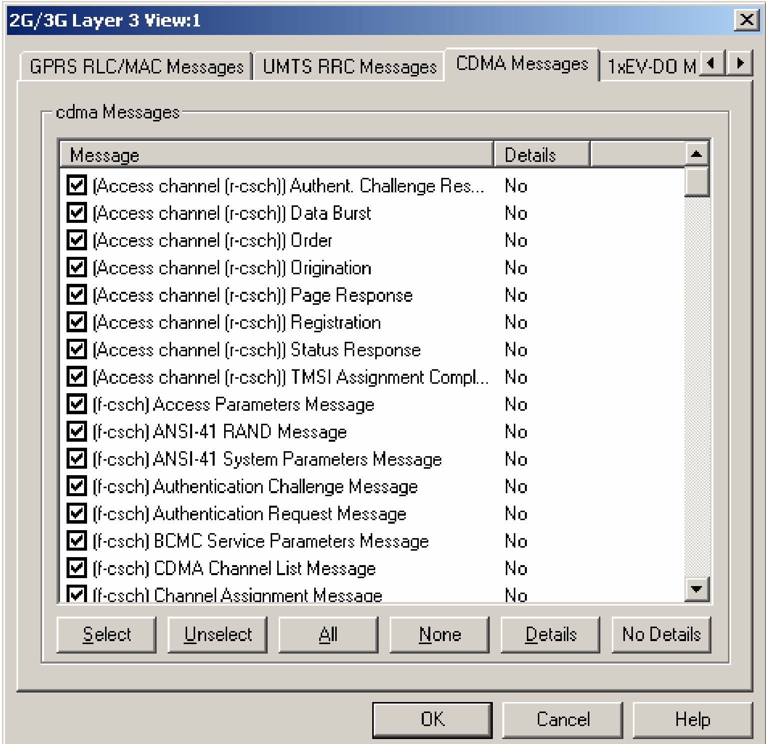


Fig. 4-171 2G/3G Layer 3 View Configuration: CDMA Messages

Message list List of all cdma2000 control message types defined for CDMA. The second column of the table indicates whether or not the detailed information concerning a message type is displayed in the *2G/3G Layer 3* view.

The buttons below the table are the same as in the *GSM L3 Messages* tab; see above.

The *1xEV-DO Messages tab* selects the 1xEV-DO messages to be displayed.

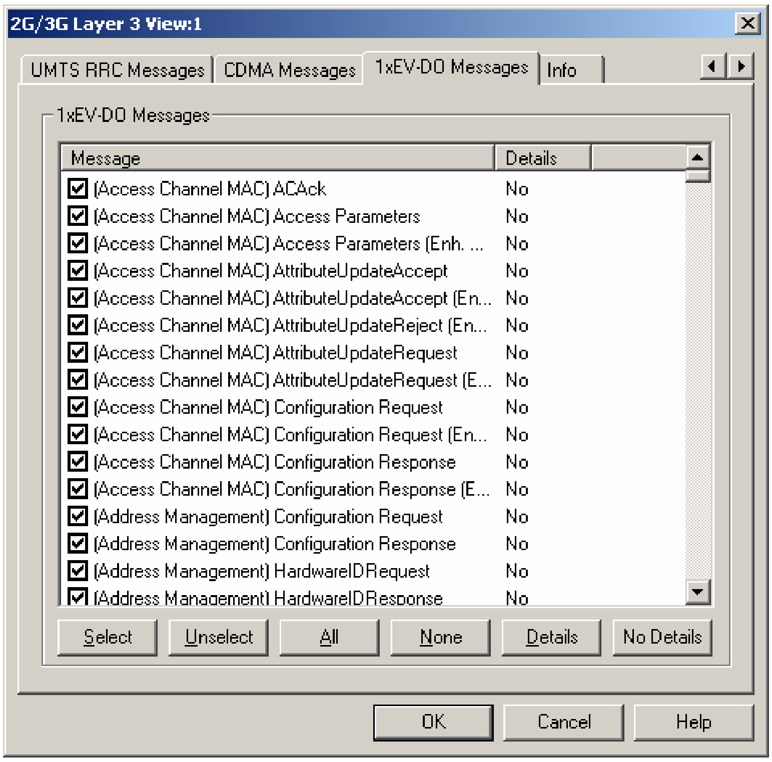


Fig. 4-172 2G/3G Layer 3 View Configuration: 1xEV-DO Messages

Message list

List of all defined 1xEV-DO control message types. The second column of the table indicates whether or not the detailed information concerning a message type is displayed in the *2G/3G Layer 3* view.

The buttons below the table are the same as in the *GSM L3 Messages* tab; see above.

2G/3G NQA View

The *2G/3G NQA View* shows a bar graph representing the call statistics, i.e. the number of *Good, Blocked, Dropped*, and *No service* calls of each GSM or UMTS mobile used. The absolute number of calls is displayed on the bars.

The view is empty unless the *Network Quality Analysis (NQA)* is active. Moreover, it requires one of the measurement modes *NORMAL* or *CAMP* to be set and the *Autodial* function to be active. All driver settings and call classes are explained in chapter 6.

To complement the *2G/3G NQA*, the *UMTS/GSM NQA State View* (see p. 4.249*)* tracks the NQA states and state transitions of each call in detail.

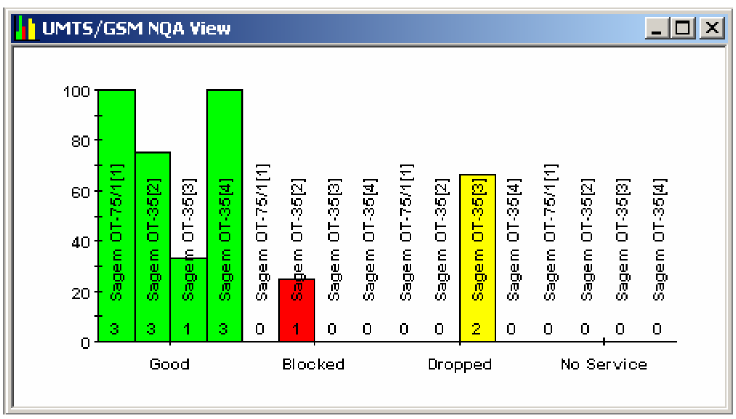
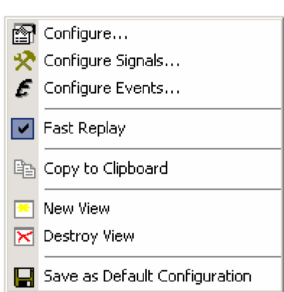


Fig. 4-173 2G/3G NQA View (for 3 mobiles)

Context menu

A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2*.*



2G/3G NQA View Configuration

The *2G/3G NQA View* configuration menu defines the devices to be displayed on the bar chart and shows information on the current view version. It is opened via a right mouse click on a point inside *2G/3G NQA View* or via the *Configuration – Settings* command (see chapter 3).

The *Configuration* tab selects the devices and their parameters to be displayed.

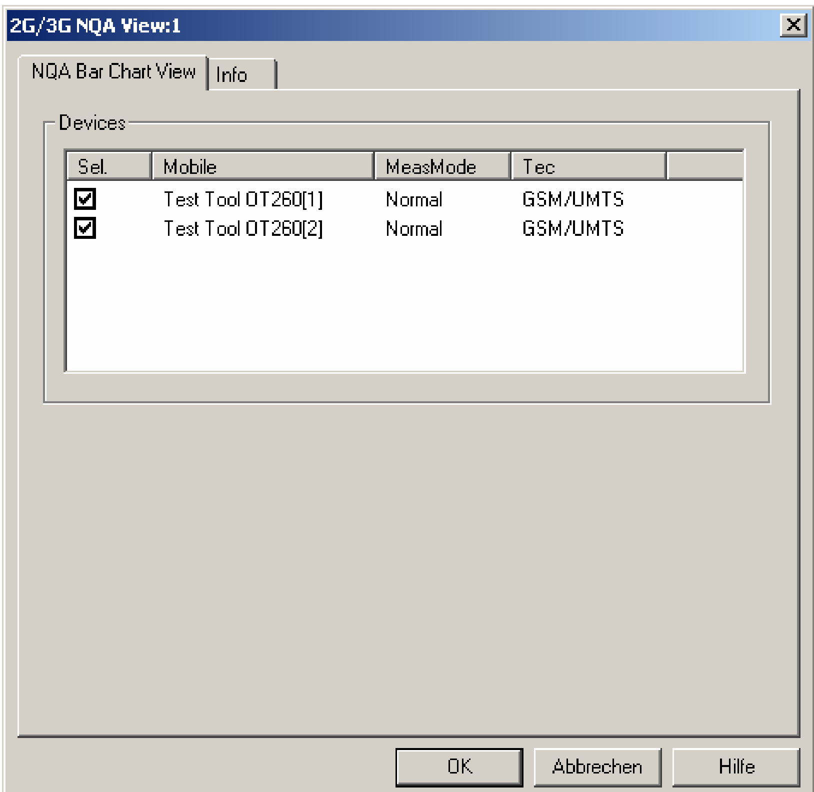


Fig. 4-174 2G/3G NQA View Configuration: NQA Bar Chart Devices

Devices List of all mobiles measured with their measurement mode and applicable Tec. An arbitrary number of mobiles can be selected from the list (click checkboxes). Only the measurement reports for selected mobiles are displayed in the 2G/3G NQA *View*.

Note that the 2G/3G NQA View configuration can only be activated when the measurement or replay is completely stopped (, see *Replay Control* in chapter 3).

2G/3G ETSI QoS View

The *2G/3G ETSI QoS View* shows the NQA classification for each 3G (UMTS) or 2G (GSM) call *(Good, Blocked, Dropped*, and *No service)* and displays a set of Quality of Service parameters defined in the ETSI/IREG specifications.

IREG is an ETSI committee developing specifications for the Quality of Service evaluation. Quality of Service (QoS) is a general notion, defined as “the collective effect of service performance which determines the degree of satisfaction of a user”. A critical technical aspect related to QoS is Network Performance (NP), i.e. “the ability of a network portion to provide the functions related to communication between users”.

Parameters to assess the QoS of various services are defined in document TS 102.250-3 (formerly: PRD IR.42) and related documents.

The view is empty unless the *Network Quality Analysis (NQA)* is activated in the driver configuration menu. Moreover, it requires one of the measurement modes *NORMAL* or *CAMP* (GSM) to be set and the *Autodial* function to be active. All driver settings and call classes are explained in chapter 6.

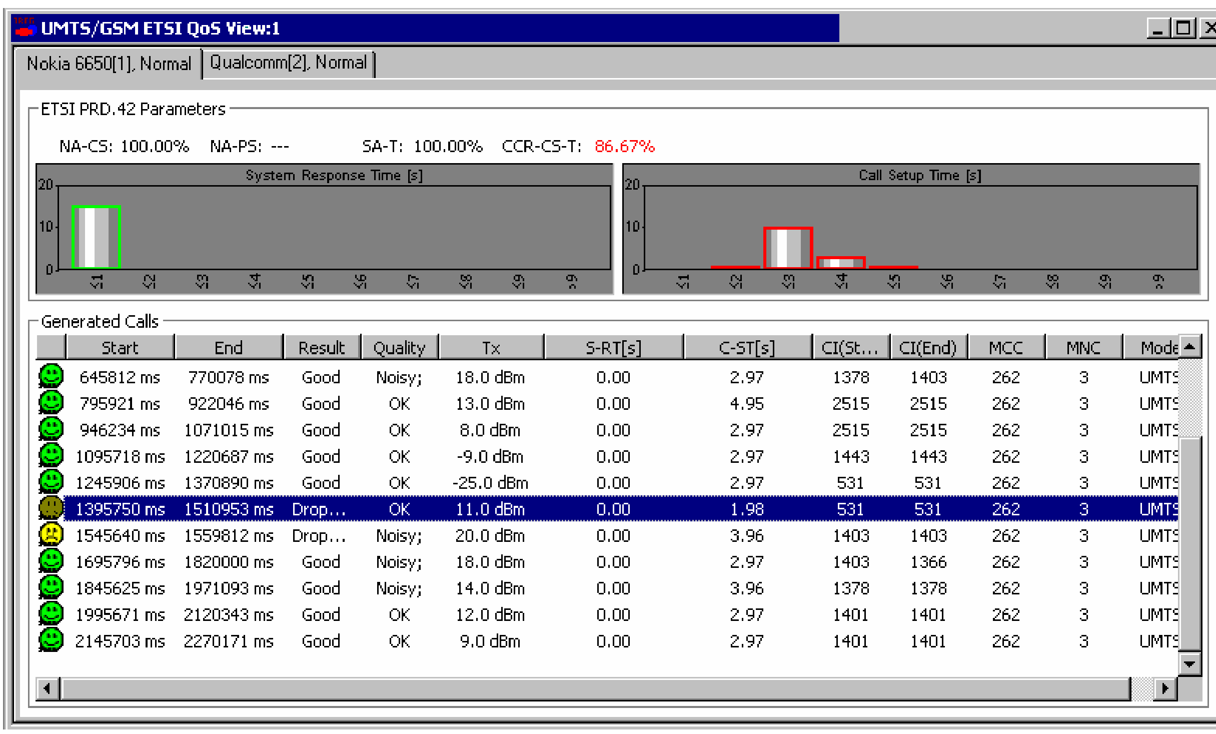


Fig. 4-175 2G/3G ETSI QoS View

The measurement results for each mobile are arranged in a separate tab. The tabs are divided into two panels. The upper panel provides a statistical evaluation of the whole measurement *(IREG IR.42 Parameters)*, the lower panel a list with the results of each individual call *(Generated Calls)*. The list can be replaced by the *Call Details* for a selected call.

IREG IR.42 Parameters

Overview of QoS service-independent and telephony-related parameters defined in TS 102.250-3 (formerly: PRD IR.42) and statistical evaluation of the timing parameters. The following values are displayed in percent:

NA-CS
: Network Accessibility Circuit Switched, ratio of the number of successful GSM network access attempts to the total number of network access attempts. The criterion for successful network access is that the path loss criterion parameter C1 is larger than 0 (see standard 3GPP TS 05.08).

NA-PS
: Network Accessibility Circuit Switched, ratio of the number of successful GPRS network access attempts (with GPRS enabled for cell) to the total number of network access attempts. The criterion for successful network access is that the path loss criterion parameter C1 is larger than 0.

SA-T
: Service Accessibility Telephony, ratio of the number of successful call attempts (after successful network access) to the total number of call attempts.

CCR-CS-T
: Call Completion Rate Circuit Switched Telephony, ratio of the number of intentionally terminated telephony calls to the number of successful telephony calls.

The larger the four values, the better the QoS. The values turn red if they fall below the limits defined in the configuration menu.

The distribution of the following timing parameters is shown in two bar graphs:

System Response Time
: Time between the start of a call attempt and indication of successful network access.

Call Setup Time
: Time between the start of a call setup attempt (after successful network access) and indication of call setup success.

Short times indicate a good QoS. The diagram scales and the number of classes are defined in the configuration menu.

Generated Calls List of all calls with their characteristics and QoS parameters. The table contains the following rows::

Colored symbols to distinguish the *Good, Dropped, Blocked* and *No Service* calls

Start/End
: Start and end time of the call

Result
: Call class: *Good, Dropped, Blocked* and *No Service* call; see description of *NQA* tab of the driver configuration menu in chapter 6.

Quality
: Call quality according to the settings in the NQA tab: OK, Noisy, Excessive HO, Delayed Call.

Tx
: Maximum transmit power of the mobile during the call

S-RT, C-ST
: System response time and call setup time, see above

MCC, MNC
: Mobile Country Code and Mobile Network Code

Mode
: Call mode: GSM or UMTS

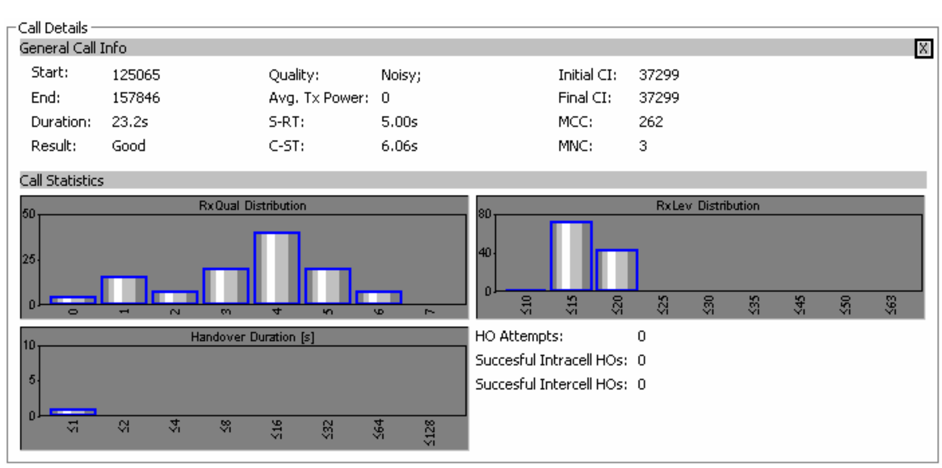
Call Details A double-click on a row in the *Generated Calls* table opens the *Call Details*, providing the entries in the *Generated Calls* table plus three bar graphs to assess the distribution of the following parameter values:

RxQual/BLER
: Indication of the Bit Error Rate (GSM) or Block Error Rate (UMTS)

RxLev/Ec/Io
: Indication of the downlink signal strength received by the mobile

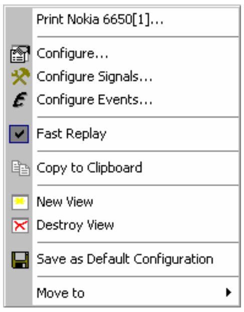
Handover Duration
: Indication of the time needed for successful handover attempts

The handover statistics (number of *Handover Attempts* and *Successful Intracell/Intercell HOs)* is indicated in addition.



Clicking closes the *Call Details* and displays the *Generated Calls* table.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

2G/3G ETSI QoS View Configuration

The *2G/3G ETSI QoS View* configuration menu defines limits for the QoS parameters and configures the bar graphs. It is opened via a right mouse click on a point inside *2G/3G ETSI QoS View* or via the *Configuration – Settings* command (see chapter 3).

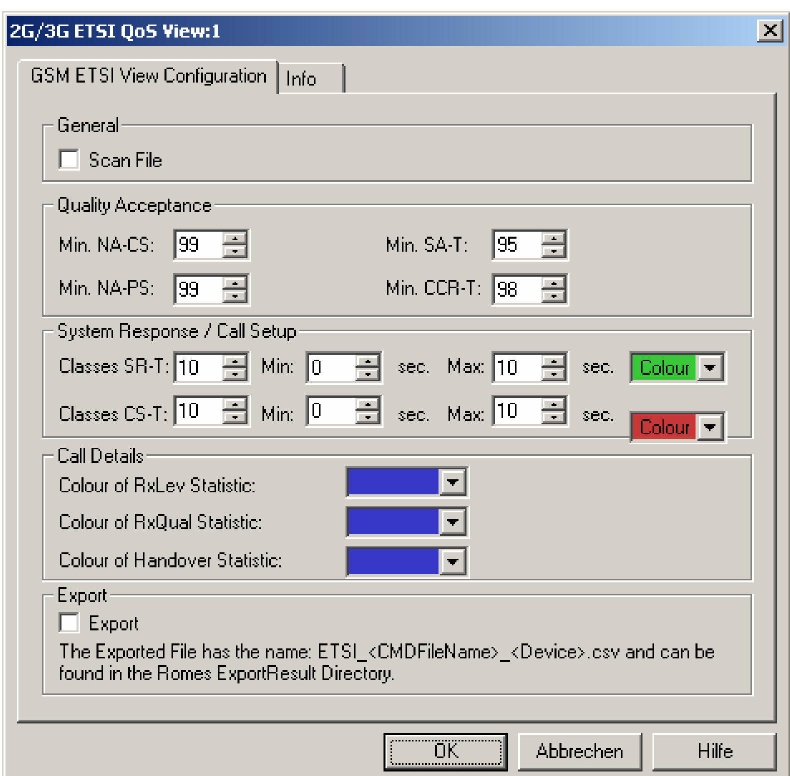


Fig. 4-176 2G/3G ETSI QoS View: Configuration

General The *Scan File* checkbox enables or disables the automatic scan for *ETSI-related QoS* data in the active CMD file.

Quality Acceptance The four input fields in the *Quality Acceptance* panel contain lower limits for the QoS Parameters displayed in the *IREG IR.42 Parameters* panel. A measurement result turns red if it is below the limits.

System Response / Call Setup

The *System Response / Call Setup* panel defines the number of classes (i.e. the maximum number of bars) in the *System Response Time* and *Call Setup Time* diagrams, sets the scale of the y-axis and the colors of the bars.

With a number n of classes and a SR or CS time interval between *Min* and *Max* seconds, the classes correspond to the following sub-intervals:

Class 1	[0 s, (Max – Min) / n]
Class k	[(k – 1)*(Max – Min) / n, k*(Max – Min) / n] , 2 ≤ k ≤ (n – 1)
Class n	[(n – 1)*(Max – Min) / n, ∞ s]

The sub-interval width (Max – Min) / n must be equal to or larger than 1 s.

Call Details

The *Call Details* panel sets the colors of the bars in the *RxQual/BLER Distribution, RxLev/Ec/Io Distribution* and *Handover Duration* diagrams.

Export

Select this option to export the results of the *Generated Calls* table to a *.csv export file that can be opened and processed by Excel, e.g.:

```
Start;End;Result;Quality;Tx;S-RT[s];C-ST[s];CI(Start);CI(End);
                                                          MCC;MNC;Mode;Type

63813 ms;132000 ms;Good;OK;-6.0 dBm;0.44;6.55;-;-;262;1;UMTS;---
```

CW Views

The *CW Info View* shows the measurement frequency of a test receiver *(R&S ESVx*, *R&S ESPI, R&S SBR, R&S TS55-R2, R&S TSMx,* see test receiver driver description in chapter 6) that operates in *Manual Tracking* mode.

The *CW Info View* can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *CW Views*.

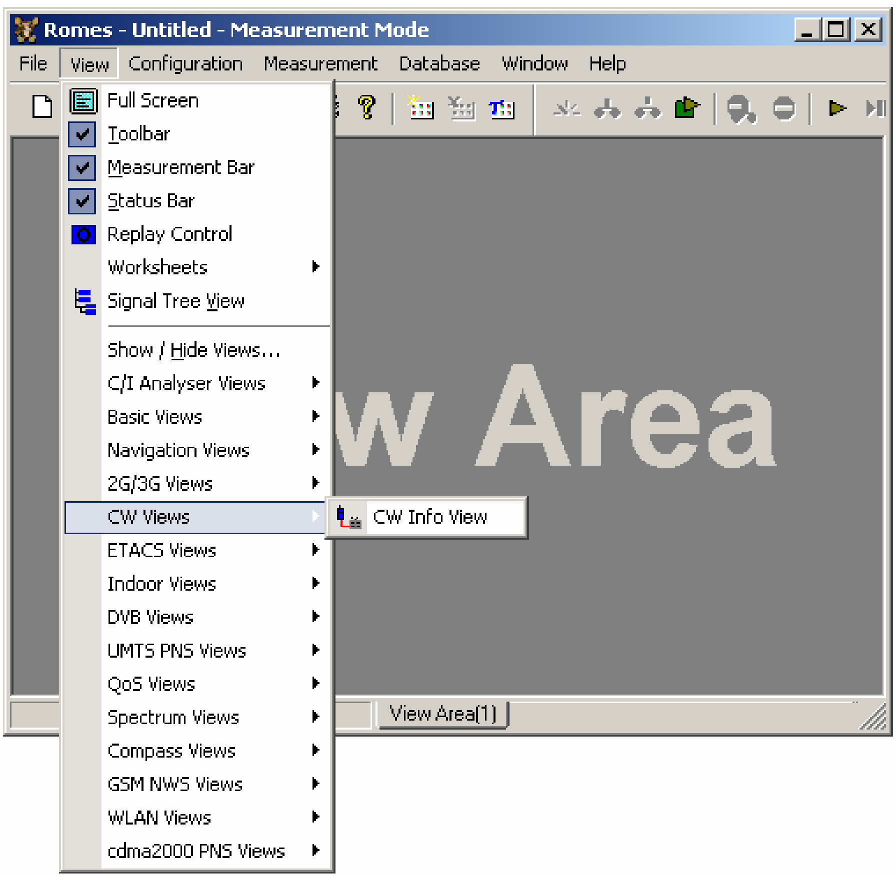


Fig. 4-177 CW views

CW Info View

The *CW Info View* shows the measurement frequencies of a test receiver that operates in *Manual Tracking* mode. To perform a measurement, the appropriate test receiver driver must be loaded and *Manual Tracking* must be enabled as explained in chapter 6.

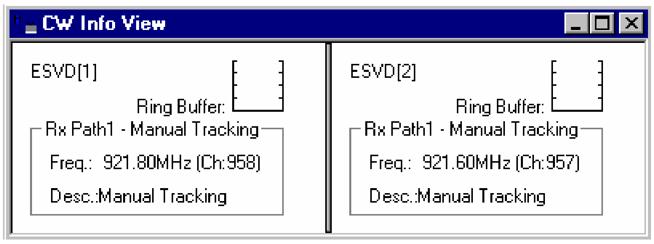


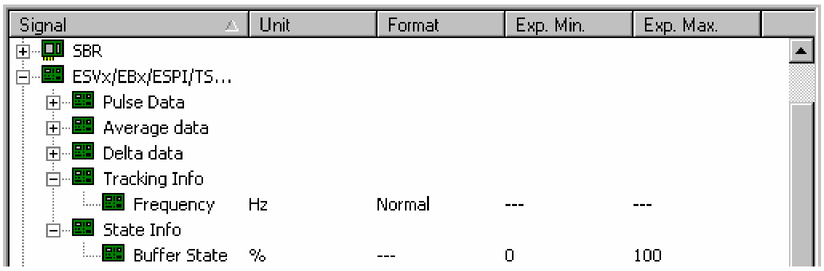
Fig. 4-178 CW Info View

Diagram

The diagram shows all connected test receivers together with the loading of the ring buffer, the current measurement frequencies and a description.

The ring buffer is an intermediate memory used to store measurement data before they are further processed. The scale of the ring buffer diagram ranges from 0% (buffer empty) to 100% (buffer full). An overflow of the buffer may cause data loss and decrease the system performance.

The frequency in tracking mode and the buffer state are also available in the *Available Signals* data tree *(Configuration – Preferences;* see section *Signal Configuration* in chapter 3).



The *CW Info View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

ETACS Views

The *ETACS Views* show ETACS-specific information included in the measurement data. ETAS data can be acquired using the ETACS driver described in chapter 6.

The ETACS views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *ETACS Views*.

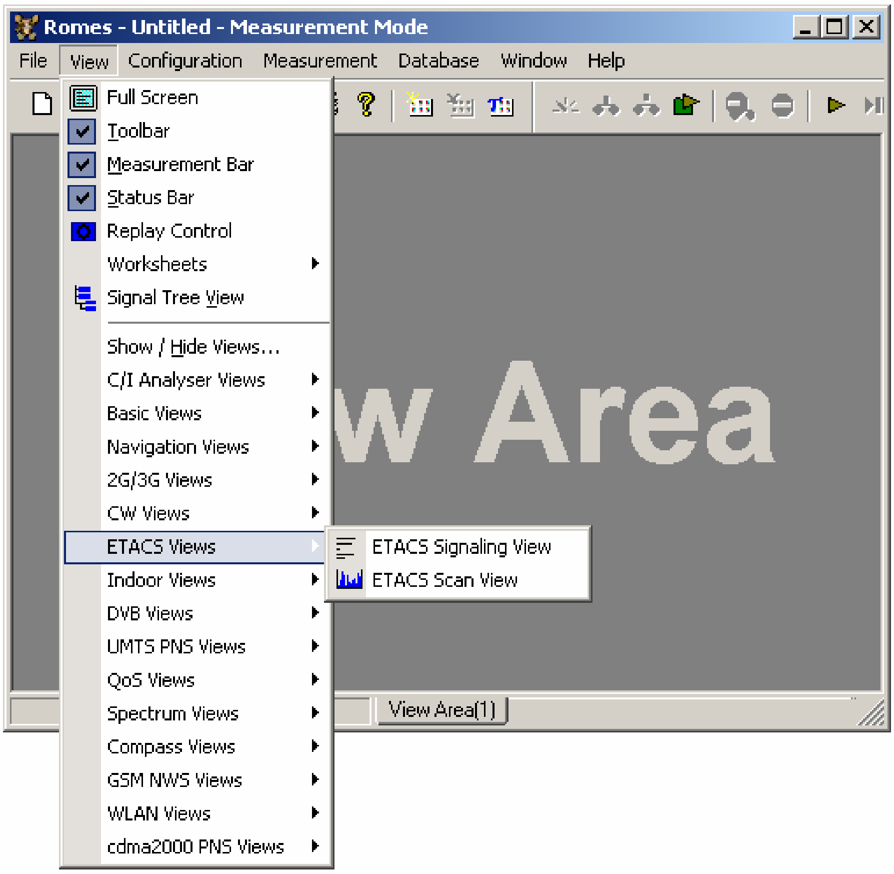


Fig. 4-179 ETACS views

ETACS Signaling View

The *ETACS Signaling View* shows the ETACS signaling messages recorded during the measurement or contained in a measurement file being replayed. The messages are shown for all ETACS mobiles used. Signaling information not available in *Scanner* mode; the mobile must be in *Tracker, Receiver,* or *Slave* mode.

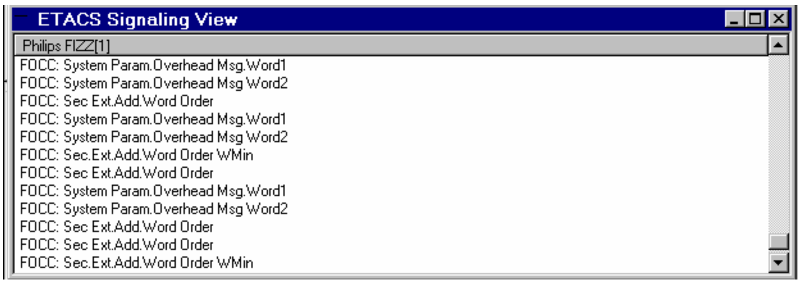


Fig. 4-180 ETACS Signaling View

Like for UMTS/GSM Layer 3 messages (see section *2G/3G Views* on page 4.75.), detailed information can be retrieved for the individual signaling messages. This is indicated by an upper case D which appears to the right of the cursor arrow when it is placed on an ETACS signaling message.

Context menu

A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see *Context menu* description on p. 4.2*.*

The *ETACS Signaling View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

ETACS Scan View

The *ETACS Scan View* contains a diagram showing the signal level of every mobile in all ETACS channels selected in the *Slave Scanner* panel of the *FIZZ Configuration* menu – see section *ETACS Mobile Driver* in chapter 6. Besides, the view is analogous to the *GSM Scan View*; see p. 4.221.

Note:
This control window is only useful in the Scanner mode where the signal level in each channel but no other information is recorded. The ETACS Scan View is empty for mobiles which are not set to Scanner mode.

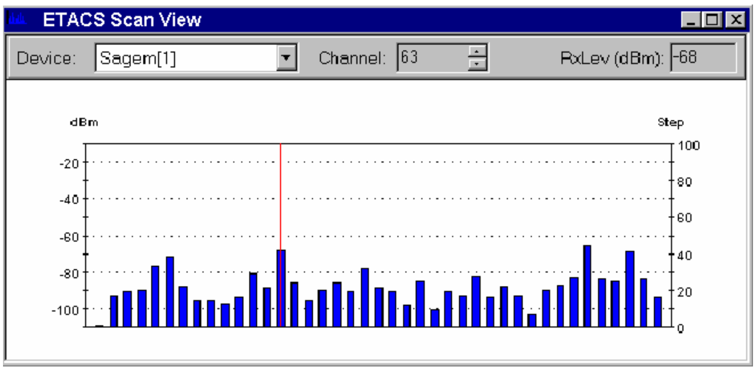


Fig. 4-181 ETACS Scan View

Depending on the selection made in the *FIZZ Configuration* menu, the level is indicated either in dBm or in RSSI units. Besides, the view is analogous to the *GSM Scan View*; see p. 4.221.

The *ETACS Scan View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

Indoor Views

The *Indoor View* shows measurement results recorded using the *INDOOR* navigation driver. This driver is suitable in areas where no GPS navigation signal is available, in particular inside buildings.

TIP

Click the icon *in the measurement bar and use the* Available Signals Drag & Drop... *dialog to display signals in the Indoor View.*

The *Indoor View* can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *Indoor Views*.

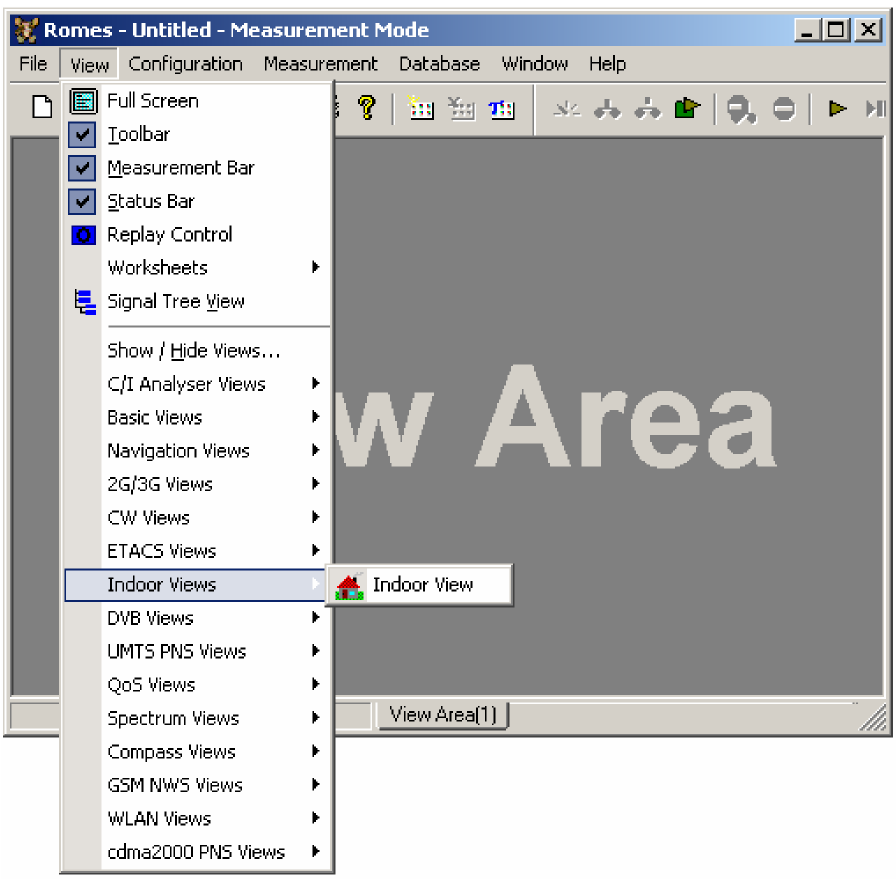


Fig. 4-182 Indoor views

Indoor View

The *Indoor View* visualizes a measurement which is performed at a set of points located on a background map. To perform a measurement, the Indoor navigation driver must be loaded as explained in chapter 6. In addition, a background map must be loaded and assigned geographical coordinates via the *Indoor Navigation* configuration menu (see section *Indoor Navigation Driver INDOOR* in chapter 6). The measurement points can be defined in the configuration menu *(Waypoints* navigation mode) or during the measurement *(Stream input* navigation mode).

Measured indoor results can be recorded in a file together with the configuration settings and replayed later. In this case, there is no need to load a driver; the configuration of the background map is part of the measurement file.

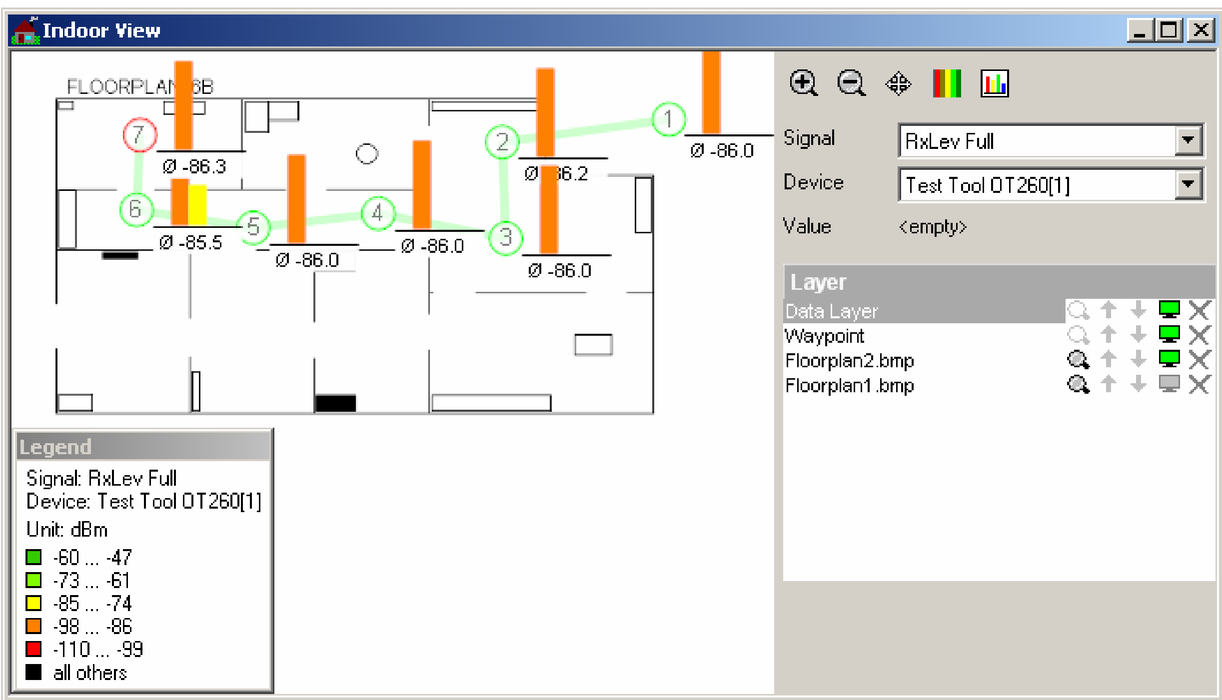


Fig. 4-183 Indoor View

Diagram

The diagram shows the loaded background map where measurement points are placed as defined in the *Indoor View Configuration* menu.

Depending on the *measurement mode* selected in the configuration menu the measurement results are either indicated at fixed points (hot spots, see *Fig. 4-183*) or visualized along the way between the waypoints with a user-defined color scale (continuous measurement). For more information see section *Measurement Mode* in chapter 6.

Control field

The control field of the Indoor view contains buttons to to zoom in/out and to move the map, to toggle the legend and diagram data display, it contains nformation about the displayed signal and the measurement device and it contains the layer management list.

The control field itself can be activated/deactivated using the *Show Info...* item in the context menu of the diagram.

To zoom into the map, click this button and mark a rectangle in the diagram to define the area to zoom. The marking of a rectangle is done by keeping the left mouse key pressed while moving from top left to down right. Different from the *Route Track View*, **a single click is not working**.

To reset the map scale after zooming, click the reset icon in the Layer management field.

To zoom out of the map, click this button and single click on the diagram.

To reset the map scale after zooming, click the reset icon in the Layer management field.

To scroll the map, click this button, click on a starting point on the background map and then move to the end point of the desired map scroll. After the starting point on the map is clicked, the scroll is shown by a thick line between the mouse cursor and the starting point.

Once the end point of the desired scroll is clicked, the map is scrolled accordingly.

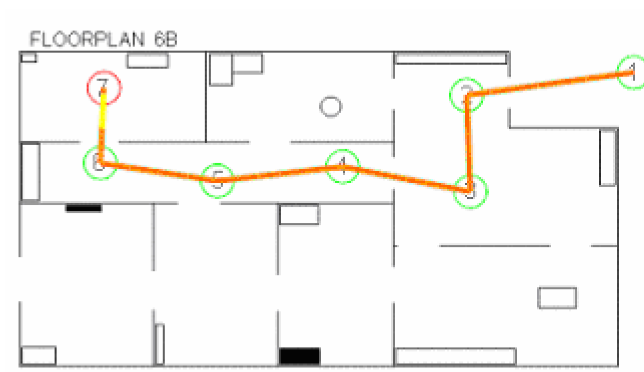
To reset the map position after scrolling, click the reset icon in the Layer management field.

This button toggles the display of the legend in the diagram view area.

or

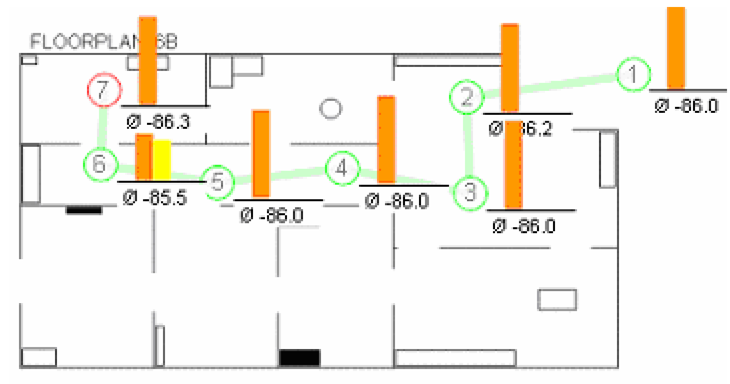
This button toggles the measurement result display format type in the diagram.

Clicking on switches to interpolation mode display:



In interpolation mode, the button changes to .

Clicking on switches to histogram mode display:



Now the button has changed back to .

The availability of both modes is **independent** from the selected measurement mode (Hot Spot or Continuous).

Signal This field group shows the active device and signal data:

Device

Value

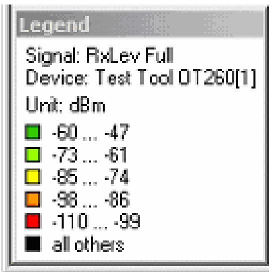
The *Device* pull-down list below the *Signal* field shows all mobiles measured. The selected *Signal* of the *Device* is displayed in the diagram.

When a waypoint or a segment of the measurement path is clicked, the *Value* field shows the measured data value at this point.

Layer This layer management field displays all loaded layer names or map filenames and offers a series of icons for layer display:

	A click on this icon resets the effects from the last map zoom or map scroll action. This icon is only active for background map layers, for other layers the icon is disabled ( ).
↑ ↓	Single-clicking on these icons moves the corresponding layer one level up or down. With background map layers, only the top active map layer is visible.
	This icon shows that the corresponding layer is active. To disable the layer, click on the icon. The icon is greyed ( ) and the corresponding layer becomes invisible. If the top map layer is disabled, the next map layer becomes visible, if defined.
✗	Clicking on this icon removes the corresponding layer from view and list.

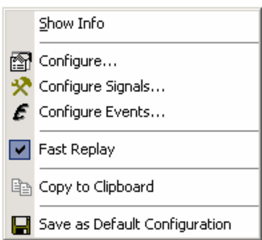
Legend



The legend window explains the signal ranges symbolized by the different colors of the measurement curve. Up to seven colors can be defined via the *Indoor Configuration* tab of the configuration menu, see *Available Signals* data tree *(Configuration – Preferences;* in section *Signal Configuration* in chapter 3).

The current signal and device is indicated above the color legend.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2. The following additional menu commands are available:

Show Info

Activates/deactivates the display of the control field of the Indoor View

Indoor View Configuration

The *Indoor View* configuration menu offers the selection of the Indoor measurement file directory, because if ROMES is configured as ‘Replay Only’ (no dongle required), the Indoor driver menu is not available. It is opened via a right mouse click on a point inside the *Indoor View* or via the *Configuration – Settings* command (see chapter 3).

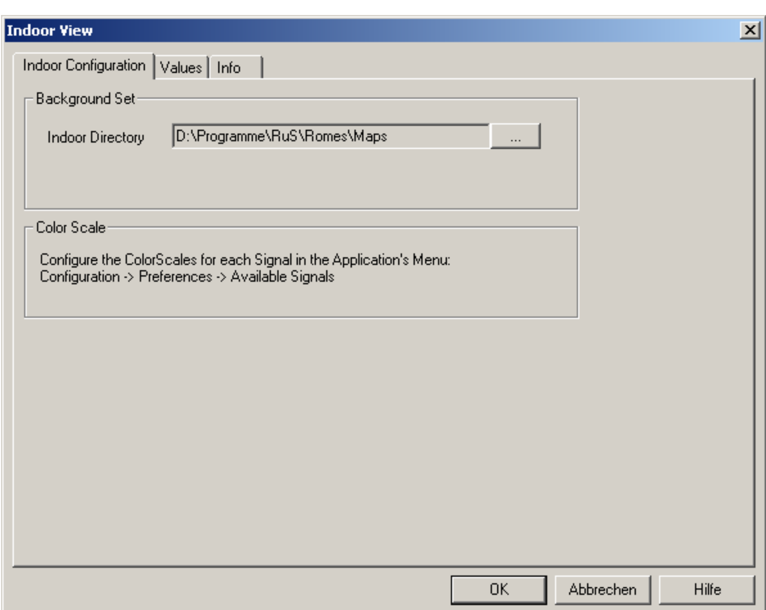


Fig. 4-184 Indoor View configuration: Configuration tab

The *Values* tab is analogous to the *Values* tab of the 2D Chart View configuration menu, see Fig. 4-10 on p 4.14.

Indoor Measurement Control

When an indoor measurement is started, the new **Indoor Control** view pops up, additionally to the Indoor view, which is different from the previous version:

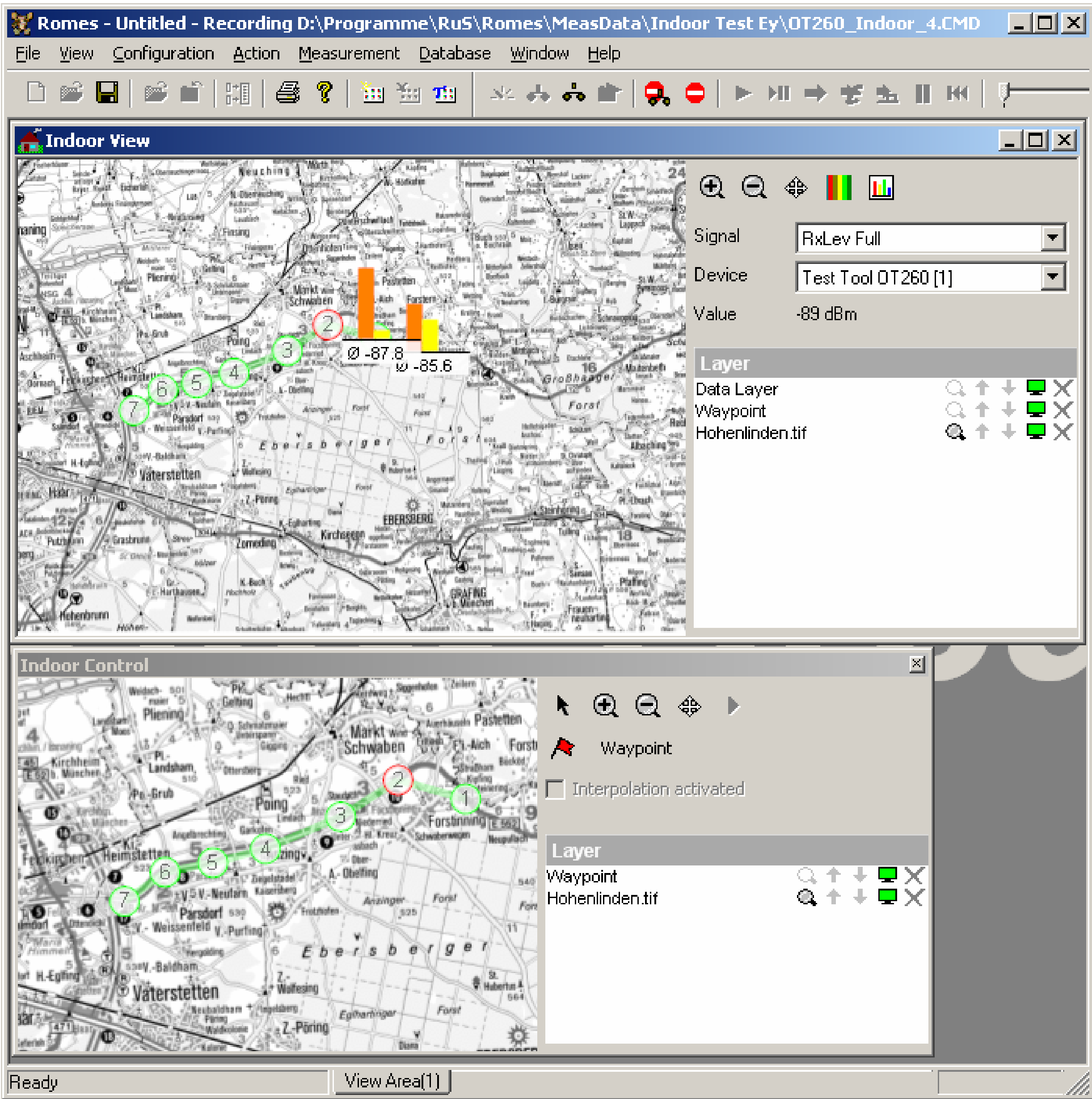


Fig. 4-185 Indoor Measurement: Indoor Control view

The *Indoor Control* view contains a control field which is different from the Indoor view:

Control field The control field of the Indoor view contains buttons to to zoom in/out and to move the map, to toggle the legend and diagram data display, it contains nformation about the displayed signal and the measurement device and it contains the layer management list.

The control field itself can be activated/deactivated using the *Show Info...* item in the context menu of the diagram.

To set positions or to activate waypoints in the Indoor Control map display, the arrow mouse cursor must be active.

To zoom into the map, click this button and mark a rectangle in the diagram to define the area to zoom. The marking of a rectangle is done by keeping the left mouse key pressed while moving from top left to down right. Different from the *Route Track View*, **a single click is not working**.

To reset the map scale after zooming, click the reset icon in the Layer management field.

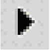
To zoom out of the map, click this button and single click on the diagram.

To reset the map scale after zooming, click the reset icon in the Layer management field.

To scroll the map, click this button, click on a starting point on the background map and then move to the end point of the desired map scroll. After the starting point on the map is clicked, the scroll is shown by a thick line between the mouse cursor and the starting point.

Once the end point of the desired scroll is clicked, the map is scrolled accordingly.

To reset the map position after scrolling, click the reset icon in the Layer management field.



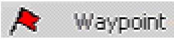
If there is more than one map layer defined in the Geoset, the measurement always starts with the top layer map.

Waypoint navigation mode measurements continue to measure up to the last defined waypoint on the top layer map, then the active layer will automatically switch to the next one down, and the measurement continues with the first waypoint on that layer.

Stream input mode measurements stop at the end of the top layer measurement route, the switch to the next layer has to be done manually using the arrow button.

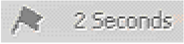
The order is **always from the highest to the lowest layer**, for both Waypoint navigation and Stream input.

To toggle the map display of the Indoor Control View on or off, which is useful to save space in the view area.

Waypoint The waypoint flag is either greyed out or active (

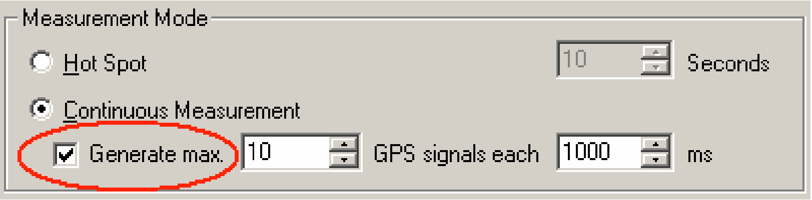
), depending on the measurement mode (see chapter 6).

When the button is active (during all modes except **Continuous mode** with **Stream navigation mode**) it can be clicked to trigger a new measurement for the predefined time period While the measurement is performed, the flag is greyed and a countdown is visible instead of the normal button caption:



During the countdown it is not possible to activate other waypoints.

Interpolation To activate the interpolation of position data (in **Continuous mode** and **Waypoint navigation** only), select the according click box in the *activated* Indoor driver menu:



Then the Indoor Control view has an activated interpolation checkbox (where it can be temporarily deactivated again):

Layer This field displays all loaded layer names or map filenames and offers a series of icons for layer display:

A click on this icon resets the effects from the last map zoom or map scroll action. This icon is only active for background map layers, for other layers the icon is disabled ( ).

Single-clicking on these icons moves the corresponding layer one level up or down. With background map layers, only the top active map layer is visible.

This icon shows that the corresponding layer is active. To disable the layer, click on the icon. The icon is greyed ( ) and the corresponding layer becomes invisible. If the top map layer is disabled, the next map layer becomes visible, if defined.

Clicking on this icon removes the corresponding layer from view and list.

DVB Views

The *DVB Views* show Digital Video Broadcasting (DVB) specific information included in the measurement data. DVB data can be acquired using one of the DVB drivers described in chapter 6.

The TSM-DVB data is not displayed in the DVB Views. *To analyze TSM-DVB data select the* TSM-DVB *signals in the data tree (Configuration – Settings – Available Signals) and use the basic views* (Alphanumeric View, 2D Chart View…).

The DVB views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *DVB Views*.

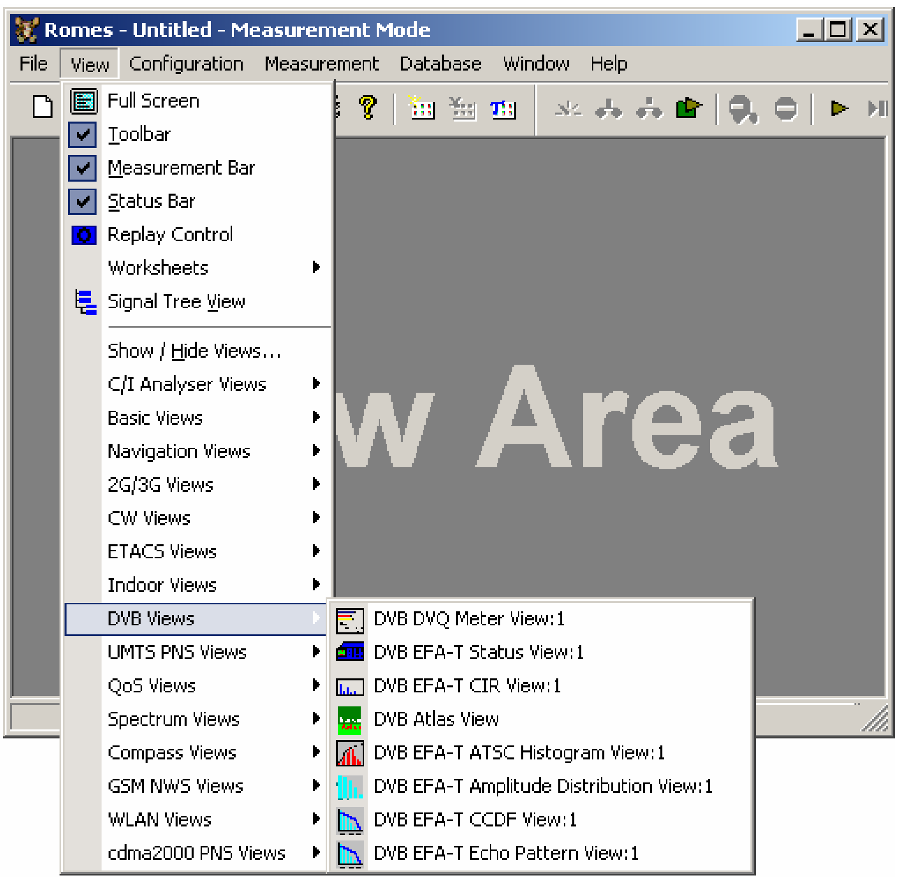


Fig. 4-186 DVB views

DVB DVQ Meter View

The *DVB DVQ Meter View* displays the Digital Video Quality Level (DVQL) of the DVQ analyzer. This view is empty unless a DVQ analyzer is used. Two different diagrams can be generated, depending on whether weighted (DVQL-W) or unweighted (DVQL-U) parameters are selected in the driver configuration menu (see chapter 6). The diagrams are the same as on the DVQ display and described in the DVQ manual.

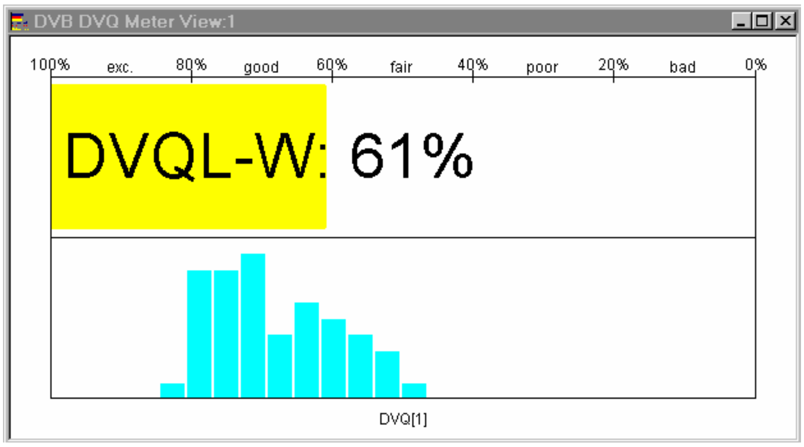
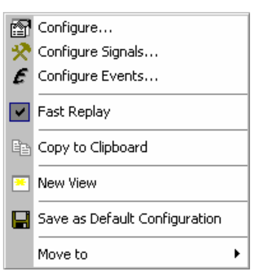


Fig. 4-187 DVB DVQ Meter View (weighted parameters)

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

DVB DVQ Meter View Configuration

The *DVB DVQ Meter View* configuration menu selects the device providing the viewed data, configures the diagram and shows information on the current view version. It is opened via a right mouse click on a point inside the *DVB DVQ Meter View* or via the *Configuration – Settings* command (see chapter 3).

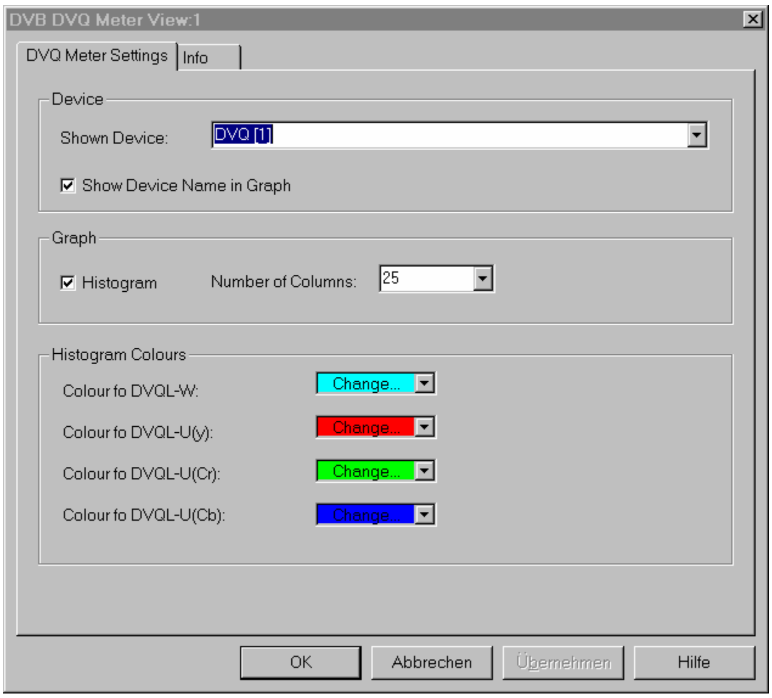
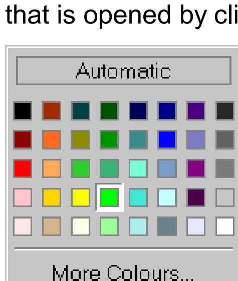


Fig. 4-188 DVB DVQ Meter View configuration

Device The *Shown Device* pull-down list contains all DVB receivers available in the measurement or in the measurement file being replayed. Only DVQ receivers provide data that can be viewed in the *DVB DVQ Meter View.* The data from the selected device is shown in the diagram. It is possible to show the device name in the graph by checking the corresponding box.

Graph In the *Graph* panel, the bar graph in the *DVB DVQ Meter View* can be switched on *(Histogram* box checked) or off. If the bar graph is switched on, the number of bars *(Number of Columns)* can be selected from a pull-down list. The width of the bars is adjusted so that the bars cover the whole diagram width.

Colors In the *Colors* panel, the colors of the bar graphs representing the weighted (DVQL-W) and unweighted (DVQL-U) parameters can be selected from a popup window that is opened by clicking on the arrow button.



The *More Colours*... button in this popup window calls up an extended color configuration menu.

DVB EFA-T Status View

The *DVB EFA-T Status View* displays parameters describing the status and important transmission parameters of the EFA DVB receiver. This view is empty unless the EFA DVB receiver by Rohde & Schwarz is used.

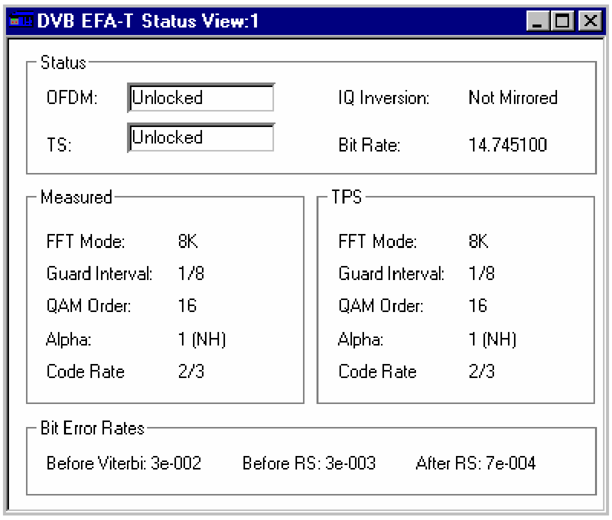


Fig. 4-189 DVB EFA-T Status View

Status The *Status* panel indicates the status of the transmission quality measurement. The meaning of the parameters is described in the EFA manual.

Measured / TPS The *Measured* and *TPS* panel display the parameters of the transmission quality measurement.

FFT Mode
Fast Fourier Transform used to obtain the I and Q samples in the base band (2K-FFT with 1705 carriers or 8K-FFT with 6817 carriers).

Guard Interval
Length of the guard interval inserted before the useful part of an OFDM frame, defined as a fraction of the period of an OFDM symbol (1/4, 1/8, 1/16, 1/32).

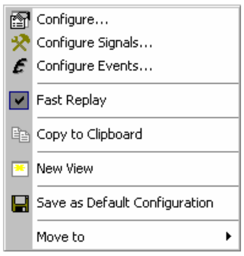
QAM Order
Order of the Quadrature Amplitude Modulation (QAM) of the OFDM signal (QPSK, 16QAM or 64QAM).

Alpha
Constellation ratio which determines the QAM constellation for the modulation for hierarchical transmission.

Code Rate
Rate of useful data plus error protection data to total data.

Bit Error Rates The *Bit Error Rate* panel indicates the bit error rate before Viterbi decoding (error correction) in the receiver, before and after the Reed-Solomon outer coder.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

DVB EFA-T Status View Configuration

The *DVB EFA-T Status View* configuration menu selects the device providing the viewed data and shows information on the current view version. It is opened via a right mouse click on a point inside the *DVB EFA-T Status View* or via the *Configuration – Settings* command (see chapter 3).

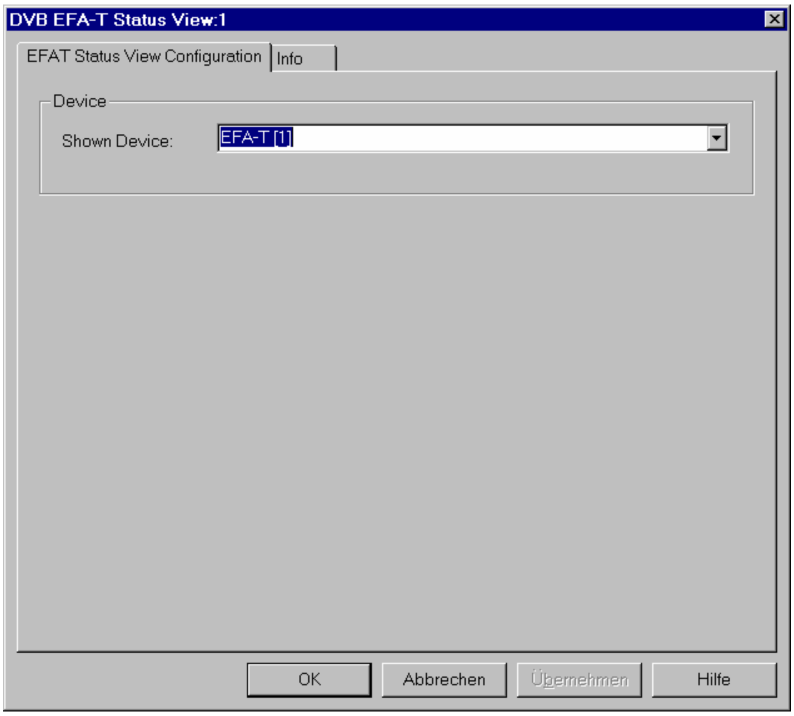


Fig. 4-190 DVB EFA-T Status View configuration

Shown Device

The *Shown Device* pull-down list contains all DVB receivers available in the measurement or in the measurement file being replayed. Only EFA DVB receivers by Rohde & Schwarz provide data that can be viewed in the *DVB EFA-T Status View.* The data from the selected device is shown in the diagram.

DVB EFA-T CIR View

The *DVB EFA-T CIR View* shows the Channel Impulse Response (CIR) as a function of time. This view is empty unless the EFA DVB receiver from Rohde & Schwarz is used and the *Impulse Response* measurement is active.

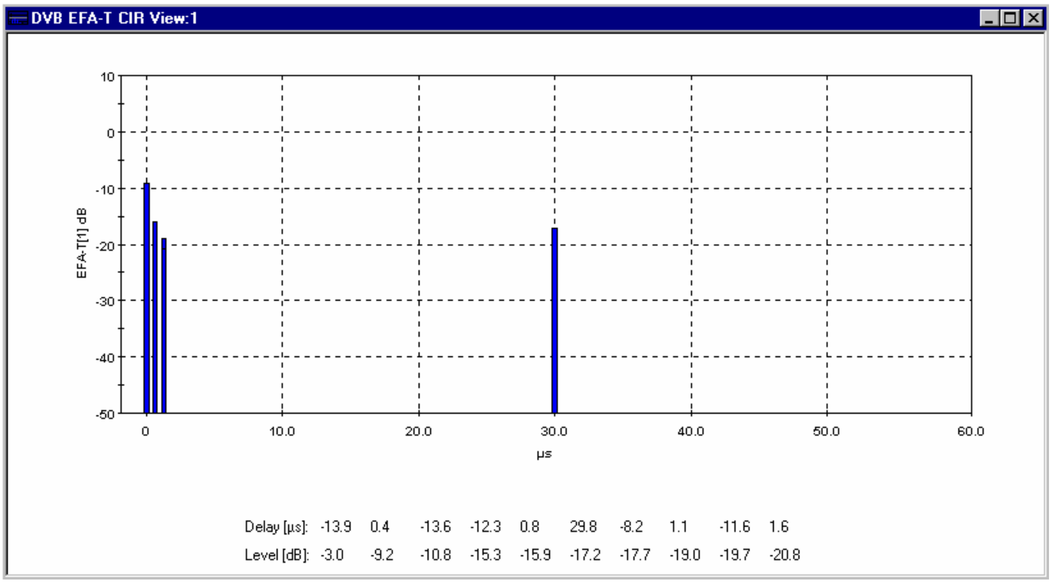
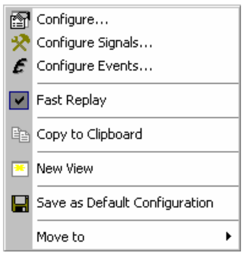


Fig. 4-191 DVB EVA-T CIR View

Diagram

The diagram shows the impulse response of the transmission channel as a function of time. The diagram scale is defined in the configuration menu; see below. The measurement is described in the EFA operating manual.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

DVB EFA-T CIR View Configuration

The *DVB EFA-T CIR View* configuration menu selects the device providing the viewed data, scales the diagram and shows information on the current view version. It is opened via a right mouse click on a point inside the *DVB EFA-T CIR View* or via the *Configuration – Settings* command (see chapter 3).

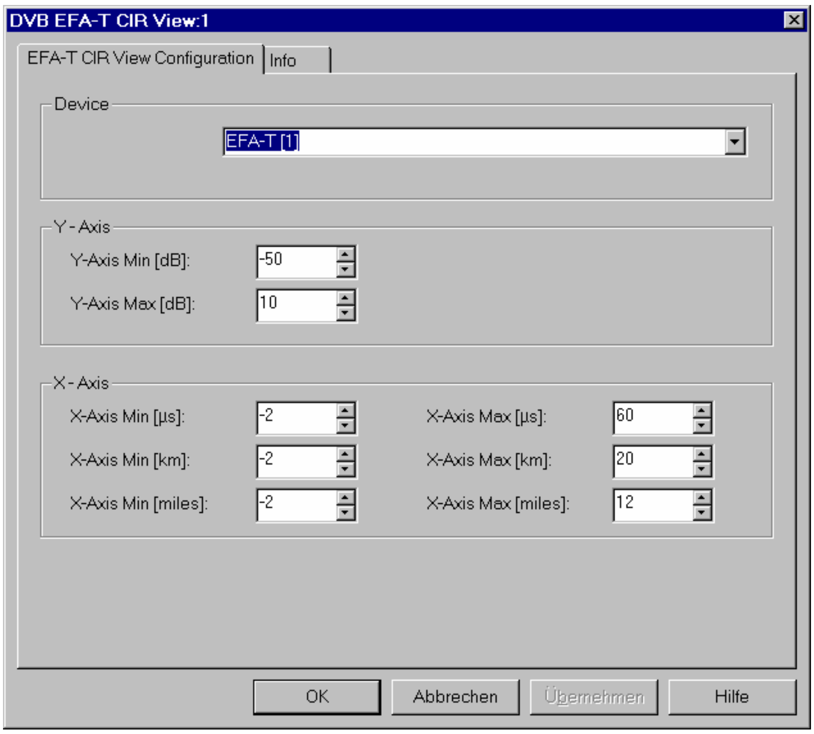


Fig. 4-192 DVB EFA-T CIR View configuration

Device The *Device* pull-down list contains all DVB receivers available in the measurement or in the measurement file being replayed. Only EFA DVB receivers by Rohde & Schwarz provide data that can be viewed in the *DVB EFA-T CIR View.* The data from the selected device is shown in the diagram.

Y-Axis The Y-Axis panel defines the lower and upper edge of the view diagram *(Y-Axis Min [dB]* and *Y-Axis Max [dB])*. Values in dB can be directly entered or incremented/decremented using the arrow buttons.

X-Axis The X-Axis panel defines the unit for the x-axis and the left and right edge of the view diagram *(X-Axis Min [..]* and *X-Axis Max [..]).* Values can be directly entered or incremented/decremented using the arrow buttons.

DVB Atlas View

The *DVB Atlas View* shows the configuration and status of the *BARCO Atlas MK II* DVB receiver and displays the measurement results. This view is empty unless the *BARCO Atlas MK II* DVB receiver is used for the measurement.

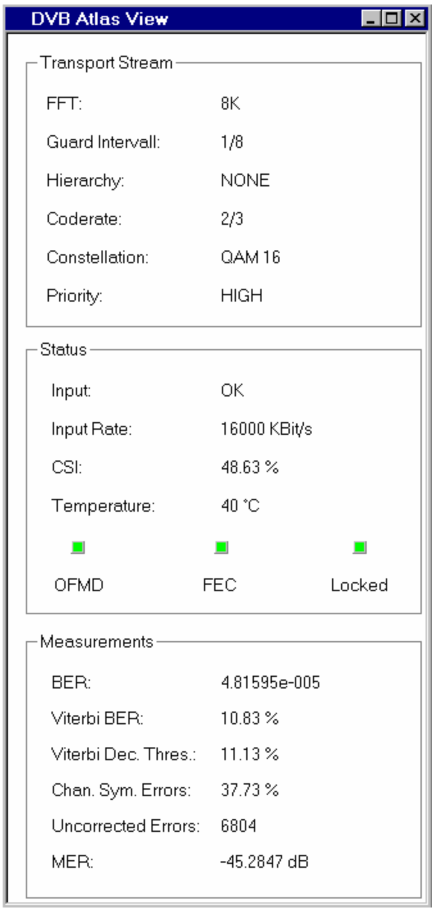


Fig. 4-193 DVB Atlas View

Transport Stream The *Transport Stream* panel displays the Orthogonal Frequency Division Multiplexing (OFDM) parameters of the received DVB signal. OFDM is the transmission scheme used in the DVB system. The parameters are either set in the driver configuration menu in accordance with the received signal or acquired automatically from the input stream; see chapter 6 for detailed information.

FFT

FFT mode of OFDM processing. 2K or 8K mode.

Guard Interval

OFDM guard interval.

Hierarchy

OFDM hierarchical mode: non-hierarchical *(NONE)* or hierarchical with α = 1, 2 or 4. If non-hierarchical is selected, the *Priority* is set to *HIGH*.

Code Rate

Code rate for the Viterbi decoder.

Constellation

Modulation type to transmit the DVB-T signal.

Priority

Priority of the stream *(HIGH or LOW)* when in hierarchical mode.

Status

The *Status* panel gives an overview of the *Atlas MK II* device status:

Input

Indicates whether the RF input is present or not *(Input Loss)*.

Input Rate

The measured input bit rate in kilobits per second.

CSI

Channel Status Indication; shows an indication of the quality of the input channel. The lower the number, higher the quality of the input.

Temperature

Current temperature of the device in Celsius.

OFDM

Indicates whether the OFDM receiver device is able to synchronize to the input from the tuner (green box) or not (red box).

FEC

Indicates whether the FEC decoder device is able to synchronize to the incoming bit stream (green box) or not (red box).

Locked

And function of OFDM sync and FEC sync.

Measurements The *Measurements* panel displays the results provided by the *Atlas MK II* DVB receiver:

BER
Approximation of the actual BER (Bit Error Rate).

Viterbi BER
Number of channel symbol errors divided by the amount of symbols in a time-window.

Viterbi Dec. Thr.
Amount of channel symbol errors at which the Viterbi chip will unlock.

Chan. Sym. Err.
Amount of channel symbol errors. This value must be interpreted using the Viterbi decision threshold.

Uncorrected Err.
Count of errors that could not be corrected by the Reed-Solomon algorithm.

MER
Modulation Error Ratio: This gives an overall figure of merit of the modulation system quality and takes into account errors introduced by the transmitter, channel and receiver. The value is expressed in dB and the higher the value, the higher is the quality of the modulation system.

The *DVB Atlas View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

DVB EFA-T ATSC Histogram View

The *DVB EFA-T ATSC Histogram View* shows the distribution of the I and Q amplitudes at the decision points of a DVB signal that is 8-level Vestigial Sideband (8VSB) modulated according to the ATSC standard. The measurement data must be 8VSB/ATSC data provided by an EFA DVB receiver from Rohde & Schwarz (model R&S EFA 50).

Depending on the driver settings, ROMES provides four different *EFA-T ATSC Histogram Views:*

- It is possible to record and display either the I or the Q amplitudes of the signal.
- Both amplitude diagrams can be displayed with either a linear or a logarithmic vertical scale.

The appropriate view type is selected automatically depending on the measurement and the measurement data. No additional view configuration is needed.

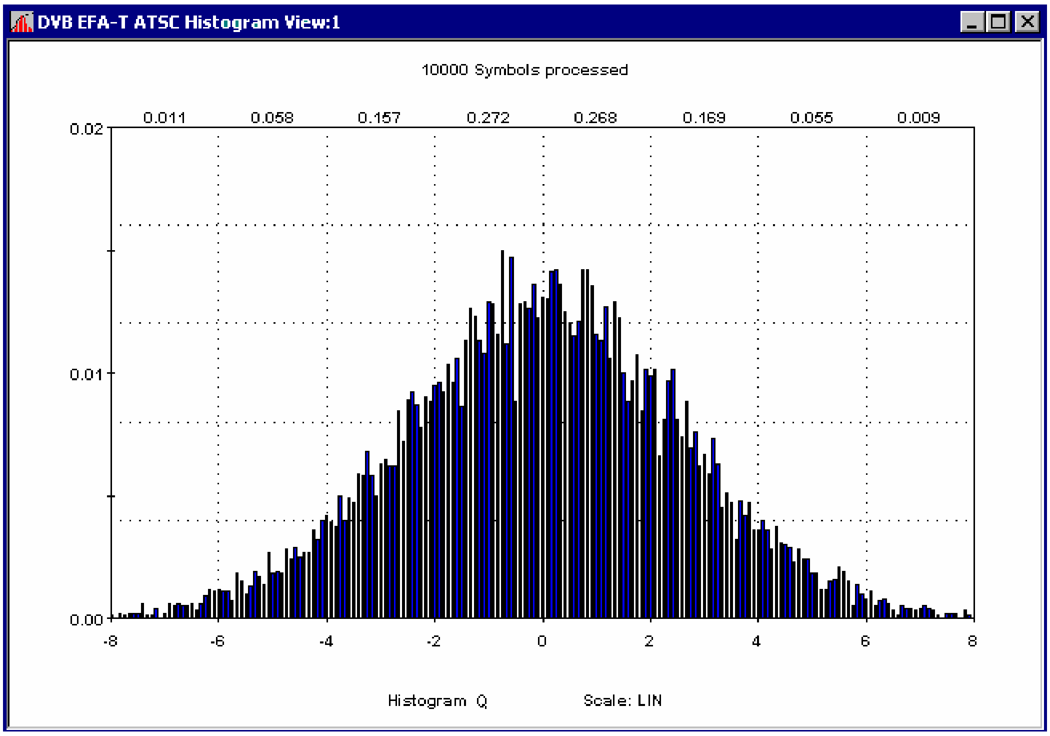


Fig. 4-194 DVB EVA-T ATSC Histogram View (Q amplitude, linear scale)

Histograms

The histograms show the relative number of decision points of the received and demodulated 8VSB/ATSC signal with a definite I or Q amplitude. The normalized amplitudes scale the horizontal axis; the decision limits for 8VSB modulation are at –6, –4, –2, 0, +2, +4, +6 of the normalized I amplitude.

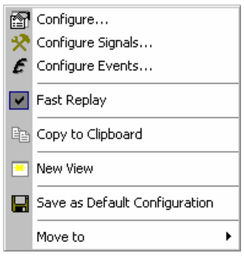
Each decision field (i.e. the amplitude range between each pair of adjacent decision limits) is divided into equidistant normalized amplitude intervals of width 1/12th. 24 bars represent the number of symbols within 1/24th of each decision field relative to the total number of processed symbols. The sum of the 24 bars within each decision field is indicated above the diagram. In addition the total number of processed symbols is displayed on top of the diagram.

I and Q amplitudes

For an ideal 8VSB-modulated signal, all decision points fall into the centers of the I decision fields (normalized I amplitudes ±1, ±3, ±5, ±7). With a uniform distribution of the I amplitudes, each I value would be exactly equal to 1/8 = 0.125. Since the synchronization pulse for 8VSB/ATSC signals is defined at amplitudes ±5, more symbols are generally found in these decision fields.

The Q amplitudes are random and not focused around distinct values (the Q amplitude information is not evaluated). For an ideal signal their distribution is of Gaussian shape, centered around zero.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu displays information about the view version.

DVB EFA-T Amplitude Distribution View

The *DVB EFA-T Amplitude Distribution View* shows the distribution of the (large) signal amplitudes of a DVB carrier signal. The measurement is performed in time domain, the results are averaged over up to 10.24 million samples. The amplitude distribution is particularly useful for analyzing unwanted (e.g. nonlinear) effects of amplifiers and transmitters at high output level.

The measurement data must be 8VSB/ATSC or DVB-T data provided by an EFA DVB receiver from Rohde & Schwarz.

To complement the DVB EFA-T Amplitude Distribution View *ROMES also provides the Complementary Cumulative Distribution Function; see p.* *4.303.*

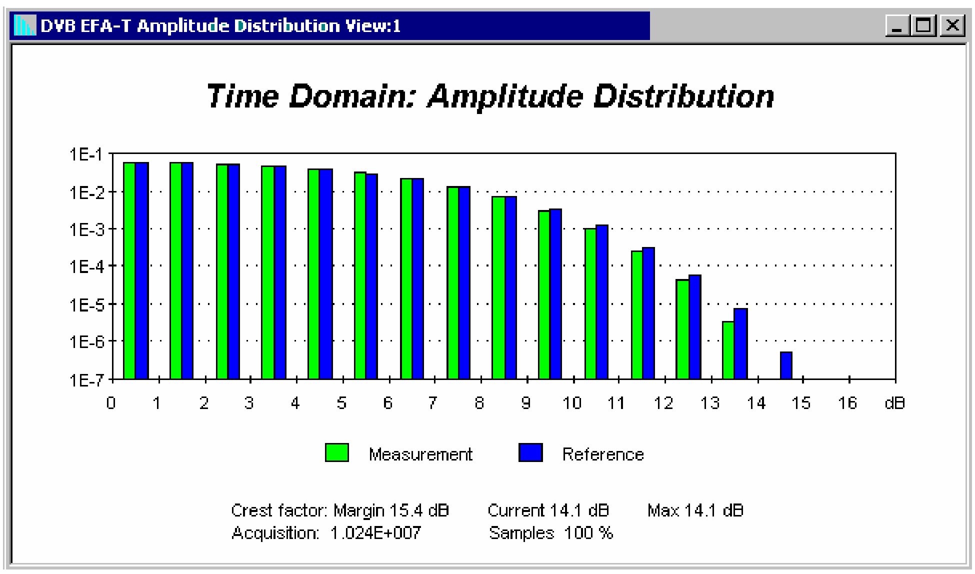


Fig. 4-195 DVB EFA-T Amplitude Distribution View

Histogram

The histogram shows the relative number of measured samples with a definite total amplitude. The amplitudes are expressed as dB-values relative to the RMS-amplitude evaluated over the current *Acquisition* set (see below). Each bar shows the number of samples in a 1dB-wide amplitude range relative to the total number of evaluated samples. The amplitude distribution for values below the RMS-amplitude is not displayed.

The green bars correspond to the measured *Acquisition* samples; the blue bars are displayed for comparison and show the results of an ideal DVB-modulated carrier signal.

Legend and numeric values

A color legend indicates the display colors for the measurement and the reference data; see above. Below, the following measurement values are displayed:

Crest factor

Ratio between the maximum signal amplitude and the RMS-averaged amplitude in dB. The crest factor is evaluated in different ways: The *Current* value is the crest factor evaluated over the current *Acquisition* samples (see below). The *Max* values is the maximum crest factor ever measured since the start of the measurement. The *Margin* is the largest crest factor that the test receiver can determine under the conditions of the measurement; it must be larger than the *Max.* value.

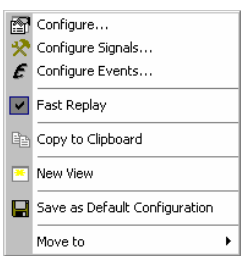
Acquisition

Number of samples evaluated. The value increases until 10.24 million samples are reached. When more data is collected, the oldest samples are discarded; the RMS-amplitude, the diagram bars and the *Current* crest factor is calculated from the last 10.24 million samples (pipeline structure).

Samples

Number of samples evaluated divided by 10.24 million times 100%. The value increases from 0% to 100% and remains constant after 10.24 million samples have been measured.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu displays information about the view version.

DVB EFA-T CCDF View

The *DVB EFA-T CCDF View* shows the Complementary Cumulative Distribution Function (CCDF) of a DVB carrier signal. The CCDF indicates how often a particular signal level is reached or exceeded. This quantity is particularly useful for analyzing unwanted (e.g. non-linear) effects of amplifiers and transmitters at high output level.

Depending on the driver settings, ROMES provides two different *EFA-T CCDF Views:*

- The *CCDF (RF)* view is based on the modulated DVB carrier (RF) signal which is sampled using the same method as for the amplitude distribution (see p. 4.302.). The results are averaged over up to 10.24 million samples.
- The *CCDF (ENV)* view is based on the envelope of the DVB carrier signal. The results are averaged over up to 1 million amplitude values.

Both measurements are performed in the time domain. The appropriate view type is selected automatically depending on the measurement and the measurement data. No additional view configuration is needed.

The measurement data must be 8VSB/ATSC or DVB-T data provided by an EFA DVB receiver from Rohde & Schwarz.

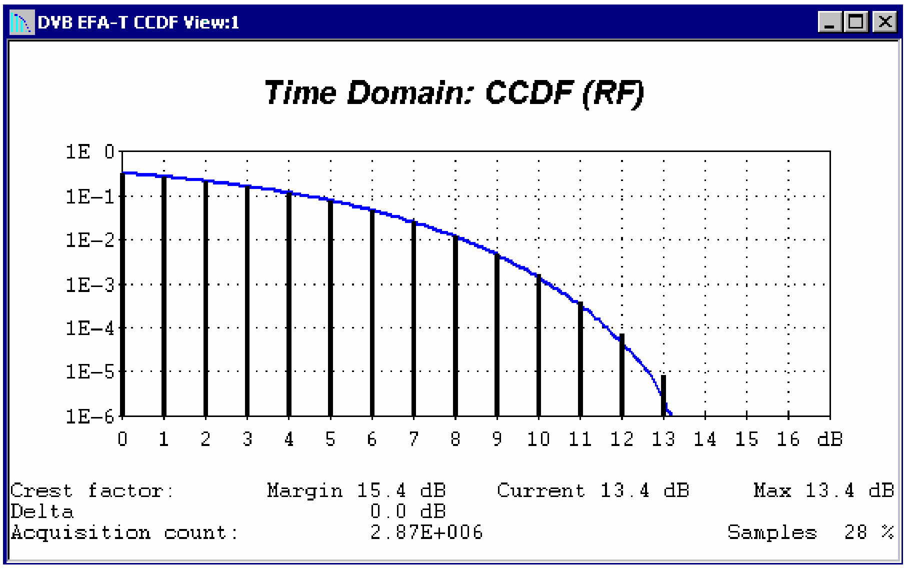


Fig. 4-196 DVB EFA-T CCDF (RF) View

Diagram

The blue curve in the diagram histogram shows the measured CCDF as a function of the signal amplitude. The amplitudes are expressed in dB relative to the RMS-amplitude evaluated over the current *Acquisition* set (see below). The *CCDF (RF)* at each amplitude x is calculated by integrating the amplitude distribution (see p. 4.302.) between x and infinity. The *CCDF (ENV)* is calculated analogously using the amplitude distribution of the envelope signal. Due to its definition, the CCDF is a monotonically decreasing function.

Example:

A CCDF of 10^{-3} at an amplitude value of 10 dB indicates that 1/1000 of all measurement values have an amplitude that exceeds the RMS amplitude by 10 dB or more.

The CCDF for amplitudes below the RMS-value is not shown. The bars are displayed for comparison and show the CCDF of an ideal 8VSB/ATSC-modulated reference signal. In contrast to the measured values, the reference bars are fixed and cannot be evaluated for arbitrary modulation schemes.

Numeric values

Below the diagram, the following measurement values are displayed:

Crest factor

Ratio between the maximum signal amplitude and the RMS-averaged amplitude in dB. The crest factor is evaluated in different ways: The *Current* value is the crest factor evaluated over the current *Acquisition* samples (see below). The *Max* values is the maximum crest factor ever measured since the start of the measurement. The *Margin* is the largest crest factor that the test receiver can determine under the conditions of the measurement; it must be larger than the *Max.* value.

Delta

Difference between the amplitude at which the measured CCDF reaches 10^{-3} and the amplitude at which the CCDF of the ideal 8VSB/ATSC-modulated reference signal reaches 10^{-3}. If the measured signal is also VSB/ATSC-modulated, then *Delta* provides a rough estimate of the nonlinearities in the measured signal. If the measured signal is a DVB-T signal, then the *Delta* value is invalid, the view displays the value “0.0 dB”.

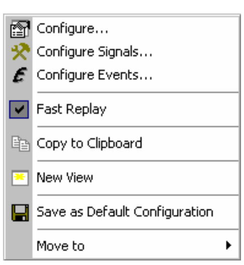
Acquisition

Number of samples evaluated. The value increases until 10.24 million samples are reached. When more data is collected, the oldest samples are discarded; the RMS-amplitude, the diagram bars and the *Current* crest factor is calculated from the last 10.24 million samples (pipeline structure).

Samples

Number of samples evaluated divided by 10.24 million times 100%. The value increases from 0% to 100% and remains constant after 10.24 million samples have been measured.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu displays information about the view version.

DVB EFA-T Echo Pattern View

The *DVB EFA-T Echo Pattern View* shows the channel impulse response pattern of a DVB carrier signal. The pattern contains the main pulse and the interfering echoes together with their time delay relative to the main pulse and their relative strength. The data is calculated from an analysis of the linear distortion of the DVB channel in the frequency domain, which is transformed to the time domain using an Inverse Fast Fourier Transform (IFFT).

The measurement data must be 8VSB/ATSC data provided by an EFA DVB receiver from Rohde & Schwarz.

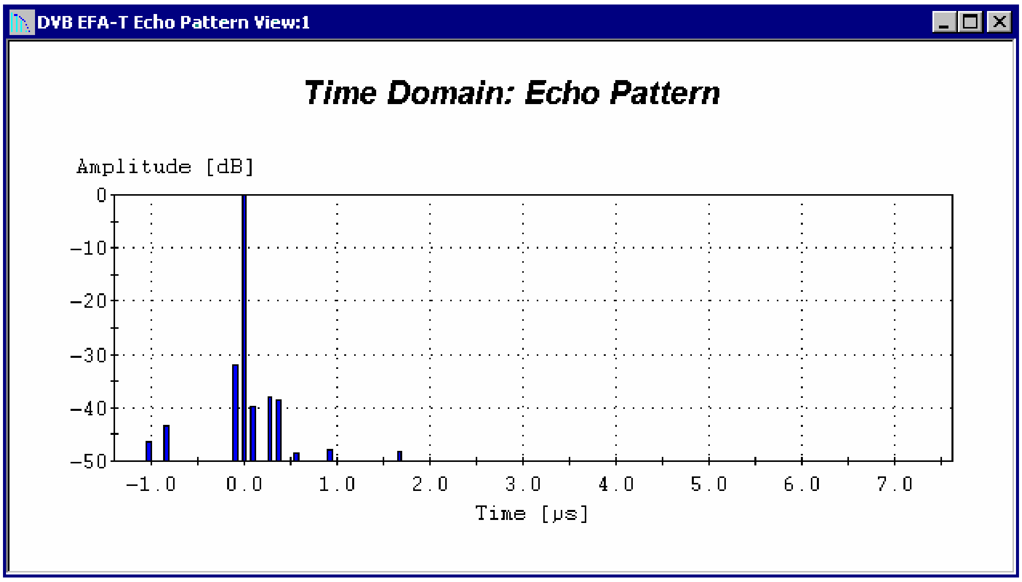
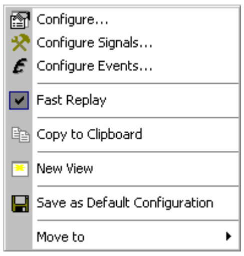


Fig. 4-197 DVB EFA-T Echo Pattern View

Histogram

The histogram shows the main pulse at t = 0 µs, accompanied by pre-echoes to the left (i.e. in the negative time range) and post-echoes to the right. Pre-echoes are mainly caused by crosstalk in filters, whereas post-echoes typically result from reflections. All pulses are normalized to a main pulse level of 0 dB. The time axis is set in accordance with the *Echo Pattern – Range* and *Scale* settings made in the *ATSC Ext. Configuration* tab of the driver configuration menu.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu displays information about the view version.

UMTS PNS Views

The *UMTS PNS Views* display information about UMTS Pseudo Noise (PN) data. UMTS PNS measurements are performed using the UMTS PN Scanner driver R&S PNS (see chapter 6). The driver controls a R&S FSP spectrum analyzer, a R&S ESPI test receiver, or a R&S TSMU radio network analyzer in order to alternate between UMTS Pseudo Noise (PN) scans and a spectrum analysis. Most of the results obtained with the different test instruments are equivalent.

- In an UMTS PN scan, the test device measures and identifies all UMTS downlink (Node B) signals in the air. The main purpose of this measurement is to test the receiving conditions of a mobile in an UMTS network and to analyze possible interferences. Results of the UMTS PN scans are displayed in all PNS views except the *PNS Spectrum View* and in the *PNS Spectrum History View.*

- The spectrum analysis consists of a frequency sweep over a specified range to detect arbitrary UMTS downlink and uplink signals. Results of the UMTS PN scans are displayed in all PNS views except the *PNS Spectrum View* and in the *PNS Spectrum History View.*

Many of the UMTS PN Scanner results can also be displayed in other ROMES views, e.g. in the *Alphanumeric View*, the *2D Chart View*, the *Route Track View,* and the *Statistic Histogram View*. Some measurement examples using the UMTS PN Scanner are outlined in chapter 2.

ROMES offers two additional views to analyze a general spectrum acquired with an R&S FSP or R&S ESPI; see section Spectrum Views on p. 4.364*. The general spectrum views do not require a PNS driver.*

The UMTS PNS views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *UMTS PNS Views*.

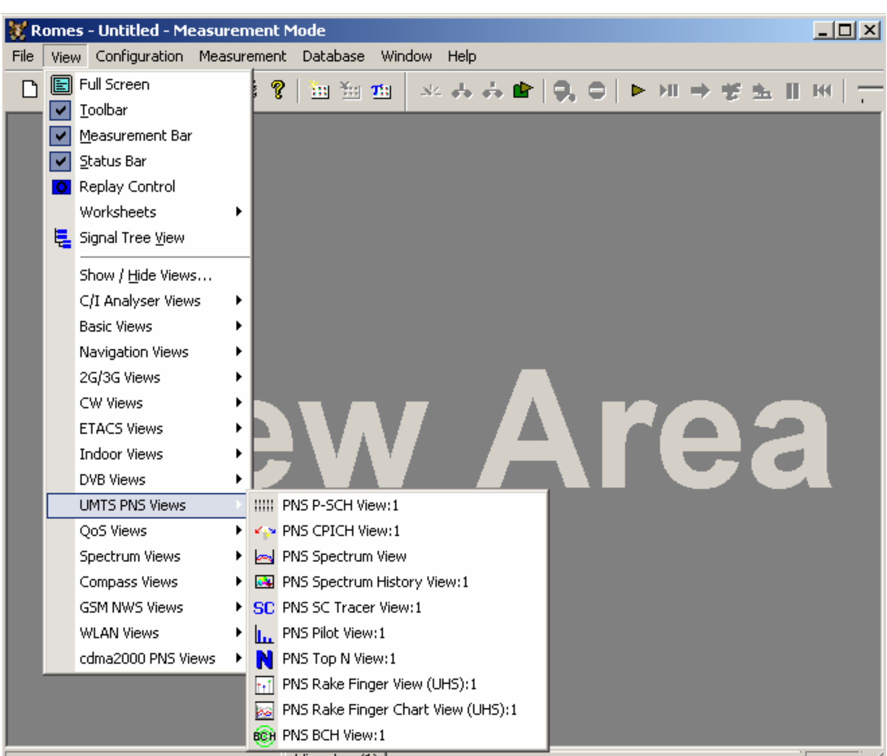


Fig. 4-198 View – UMTS PNS menu

PNS P-SCH View

The *PNS P-SCH View* displays the signal power of the Primary Synchronization Channel of all recorded DL UMTS signals. Additional information is displayed in a table below the diagram.

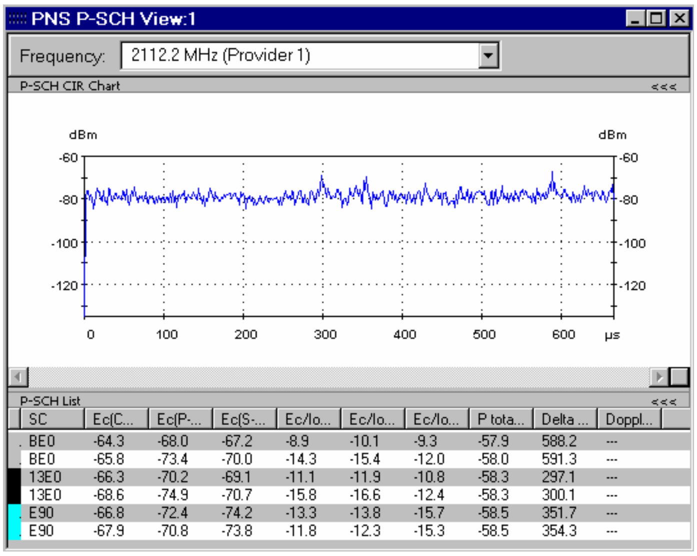


Fig. 4-199 PNS P-SCH View

Frequency

Below the view title, the *Frequency* pull-down list contains all measured frequencies selected in the *Receiver* tab of the driver configuration menu. The list is also provided in the *PNS CPICH View, PNS Pilot View* and *PNS SC Tracer View.*

Changing the frequency in one of these views automatically adapts the frequencies in all other views, provided they have the same current number in their title bar (e.g. the 1 in the figure above). Using this feature, it is possible to generate different groups of views with the same current number (opened by means of the context menu; see below) and select frequencies for an entire group with a single mouse click.

View area

The entire view area is horizontally split to accommodate a chart and a table/list. The *P-SCH CIR Chart* shows the power of the received P-SCHs in all recorded DL UMTS signals over the time. This power is measured when the system correlates to the P-SCHs (1st synchronization step; see section *PNS CPICH View* on p. 4.310.) and therefore always available. The *P-SCH List* below shows only the signals to which the system could synchronize in order to determine the SC. Typically the tallest peaks of the diagram correspond to the values of *Ec (P-SCH)* displayed in the table.

A click on the *P-SCH CIR Chart* or *P-SCH Lists* title bars compresses and expands the 2D-chart or table. A compressed chart leaves more space for the table and vice versa. Moreover, the tables appear in several PNS views so that compressing them can help to avoid redundancies. A compressed subdiagram is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

Diagram scale

The diagram is opened with a default x-axis scale of one UMTS slot (2/3 ms ≈ 666 µs). If placed inside the diagram area the cursor takes the shape of a zoom-in icon (a magnifying glass with a '+' inside), and a vertical line is displayed at the cursor position.

A left mouse click magnifies the diagram in x-direction around the cursor position, *Ctrl* plus left mouse click causes the opposite. An area to become the new x-axis range (e.g. the area around a peak) can be marked while the left mouse button is pressed. *Reset Zoom* in the context menu restores the default scale. A scrollbar is provided to move the magnified diagram to the right or left.

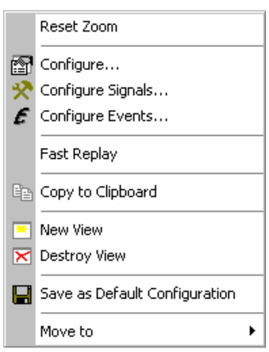
The scale of the y-axis (power in dBm) can be set in the configuration menu.

Table

Below the diagram, the *P-SCH List* gives an overview of the received signals together with their scrambling codes, different power parameters, frequency and timing information. On mouse hover-over, each cell in the table header provides a short explanation of the corresponding column. The *P-SCH List* is identical with the *Peak List* in the *PNS CPICH View.* For a detailed explanation of the parameters refer to section *PNS CPICH View* on p. 4.310.

In the configuration menu, it is possible to show or hide each individual table row.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The context menu provides the following additional commands:

Reset Zoom Resets the x-axis scale to 0 ms to 2/3 ms.

PNS P-SCH Configuration

The *PNS P-SCH* configuration menu defines the y-axis scale, i.e. the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *PNS P-SCH View,* and the contents of the table. It is opened via a right mouse click on a point inside the *PNS P-SCH View* or via the *Configuration – Settings* command (see chapter 3).

All settings are analogous to the settings in the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

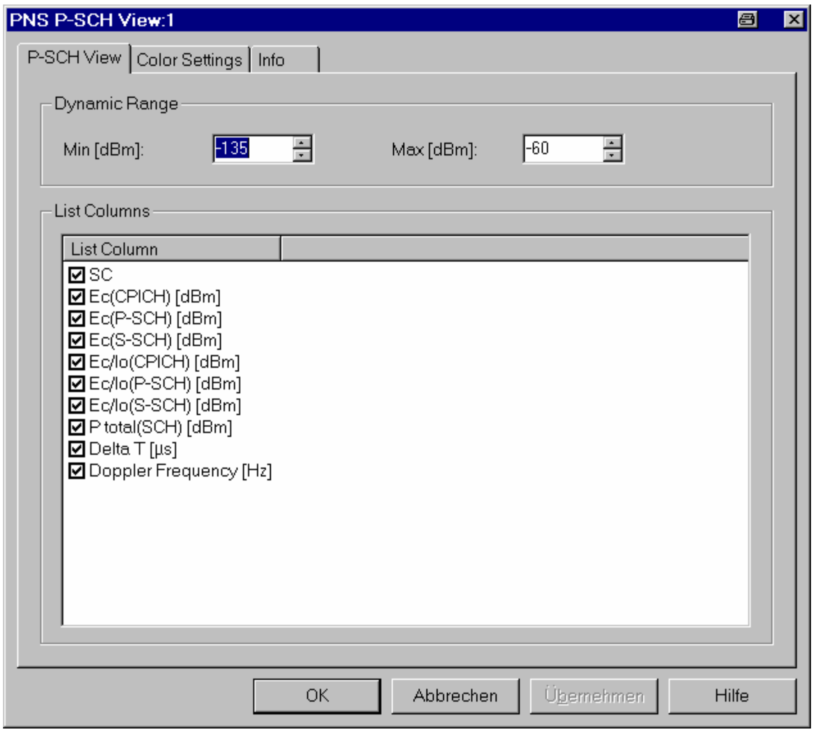


Fig. 4-200 PNS P-SCH configuration: P-SCH View

The *Color Settings* tab of the *PNS P-SCH* configuration menu is analogous to the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

PNS CPICH View

The *PNS CPICH View* shows the average signal power of the received P-CPICHs and a comprehensive analysis of the properties of all DL signals received in the UMTS PN scan.

Different signals are distinguished by their slot timing (the beginning of the slot detected by the receiver of the test instrument). Signals from different Node Bs are distinguished by their primary scrambling codes (SC), transmitted over the CPICH. Signals with different slot timing but equal SC originate from the same Node B but propagated along different paths. A comparison of those signals provides important information on reflections and possible interferences.

The analysis requires synchronization to each received signal, which is performed in a 3-step process:

1. The test device searches for the Primary Synchronization Channel (P-SCH) to obtain the slot timing. The start of the P-SCH marks the beginning of the slot.
2. The Secondary Synchronization Channel (S-SCH) is analyzed to obtain the scrambling code group (CG) and the frame timing.
3. The SC within the CG is determined by correlating with the pilot bits of the CPICH.

Steps 2 and 3 are modified if *High Speed* is selected in the *Measurements* tab of the driver configuration menu (see chapter 6). This tab also defines the *Synchronization Rate.*

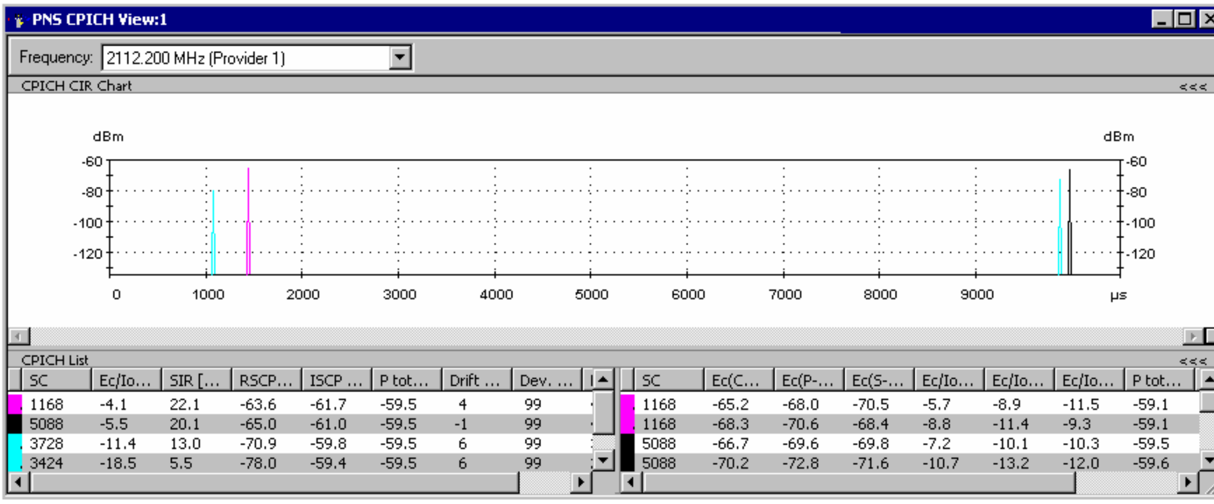


Fig. 4-201 PNS CPICH View

Frequency

Below the view title, the *Frequency* pull-down list contains all measured frequencies selected in the *Receiver* tab of the driver configuration menu. The list is also provided in the *PNS P-SCH View, PNS Pilot View* and *PNS SC Tracer View.*

Changing the frequency in one of these views automatically adapts the frequencies in all other views, provided they have the same current number in their title bar (e.g. the 1 in the figure above). Using this feature, it is possible to generate different groups of views with the same current number (opened by means of the context menu; see below) and select frequencies for an entire group with a single mouse click.

View area

The entire view area is horizontally split to accommodate a chart and a table/list. The *CPICH CIR Chart* (Carrier to Interference Ratio) shows the average signal power of the P-CPICHs of all received signals over the time. The displayed powers and times correspond to the *Ec (CPICH) [dBm]* and *Delta T[µs]* values listed in the *Peak List* (right-hand part of the *CPICH List)*.

A click on the *CPICH CIR Chart* or *CPICH Lists* title bars compresses and expands the 2D-chart or table. A compressed chart leaves more space for the table and vice versa. Moreover, the tables appear in several PNS views so that compressing them can help to avoid redundancies. A compressed subdiagram is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

Diagram scale

The diagram is opened with a default x-axis scale of little more than one UMTS frame (10 ms). If placed inside the diagram area the cursor takes the shape of a zoom-in icon (a magnifying glass with a '+' inside), and a vertical line is displayed at the cursor position.

A left mouse click magnifies the diagram in x-direction around the cursor position, *Ctrl* plus left mouse click causes the opposite. An area to become the new x-axis range (e.g. the area around a peak) can be marked while the left mouse button is pressed. *Reset Zoom* in the context menu restores the default scale. A scrollbar is provided to move the magnified diagram to the right or left.

The scale of the y-axis (power in dBm) can be set in the configuration menu.

Table entries

Below the diagram, the *CPICH Lists* give an overview of the received signals together with their scrambling codes, different power parameters, frequency and timing information. On mouse hover-over, each cell in the table header provides a short explanation of the corresponding column.

The entire table is divided into the *CPICH List* and the *Peak List.* In the configuration menu, it is possible to show or hide each individual table row in both lists.

CPICH List

The *CPICH List* (left-hand part of the *CPICH Lists)* provides a general description of the received CPICH signals from each Node B. Each signal is characterized by its SC, corresponding to the transmitting Node B, and includes all possible peaks (reflections) indicated in the *Peak List* on the right-hand side. The list can contain the following CPICH-related values (see also standard 3GPP TS 25.215 and related standards. All power results in the CPICH List and Peak List are obtained in an unbiased measurement: The contribution of the noise floor to the powers is subtracted.):

SC [Hex]

Primary scrambling code no. of the CPICH signal in the format selected in the *TEC for UMTS PNS* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. In decimal representation, the primary scrambling code numbers are multiples of 16: SC[dec] = 16*i where i=0 to 511, so the least significant digit of the hex numbers is always 0 (see also *PNS SC Tracer View* on p. 4.323). Sequence numbers *:1, :2* behind a code distinguish multiple reflections.
Each SC is identified by a color, to be customized in the configuration menu. The SC color codes are also shown in the *Route Track* menu; see paragraph on scrambling code indication on p. 4.37.

Signal power

Ec/Io [dB]

Ratio of the received energy per PN chip of the CPICH and of the entire Node B signal to the total transmit power spectral density. The value equals to the sum of the *Ec/Io (CPICH) [dB]* values of all individual peaks of the same SC displayed in the *Peak List;* see below.

SIR [dB]

Signal-to-Interference Ratio of the CPICH, RSCP/ISCP*256 where 256 is the CPICH spreading factor.

RSCP [dBm]

CPICH Received Signal Code Power; sum of the received powers of all peaks on one code, measured on the pilot bits of the Primary CPICH.

ISCP [dBm]

Interference Signal Code Power, the interference on the received signal measured on the pilot bits. Both the orthogonal and the non-orthogonal parts of the interference are included in the measurement.

P total [dBm]

Total received wide-band power in the channel, measured within the correlation sections of the P-CPICH. The observed signal section is the same for all signals, so *P total* is the same for all Node Bs. *P total* is equal to Io during the CPICH chips so that the following relation holds:

P total + Ec/Io = RSCP

Signal timing

Drift [ns/s] Averaged change of the time delay of the CPICH peaks of a Node B signal over the time. A drift translates into a lateral deviation of the signal in the *PNS SC Tracer View* (see p. 4.323). It may be due to one or several of the following effects:

- Doppler effect due to a relative movement of the test vehicle and the Node B.
- Drift of the system time compared to the nominal UMTS timing
- Drift of the Node B timing compared to the nominal UMTS timing

A measurement at fixed position eliminates the Doppler effect and thus allows to isolate and assess the two other effects. To disentangle system time and Node B drift it is sufficient to compare signals from several Node Bs: If several signals are measured with the same drift this common drift is very likely to be due to the system time. After subtraction of this common system time drift, one is left with the drift of the individual Node Bs.

Dev. Drift [ns/s]
90% confidence interval width of the average time drift. A small value indicates that the drift measurement is estimated to be relatively accurate.

Note:
The accuracy of the drift measurement increases with the number of measured values. Consequently, the Dev. Drift values (and often also the Drift values) typically decrease as the measurement progresses.

Del. Spread [Chip]
RMS delay spread in chip periods: Standard deviation of the time delay *Delta T* at all CPICH measurement points weighted with the measured powers *Ec (CPICH)*. A small delay spread indicates that the individual CPICH peaks of the Node B signal are relatively close or that the power of peaks with different time delay is very low.

The *CPICH List* is also displayed in the *PNS Top N View.*

Peak List

The rows of the *Peak List* (right-hand part of the *CPICH Lists)* describe the single peaks (reflections) that contribute to the different Node B signals. The list can contain the following values (see also standard 3GPP TS 25.215 and related standards):

SC [Hex]
Primary scrambling code no. of the CPICH in the format selected in the *TEC for UMTS PNS* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3.

Signal power

Ec (<Ch>) [dBm]

Average energy per transmitted PN (Pseudo Noise) chip for channel <Ch>, divided by the chip period and thus converted into an average received signal power (in dBm). Ec is displayed for the (Primary) CPICH, P-SCH and S-SCH.

Ec/Io (<Ch>) [dB]

Ratio of the received energy per PN chip for channel (<Ch>) to the total transmit power spectral density. *Ec/Io* is displayed for the (Primary) CPICH, P-SCH and S-SCH.

P total (SCH)...

Total averaged received signal power for the duration of the SCH. *P total* contains the contributions of all channels during the observation period and is therefore always greater than *Ec (P-SCH)* or *Ec (S-SCH).* The following relations hold:
P total + Ec/Io (P-SCH) = Ec (P-SCH)
P total + Ec/Io (S-SCH) = Ec (S-SCH)

Signal timing

Delta T [μs]

Time delay of the signal's slot timing relative to the system time or GPS time (hardware-dependent). The reference time (left edge of the diagram) is of minor importance as the diagram extends over more than one frame, which is enough to display and separate all received signals.

Doppler Freq.

Frequency offset of the measured P-CPICH carrier frequency compared to the nominal UMTS channel frequency. In a coverage measurement on a moving test vehicle, an important source of frequency offsets is the Doppler shift due to the speed of the receiver relative to the transmitter. Constant frequency offsets do not originate from the Doppler shift and can be corrected in the configuration menu.
The *Doppler Frequency* is available only if *High Dynamic* is selected in the *Measurements* tab of the driver configuration menu (see chapter 6).

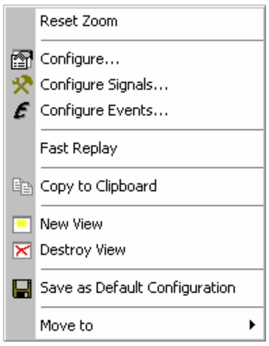
The *Peak List* is also displayed in the *PNS P-SCH View.*

Special table entries

Depending on the conditions of the measurement the tables may show some particular results:

- An invalid result "---" denotes that a peak or the entire Node B signal was too weak to be accurately measured. Selecting *High Dynamic* mode in the measurements tab of the driver configuration menu generally reduces the number of invalid results.
- A number *(:1, :2* etc., e.g. the *E90:1* in Fig. 4-201 above) behind the scrambling code denotes that signals with the same scrambling code but with a significant difference in their time delays were received. Two different scenarios can cause multiple scrambling codes:
  - If several of those signals occur at the same time, they are likely to belong to different Node Bs that accidentally use the same SC.
  - Two signals with different numbers behind their scrambling codes that are received at different times can belong to the same Node B but actually indicate a strong time drift.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The context menu provides the following additional commands:

Reset Zoom Resets the x-axis scale to 0 ms to approx. 10.5 ms.

PNS CPICH Configuration

The *PNS CPICH* configuration menu customizes the diagram in the *PNS CPICH View* and the contents of the table. It is opened via a right mouse click on a point inside the *PNS CPICH View* or via the *Configuration – Settings* command (see chapter 3).

The *CPICH View* tab sets the y-axis scale of the *PNS CPICH View*, selects the information to be displayed in the table and corrects the Doppler frequency.

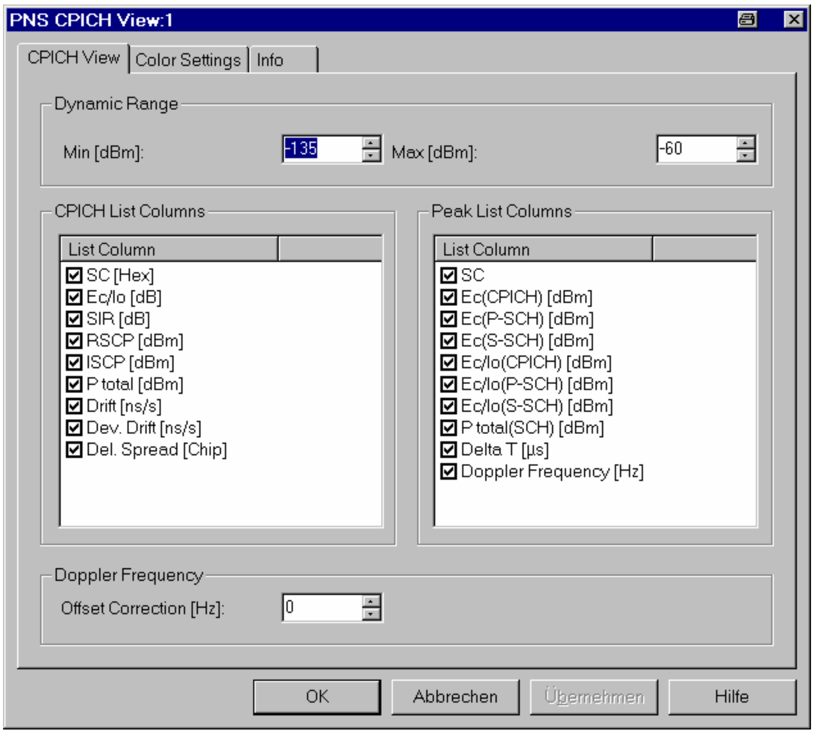


Fig. 4-202 PNS CPICH configuration: CPICH View

Dynamic Range The two input fields in the *Dynamic Range* panel define the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *PNS CPICH View.*

CPICH List

Peak List

The *CPICH List* and *Peak List* panels select which information is displayed in the tables below the *PNS CPICH* diagram (see *Fig. 4-201 above*). Clearing a box hides the corresponding row in the diagram

Doppler Frequency

The *Doppler Frequency* panel provides an input field to correct the *Doppler Frequency* displayed in the *Peak List*. The purpose of the correction is to subtract out constant frequency offsets that can not originate from the speed of the test vehicle relative to the signal source.

Possible sources of constant frequency offsets are de-tuned Node B transmitters and test device receivers.

TIP

A measurement at fixed position eliminates the Doppler effect and thus allows to assess the frequency offset of the test device receiver and the different Node Bs. A de-tuned receiver causes the same frequency offset on signals from different Node Bs. Therefore, if several Node B signals are measured with the same Doppler frequency in a fixed-position measurement, the Doppler frequency measured is due to the receiver. If this common frequency offset is entered as an Offset Correction*, the CPICH View table indicates the frequency offset of the individual Node Bs.*

The *Color Settings* tab sets the color scale for the scrambling codes. The SC color codes are also shown in the *Route Track* menu; see paragraph on scrambling code indication on p. 4.37.

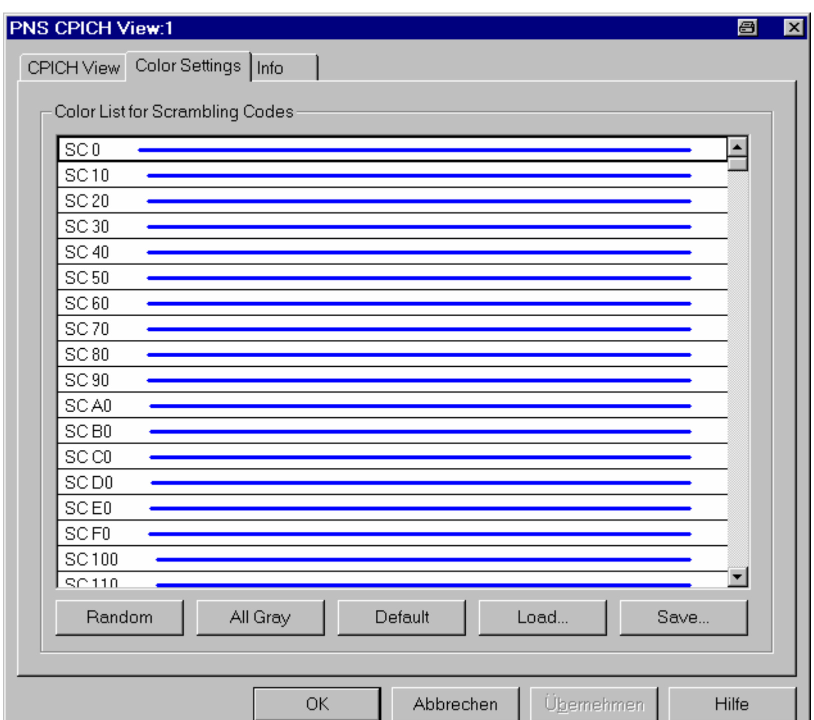


Fig. 4-203 PNS CPICH configuration: Color Settings

The colors are displayed in the diagram (power peaks) and in the first table row (scrambling code scale). A double-click on a line in the *Color List* opens the *Colors* dialog (see p. 4.322) to change the current display color.

Random No ordering; colors are assigned to the scrambling codes at random.

All Gray Color scale suppressed; all colors are gray. This option is suitable e.g. to distinguish a single scrambling code (or a small number of scrambling codes), colored different, from all other codes, colored gray.

Default Predefined color scale: Colors change continuously as the scrambling codes increase.

Load/Save A color scale can be loaded from an SC color file (*.scc) and user-defined color scales can be stored to *.scc files to be reused in a later session.

PNS Spectrum View

The *PNS Spectrum View* displays the total signal power in two different frequency ranges. By default the frequency ranges comprise the entire nominal UMTS uplink and downlink band, exceeding the nominal UMTS carrier spacing of 5 MHz. The representation allows to analyze several channels/networks or adjacent channel contributions in the uplink and downlink band at the same time.

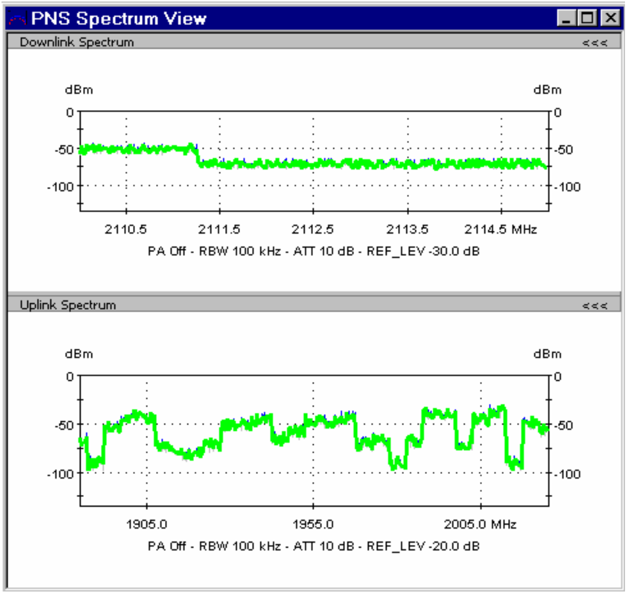


Fig. 4-204 PNS Spectrum View

View area

The entire view area is horizontally split to accommodate two different 2D-charts for the received downlink and uplink signals, respectively. The 2D-charts show the received UMTS signal strength as a function of the frequency. The diagrams are separately updated with the *Measurement Rates* set in the *Measurements* tab of the driver configuration menu:

X-axis (frequency)
: Measured uplink or downlink frequency range. In the driver configuration menu, the measurement range for uplink and downlink signals is set independently, so the scales of the two 2D-charts can be different.

Y-axis (power)
: Received total signal power. The result is a function of the *Spectrum* analyzer settings specified in the driver configuration menu. A common scale *(Dynamic Range)* for both 2D-charts can be set in the configuration menu; see below.

A click on the *Downlink Spectrum* or *Uplink Spectrum* title bars compresses and expands the corresponding 2D-charts. A compressed downlink chart leaves more space for the uplink chart and vice versa. A compressed chart is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

Diagram subtitles

The parameters displayed below the downlink and uplink spectrum diagrams represent test device settings that are important for the interpretation of the results.

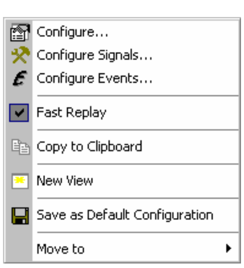
PA
: Setting of the preamplifier *(On* or *Off)*. The preamplifier is automatically set at the test device.

RBW
: Resolution bandwidth of the measurement (IF) filter of the test device as set in the driver configuration menu. The wideband signal power measured by a spectrum analyzer is a function of the RBW.

ATT
: Setting of the receiver attenuator; a large attenuation factor (i.e. a low mixer level) suppresses distortions but increases the noise level and reduces the dynamic range.

REF_LEV
: Reference level of the test device: Input signals will not overload the input path of the receiver as long as they are below the reference level.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

PNS Spectrum Configuration

The *PNS Spectrum* configuration menu defines the y-axis scale, i.e. the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *PNS Spectrum View*. It is opened via a right mouse click on a point inside the *PNS Spectrum View* or via the *Configuration – Settings* command (see chapter 3).

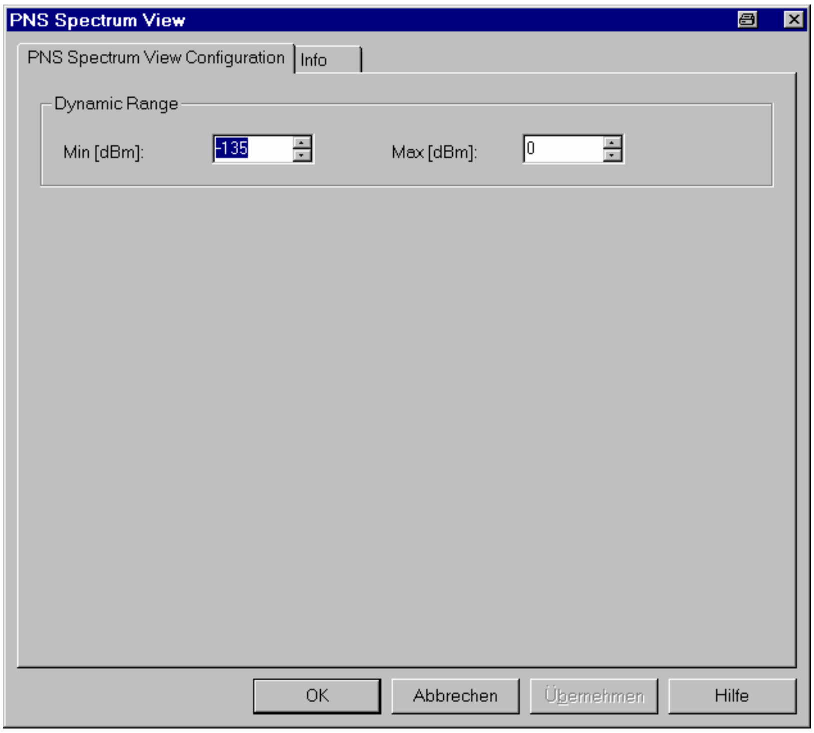


Fig. 4-205 PNS Spectrum configuration

Dynamic Range The two input fields in the *Dynamic Range* panel define the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *PNS Spectrum View.*

PNS Spectrum History View

The *PNS Spectrum History View* displays the evolution in time of the total signal power in one of two specified frequency ranges. By default the frequency ranges comprise the entire nominal UMTS uplink and downlink band, exceeding the nominal UMTS carrier spacing of 5 MHz. The representation allows to analyze several channels/networks or adjacent channel contributions in the uplink and downlink band at the same time.

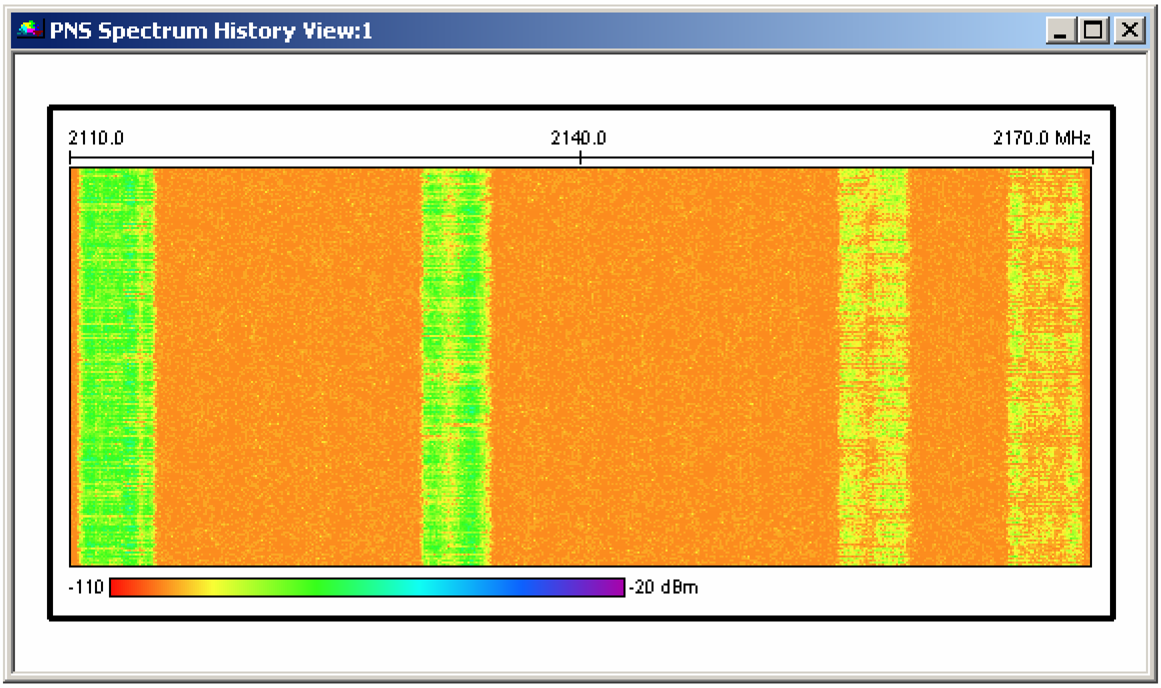


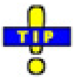
Fig. 4-206 PNS Spectrum History View

View area

The colored rectangular diagram shows the total signal power received in consecutive frequency sweeps. The result is a function of the *Spectrum* analyzer settings specified in the *Measurements* tab of the driver configuration menu. The signal power is displayed as a function of the frequency and time using the color scheme defined in the configuration menu. The configuration menu also defines which of the two frequency ranges (termed uplink or downlink) are displayed. The rectangular view area represents the time/frequency plane:

X-axis (frequency)

Measured uplink or downlink frequency range as defined in the driver configuration menu. If the view window is narrower than the diagram width, a scrollbar appears across the bottom of the diagram.



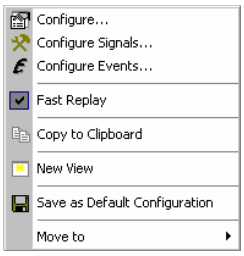
If the PNS spectrum is measured with a TSMU test receiver, the number of measurement points per sweep and thus the diagram width can be varied; see description of the Measurements *tab of the* R&S UMTS PNS *driver configuration menu in chapter 6.*

Y-axis (time)

Linear time scale of the measurement. The diagram consists of 100 to 800 lines, arranged from top to bottom. Each line shows the result of a single sweep across the specified frequency range.

The diagram is continuously updated during the measurement or replay by adding new lines. It is automatically scrolled as soon as a line reaches the bottom of the diagram.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

PNS Spectrum History Configuration

The *PNS Spectrum History* configuration menu defines the number of lines, selects the frequency range and sets the colors in the *PNS Spectrum History View*. It is opened via a right mouse click on a point inside the *PNS Spectrum History View* or via the *Configuration – Settings* command (see chapter 3).

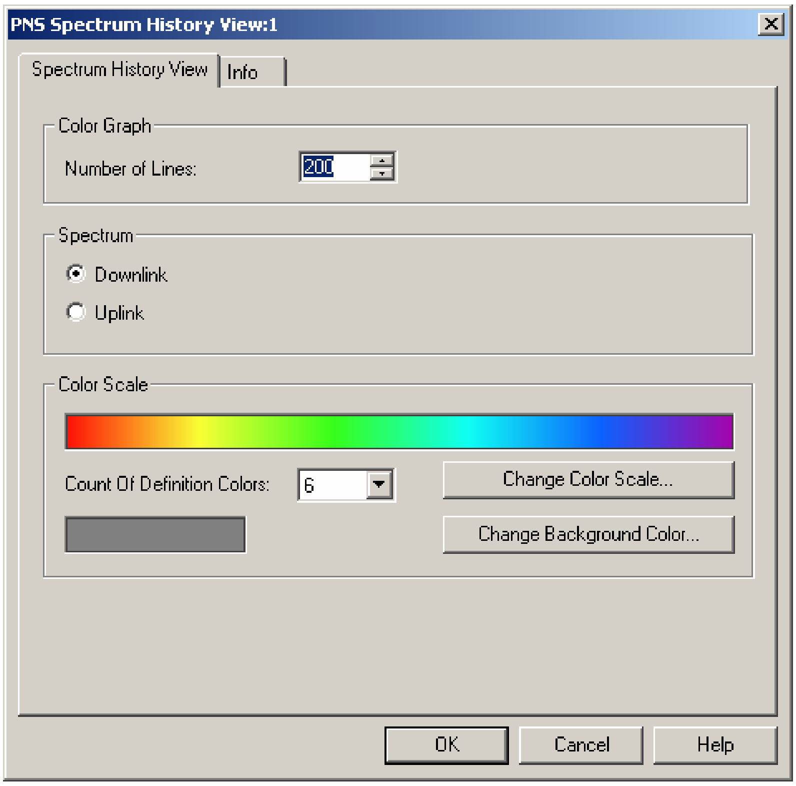


Fig. 4-207 PNS Spectrum History configuration

Color Graph

The *Color Graph* panel defines the *Number of Lines* to be displayed in the *PNS Spectrum History View*. A line corresponds to a single frequency sweep. The corresponding frequency range and the measurement rate is set in the *Measurements* tab of the driver configuration menu. The *Number of Lines* parameter defines the height of the *PNS Spectrum History View*.

Spectrum

The *Spectrum* panel contains two option buttons to select either the downlink or the uplink spectrum to be displayed. The downlink and uplink frequency ranges are defined in the driver configuration menu. They are measured simultaneously and recorded in a common measurement file, however, they can be analyzed separately in the *UMTS PNS Spectrum* ... views.

Color Scale

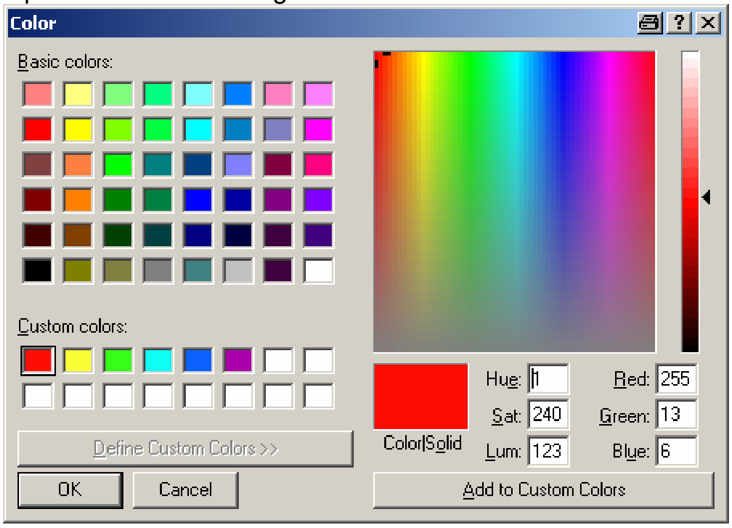
The *Color Scale* panel defines a color scale for the lines in the *PNS Spectrum History View* and for the background. The scale is derived from 2 to 16 *definition colors*. The definition colors are entered at equidistant positions on the color scale, the first and last color defining the beginning and the end of the scale. Between the definition colors, the hue changes continuously.

Count of Definition Colors

Pull-down list to select the number of definition colors in the range 2 to 16.

Change Color Scale

Opens the *Colors* dialog to select or define the definition colors.



The current definition colors are displayed in the Custom Colors section. The F1 function key provides help about the remaining control elements in the dialog.

Change Background Color

Opens the Colors dialog to select or define a background color for the diagram; see above.

PNS SC Tracer View

The *PNS SC Tracer View* shows the evolution in time of the time delay and CPICH signal power of all received UMTS peaks with a particular primary scrambling code (SC) or a particular rank in a top N pool.

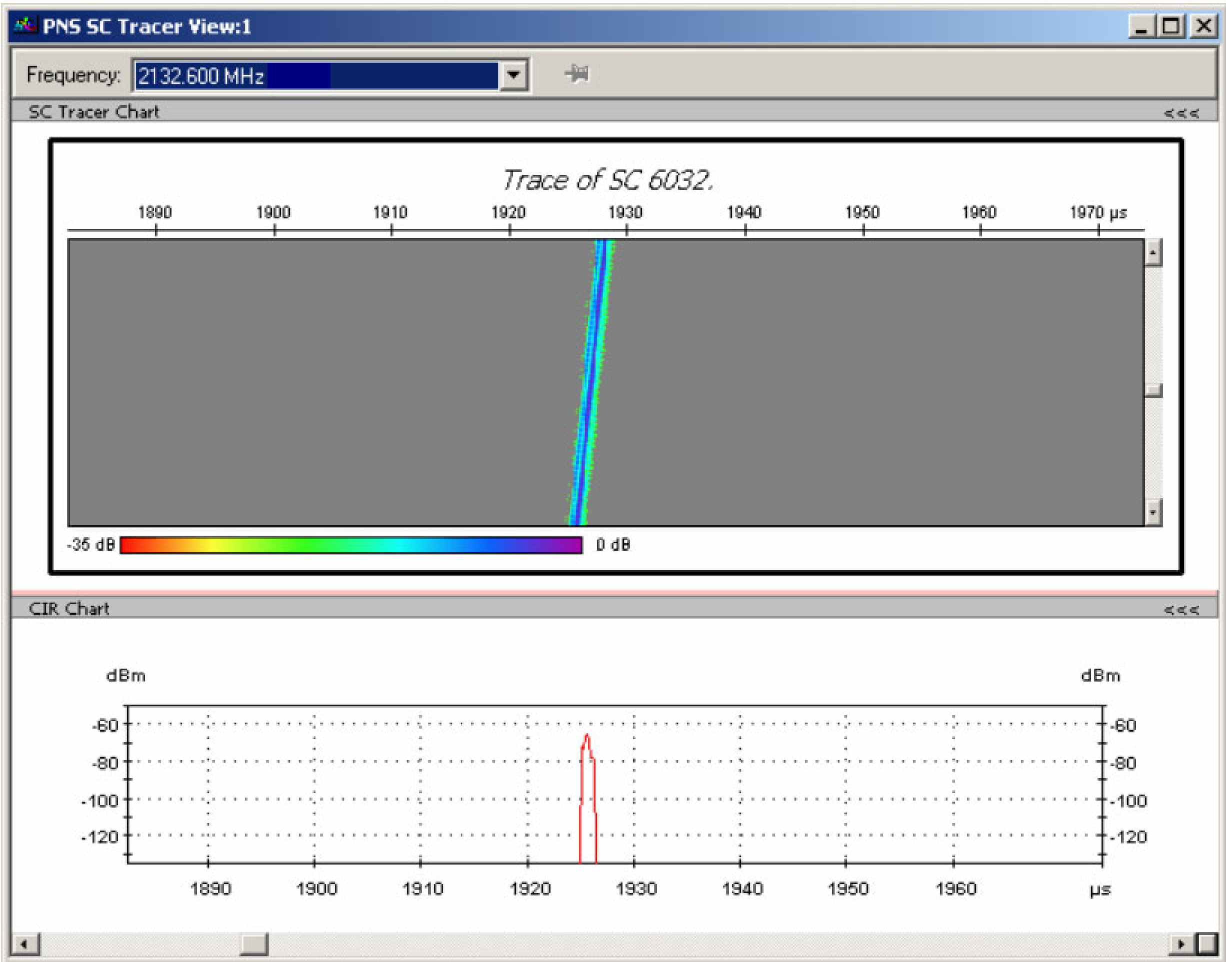


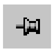
Fig. 4-208 PNS SC Tracer View

Frequency

Below the view title, the *Frequency* pull-down list contains all measured frequencies selected in the *Receiver* tab of the driver configuration menu. The list is also provided in the *PNS P-SCH View, PNS Pilot View* and *PNS CPICH View.*

Changing the frequency in one of these views automatically adapts the frequencies in all other views, provided they have the same current number in their title bar (e.g. the 1 in the figure above). Using this feature, it is possible to generate different groups of views with the same current number (opened by means of the context menu; see below) and select frequencies for an entire group with a single mouse click.

Fix current scrambling code



The pin icon to the right of the *Frequency* list forces the system to trace the current scrambling code, even if *Trace Top N Element* is selected in the configuration menu. In fixed SC mode the icon is crossed out with red color and *Fixed Top N...* is indicated in the title of the *SC Trace Chart.*

Clicking the crossed-out icon again releases the fixed SC: The system continues tracing the selected top N element. If *Trace a Fixed SC* is selected in the configuration menu the pin icon has no effect.

View area

The entire view area is horizontally split to accommodate two different charts.

A click on the *SC Tracer Chart* or *CIR Chart* title bars compresses and expands the corresponding chart. A compressed chart leaves more space for the other chart. A compressed chart is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

SC Tracer Chart

The colored rectangular diagram shows the evolution in time of the power *Ec (CPICH) [dBm]* and the time delay *Delta T[µs]* using the color scheme defined in the configuration menu*. Ec (CPICH) [dBm]* and *Delta T[µs]* are listed in the *Peak List* in the *PNS CPICH View* (see 4.310). The rectangular diagram area represents the time/delay time plane.

In this plane, the signals with the same SC form one or several traces that change their slot timing (horizontal position) and strength (color). All signals can be assumed to originate from the same Node B (see explanation at the beginning of section *PNS CPICH View* on p. 4.310); multiple traces indicate multiple signals with different timing but the same SC and thus reflections. The example of *Fig. 4-208 above* shows a single (direct) signal. The time delay of the signal decreases (increases) while the test vehicle approaches (goes away from) the transmitting Node B; the signal strength can be expected to reach its maximum where the distance to the Node B is close to its minimum. The slope of the trace corresponds to the *Drift* which is also displayed in the *PNS CPICH View.*

X-axis (del. time)

Symmetric range centered around the first relative slot timing measured. The delay time span is fixed and equals to 90 µs (13.5% of a slot).

Y-axis (time)

Linear time scale of the measurement. The diagram consists of 100 to 800 lines, arranged from top to bottom. Each line shows the result of a single scan or sweep with a frequency range of 5 MHz. The diagram is continuously updated during the measurement or replay by adding new lines. It is scrolled and a scrollbar is added along the right border as soon as a line reaches the bottom of the diagram.

Display line

On moving across the *SC Tracer Chart* area, the cursor displays a black, horizontal line. A left mouse click on the chart updates the *CIR Chart* which now displays the peaks at the time corresponding to the position of the display line.

CIR Chart

The *CIR Chart* (Carrier to Interference Ratio) shows the average signal power of the P-CPICHs of all received peaks over the time. The displayed powers and times correspond to the *Ec (CPICH) [dBm]* and *Delta T[µs]* values listed in the *Peak List* in the *PNS CPICH View* (see 4.310).

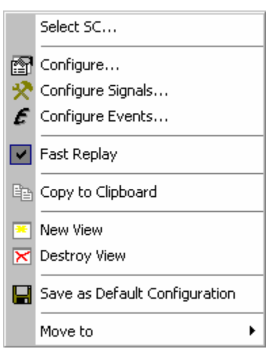
The diagram is opened with a default x-axis scale of 90 µs (13.5% of a slot). If placed inside the diagram area the cursor takes the shape of a zoom-in icon (a magnifying glass with a '+' inside), and a vertical line is displayed at the cursor position.

A left mouse click magnifies the diagram in x-direction around the cursor position, *Ctrl* plus left mouse click causes the opposite. An area to become the new x-axis range (e.g. the area around a peak) can be marked while the left mouse button is pressed. *Reset Zoom* in the context menu restores the default scale. A scrollbar is provided to move the magnified diagram to the right or left.

The scale of the y-axis (power in dBm) can be set in the configuration menu.

By default the diagram shows current results, corresponding to the last line in the *SC Tracer Chart.* To select a previous result for viewing, the display line in the *SC Tracer Chart* can be used; see above.

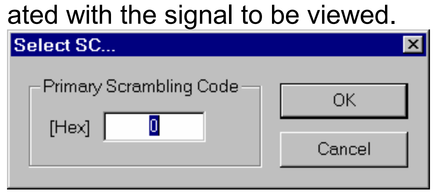
Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2. The context menu provides the following additional commands:

Select SC...

Opens a dialog box to select the primary scrambling code associated with the signal to be viewed.



The scrambling code is defined in the format selected in the *TEC for UMTS PNS* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. *Select SC…* is unavailable if a particular top N element is traced; see description of the configuration menu.

PNS SC Tracer Configuration

The *PNS SC Tracer* configuration menu selects the signals displayed in the *PNS SC Tracer View,* scales the diagrams and defines the colors in the view. It is opened via a right mouse click on a point inside the *PNS SC Tracer View* or via the *Configuration – Settings* command (see chapter 3).

The *SC Tracer Target Selection* tab selects the signals displayed in the *PNS SC Tracer View*.

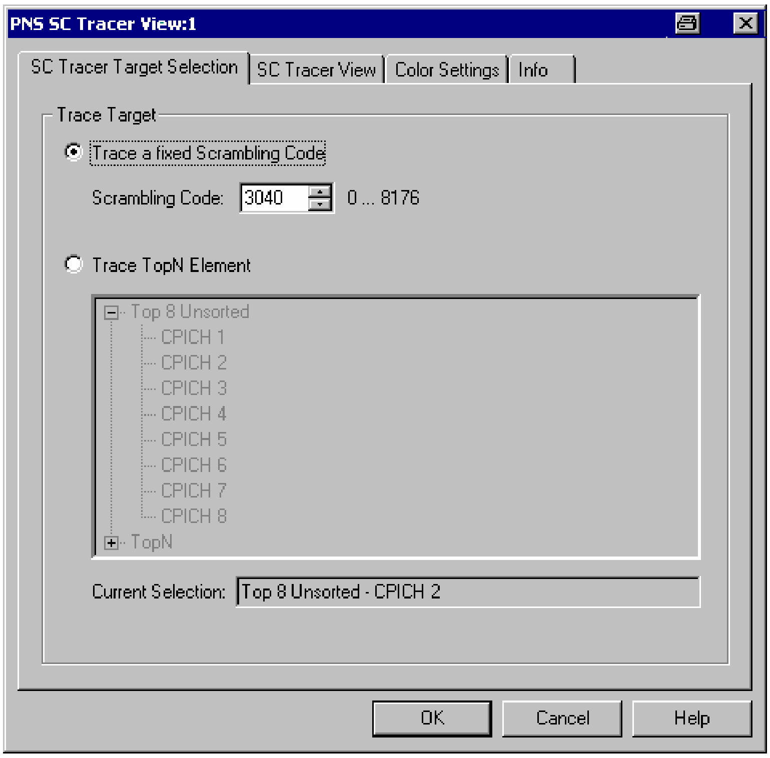


Fig. 4-209 PNS SC Tracer configuration – SC Tracer Target Selection

Trace Target The *Trace Target* option buttons select either a signal with a definite scrambling code or a particular top N element to be traced.

Fixed SC

The scrambling code is defined in the format selected in the *TEC for UMTS PNS* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. In decimal representation, the primary scrambling codes are multiples of 16: SC[dec] = 16*i where i=0 to 511, so the least significant digit of the hex numbers must be 0, preceded by a hex value between 0 and 1FF.
If a scrambling code that is not assigned to any measured signal is selected the *PNS SC Tracer View* remains empty.

Top N Element

List of all top N pools defined in the driver configuration menu (see chapter 6). The current top N pool selection is indicated below the list.

The *SC Tracer View* tab scales the diagrams and defines the colors in the view.

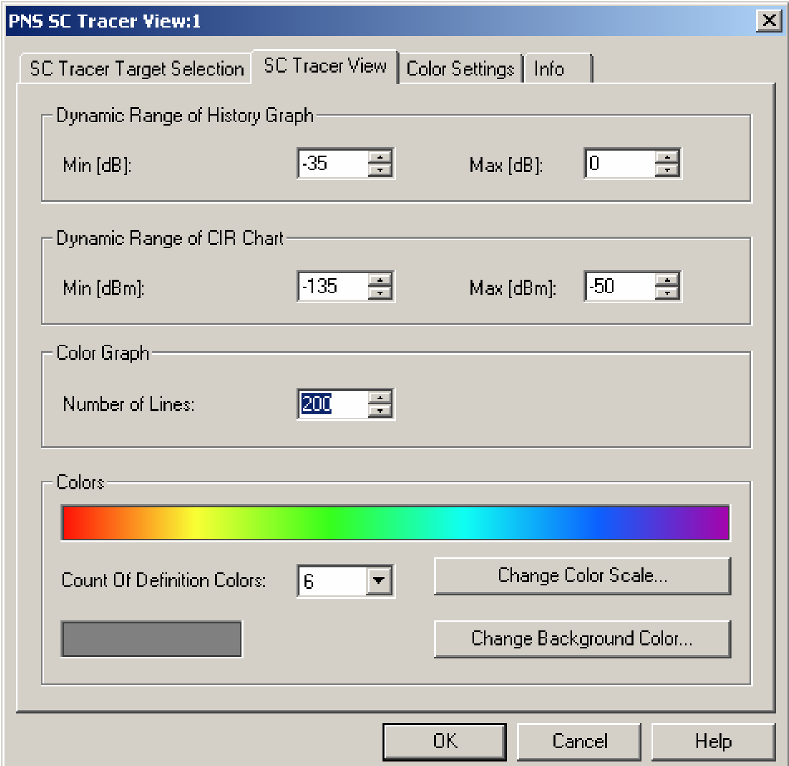


Fig. 4-210 PNS SC Tracer configuration – SC Tracer View

Dynamic Range... The input fields in the *Dynamic Range...* panels define the minimum *(Min [dBm])* and the maximum *(Max [dBm])* signal level displayed in the diagrams of the *PNS SC Tracer View.* Signals exceeding the dynamic range will not be displayed.

Colors The color settings in the remaining panels of the configuration menu are identical with the *PNS Spectrum History View* color settings; see section *PNS Spectrum History View* on p. 4.320.

The *Color Settings* tab of the *PNS Top N* configuration menu is analogous to the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

PNS Pilot View

The *PNS Pilot View* displays the Received Signal Code Power (RSCP) of the Common Pilot Channels (CPICHs) together with their scrambling codes.

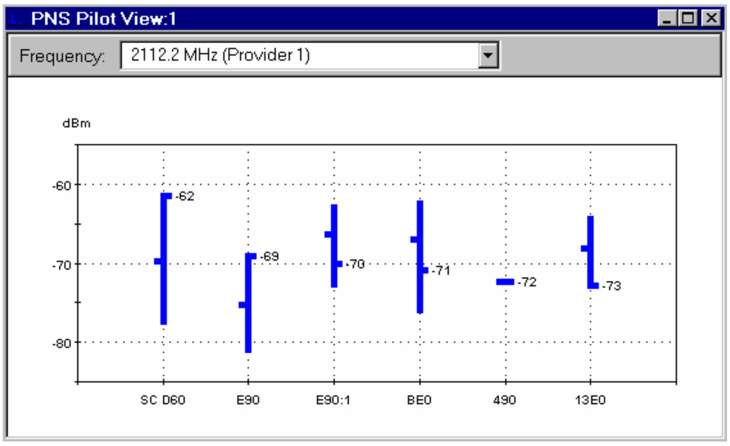


Fig. 4-211 PNS Pilot View: Min - Max - Average - Current Graph

Frequency

Below the view title, the *Frequency* pull-down list contains all measured frequencies selected in the *Receiver* tab of the driver configuration menu. The list is also provided in the *PNS P-SCH View, PNS CPICH View* and *PNS SC Tracer View.*

Changing the frequency in one of these views automatically adapts the frequencies in all other views, provided they have the same current number in their title bar (e.g. the 1 in the figure above). Using this feature, it is possible to generate different groups of views with the same current number (opened by means of the context menu; see below) and select frequencies for an entire group with a single mouse click.

View area

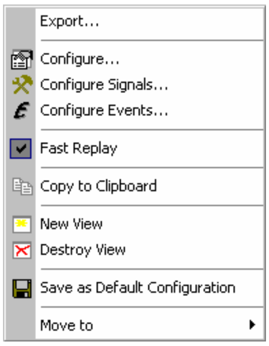
The view contains a pull-down list to select one of the receiver frequencies selected in the *Receiver* tab of the driver configuration menu and a chart.

The chart shows the CPICH Received Signal Code Power; i.e. the received signal power measured on the pilot bits of a Primary CPICH which is identified by its primary scrambling code. The x-axis shows the primary scrambling code (SC) numbers; the scale of the y-axis (power in dBm) can be set in the configuration menu.

In the default configuration the diagram represents a Min.-Max.-Average-Current chart: Each signal generates a vertical bar with a marking to the right and to the left. The lower and upper ends of the bar indicate the minimum and maximum RSCP of the signal ever measured, the marking to the left the average RSCP since the start of the measurement and the marking to the right (with numeric value) the current RSCP. All four values are constantly updated while the measurement or replay is running.

In the configuration menu the diagram can be converted to a bar chart.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2. The context menu provides the following additional commands:

Export

Opens a *Save As* dialog to export the current RSCP values to a text file; see below. This function is unavailable while a measurement or replay is running; it can be activated after *Stop, Stop Recording* or *Pause Replay.* The export function is not affected by a change of the chart type.

Export file format

The export file is an ASCII table in *.csv format that can be opened and processed by Excel. The table headings form the first line of the file. Each of the following lines corresponds to a single signal with definite SC. The values in the lines are separated by semicolons.

The file contains current measurement values as indicated in the Min.-Max.-Average-Current chart. The values form the following columns:

SC

Primary scrambling code of the signal in the format selected in the *TEC for UMTS PNS* tab of the *Configuration of Software Modules* menu; refer to section *Configuration Menu* in chapter 3. Sequence numbers *:1, :2* behind a code distinguish multiple reflections.

RSCP…

Minimum, maximum and average RSCP in dBm

The last four columns contain the timestamps describing the recording history of each signal.

Tfirst

Time when the signal was detected for the first time. This can coincide with the beginning of the measurement.

Tlast

Time when the signal was detected for the last time. This can coincide with the time when recording or replay was stopped.

Tmin/Tmax

Time when the minimum/maximum RSCP was measured

SC	RSCPmin[dBm]	RSCPavg[dBm]	RSCPmax[dBm]	Tfirst	Tlast	Tmin	Tmax
233:01:00	-81.3	-71.4	-63.0	214188	312740	214188	312740
190	-85.8	-74.3	-63.4	214188	312740	214188	312740
318:01:00	-82.6	-74.5	-64.0	224433	312740	224433	312740
214	-82.6	-71.8	-61.8	11437	284900	284900	174652
233	-88.6	-70.4	-61.1	11437	274645	274645	140913
73	-93.2	-69.2	-58.5	11437	274645	269859	102748

To ensure that the export file contains all signals ever recorded in the measurement, deactivate the History *parameter in the configuration menu.*

PNS Pilot Configuration

The *PNS Pilot* configuration menu defines the y-axis scale, i.e. the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *PNS Pilot View,* and the diagram type *(Graph)*. It is opened via a right mouse click on a point inside the *PNS Pilot View* or via the *Configuration – Settings* command (see chapter 3).

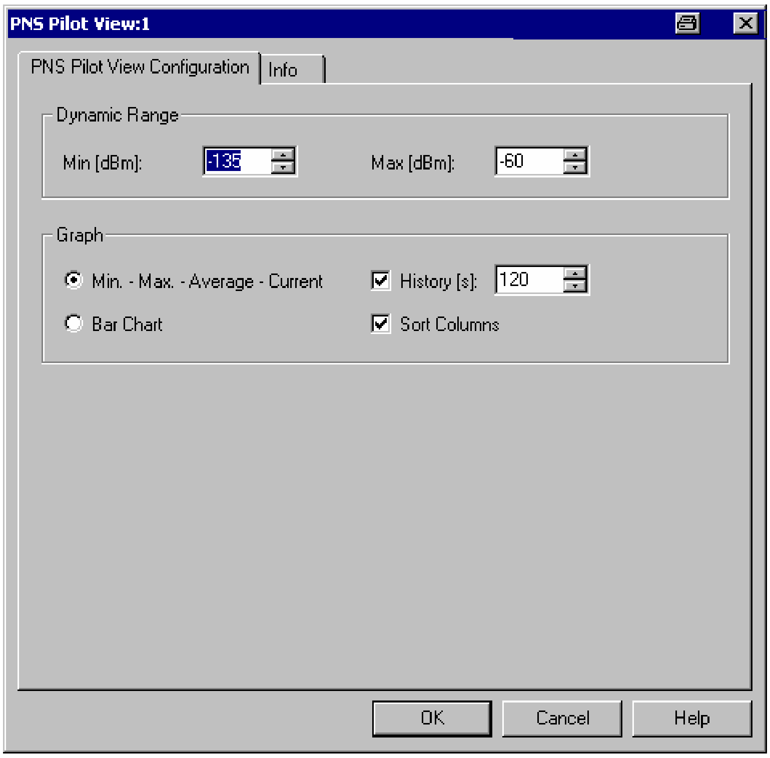


Fig. 4-212 PNS Pilot configuration

Dynamic The two input fields in the *Dynamic* panel define the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *PNS Pilot View.*

Graph The *Graph* panel selects the diagram type. The two alternative graphs *Min-Max.-Average-Current* and *Bar Chart* are described above (see *View area* on p. 4.328).

History [s]
Excludes all results that are older than the specified number of seconds from the statistical evaluation in the *Min-Max.-Average-Current* view. The history time is not used in a bar chart. Clearing this parameter corresponds to an infinite history time; this ensures that all signals ever recorded in the current measurement are displayed in the view and can be exported to an ASCII table.

Sort Columns
Sorts the bars/columns according to their RSCP: The strongest signal is displayed on the left side, the weakest on the right side. If the box is cleared, the signals and SC numbers keep their position irrespective of the evolution of their signal power.

PNS Top N View

The *PNS Top N View* displays the properties of the signals from the Node Bs that are elements of the *Top N Pools* defined in the driver configuration menu. A Top N Pool contains up to N Node Bs with specific characteristics providing the strongest P-CPICH level at a given position and time; for more information refer to the description of the driver configuration menu in chapter 6.

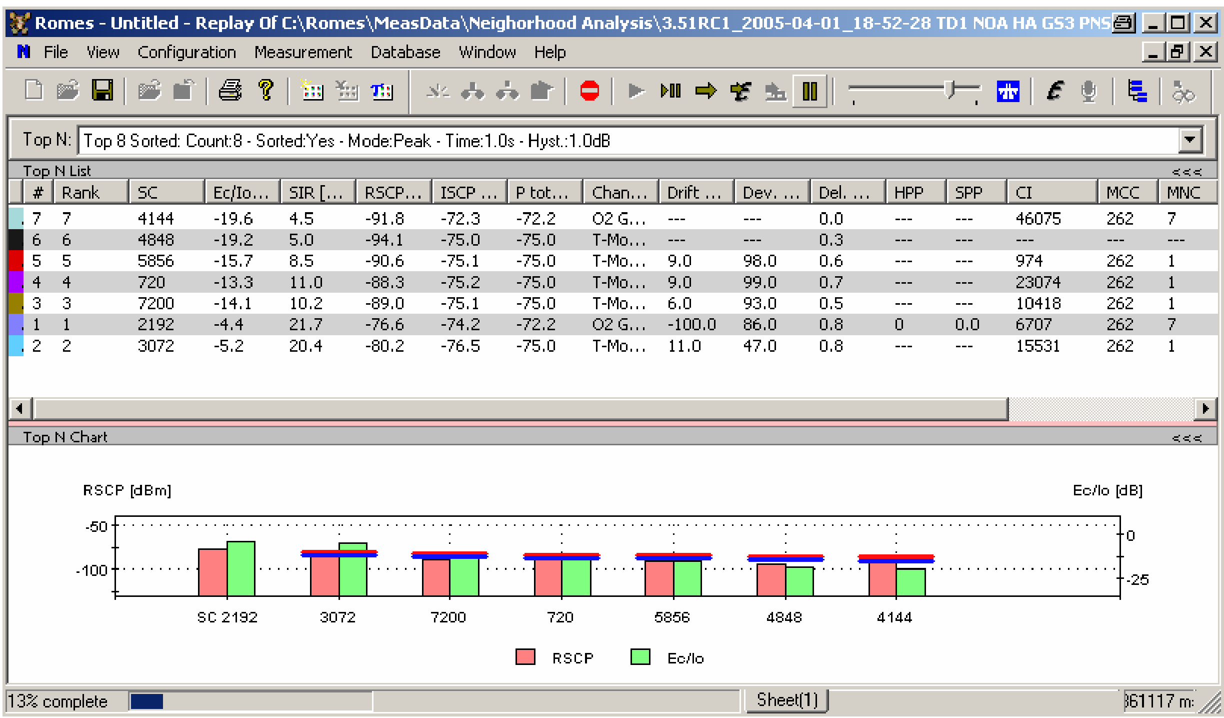


Fig. 4-213 PNS Top N View

View area

The entire view area is horizontally split to accommodate a pull-down list with all defined *Top N* measurements, a table and a bar chart.

A click on the *Top N List* or *Top N Chart* title bars compresses and expands the table or chart. A compressed chart leaves more space for the table and vice versa. Moreover, most of the information in the table is also displayed in the *PNS CPICH View* (see p. 4.310) so that compressing it can help to avoid redundancies. A compressed subdiagram is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

Top N

Below the view title, the *Top N* pull-down list contains all top N pools defined in the *Top N* tab of the driver configuration menu. The results in the table and the *Top N Chart* refer to the top N pool selected in the list.

Table

The *Top N List* gives an overview of the received signals in the current top N pool together with their scrambling codes, different power parameters, frequency and timing information. On mouse rollover, each cell in the table header provides a short explanation of the corresponding column. Most of the results in the *Top N List* are also displayed in the *Peak List* in the *PNS CPICH View.* For a detailed explanation of the parameters refer to section PNS CPICH View on p. 4.310. The *Top N List* contains the following additional columns:

#
: Current number of a Node B within the measurement. Node Bs are numbered in ascending order, according to the time when they enter the top N pool. This means that the current numbers tend to increase as the measurement progresses.

Rank
: Current rank of a Node B within the pool, according to its average or maximum Ec/Io (see driver configuration menu). The ranks are reassigned every time the pool is updated; they are in the range $1 \leq Rank \leq N$.

Channel
: Name of the channel and channel frequency of the Node B

HPP
: Hard Pilot Pollution of the Node B signal as defined in the driver configuration menu (see chapter 6)

SPP
: Soft Pilot Pollution of the Node B signal as defined in the driver configuration menu

The following information is available only if the PN scanner data are recorded with a TSMU equipped with option TSMU-K14, *BCH Demodulation* (see description of the UMTS PNS driver configuration menu in chapter 6), and if SIB3 decoding is enabled.

CI
: Cell Identity

MCC
: Mobile Country Code

MNC
: Mobile Network Code

In the view configuration menu, it is possible to show or hide each individual table row.

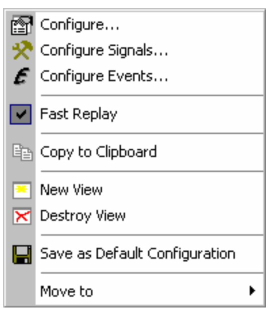
Diagram

Below the table, the *Top N Chart* shows the ratio *Ec/Io* and the Received Signal Code Power *(RSCP)* for all Node B signals in the current top N measurement (see section *PNS CPICH View* on p. 4.310).

Signals from different Node Bs are distinguished by their primary scrambling codes (SC), displayed along the x-axis. The scales for the two parameters RSCP and Ec/Io are displayed on the left and right edge of the diagram. Both y-axis scales (RSCP in dBm and Ec/Io in dB) can be set independently in the configuration menu.

In the configuration menu, it is also possible to select the display colors for the RSCP and Ec/Io bars and to choose whether the pilot pollution limits are displayed in the diagram. The pilot pollution limits are displayed as two horizontal lines across all Node B bars except the ones with the highest rank (1).

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

PNS Top N Configuration

The *PNS Top N* configuration menu defines the y-axis scale, i.e. the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *PNS Top N View,* defines the display colors for the RSCP and Ec/Io bars, shows or hides the pilot pollution limits, and selects the contents of the table. It is opened via a right mouse click on a point inside the *PNS Top N View* or via the *Configuration – Settings* command (see chapter 3).

All RSCP settings are analogous to the settings in the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310. The pilot pollution limits are identical with thresholds providing the criteria for HPP and SPP (see description of the driver configuration menu in chapter 6).

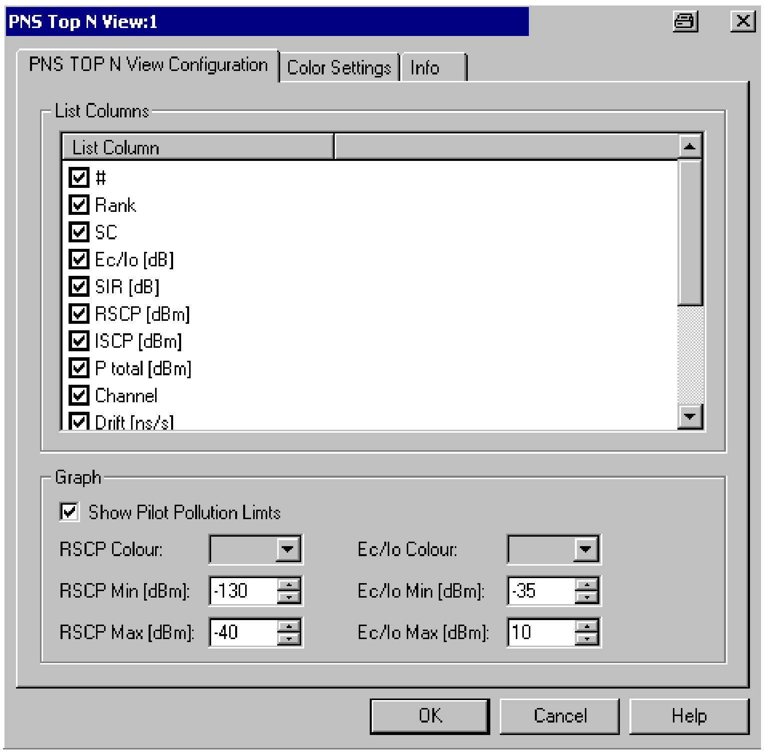


Fig. 4-214 PNS Top N configuration: Top N View

The *Color Settings* tab of the *PNS Top N* configuration menu is analogous to the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310.

PNS Rake Finger View

The *PNS Rake Finger View* displays the power and timing of several multipath echoes of a single Node B signal captured with the rake receiver of a TSMU operating in ultra high speed mode. The ultra high speed mode must be enabled explicitly in the UMTS PNS driver configuration menu; see description in chapter 6.

The PNS Rake Finger View *is complemented by the PNS Rake Finger Chart View (see p. 4.337) showing the evolution in time of the signal powers.*

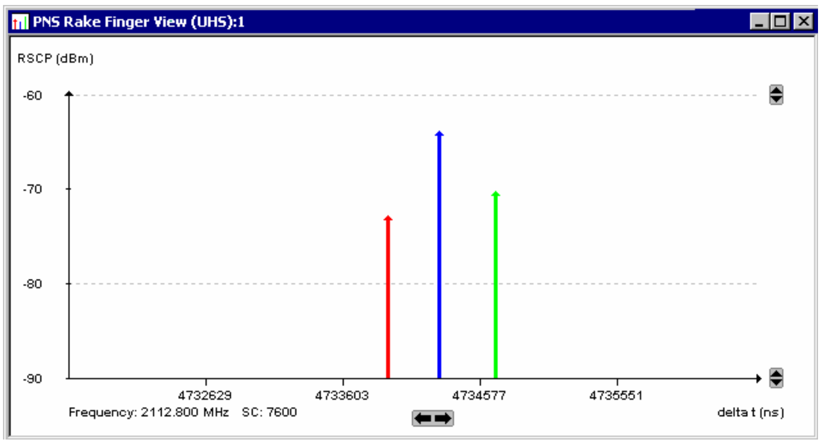


Fig. 4-215 PNS Rake Finger View

Diagram

The diagram shows the power and timing of the different multipath echoes of a Node B signal. The carrier frequency/UTRAN channel and scrambling code (SC) of the cell are displayed below the diagram; they must be selected in the UMTS PNS driver configuration menu (see chapter 6).

Each captured echo generates a vertical arrow. The length of the arrows corresponds to the signal power (RSCP in dBm); their horizontal position corresponds to the timing. The time scale is relative to the (P-CPICH) frame timing of the received DL signal, so it is 10 ms-periodic. The color scale for the arrows is defined in the *PNS Rake Finger View* configuration menu.

The maximum number of captured signals is limited by the properties of the TSMU rake receiver (maximum number of rake fingers) and depends on the measurement rate. It is 4 for a 333 Hz measurement rate, 8 for 250 Hz, and 12 for all other rates.

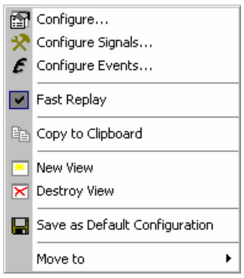
Diagram scaling

The diagram can be scaled vertically using the buttons. A mouse click or a rectangle drawn with the cursor zooms in on the diagram, *Ctrl* plus a mouse click into the view zooms out. shifts the diagram in vertical direction. Additional scaling options are provided in *PNS Rake Finger View* configuration menu described below.

The relative timing offset for different echoes is due to propagation paths of different lengths. For typical multipath propagation conditions, horizontal diagram divisions of approx. 1 µs are appropriate.

ROMES generates a warning *Not all data is in visible area!* if one of the captured signals is outside the diagram area.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, activate the fast replay mode, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

PNS Rake Finger View Configuration

The *PNS Rake Finger View* configuration menu sets zoom options and defines the color scheme for the signal arrows in the *PNS Rake Finger View*. It is opened via a right mouse click on a point inside the view or via the *Configuration – Settings* command (see chapter 3).

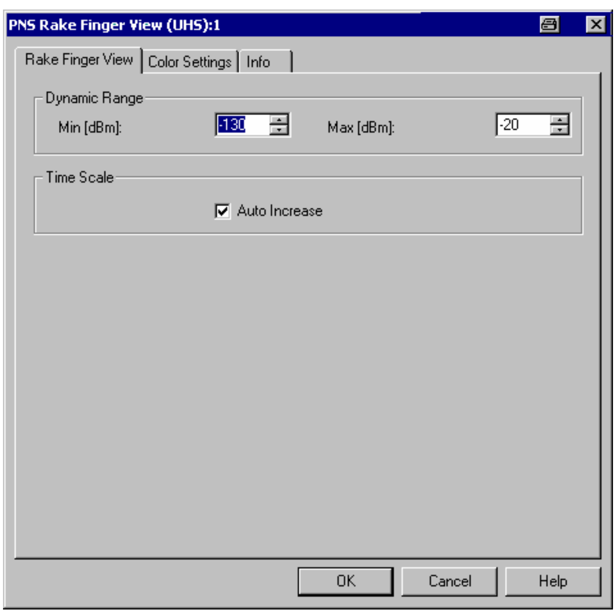


Fig. 4-216 PNS Rake Finger View Configuration

Dynamic Range Defines the scale of the vertical (RSCP) axis, i.e. the minimum and maximum RSCP for a single echo.

Time Scale Modifies the scaling mechanism for the time axis. If *Auto Increase* is on (recommended) the diagram can be scaled as described in the view description.

The *Color Settings* tab of the *PNS Rake Finger View* configuration menu is analogous to the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310. Note that the colors are assigned to rake fingers rather than to a particular echo. An changed color in the view may indicate a finger exchange (see p. 4.338).

PNS Rake Finger Chart View

The *PNS Rake Finger Chart View* displays the evolution in time of the RSCP and Ec/Io of several multi-path echoes of a single Node B signal. The signals must be captured with the rake receiver of a TSMU operating in ultra high speed mode. The ultra high speed mode must be enabled explicitly in the UMTS PNS driver configuration menu; see description in chapter 6.

The PNS Rake Finger Chart View *is complemented by the* PNS Rake Finger View *(see p. 4.335) showing the timing and power of the signals at a fixed time.*

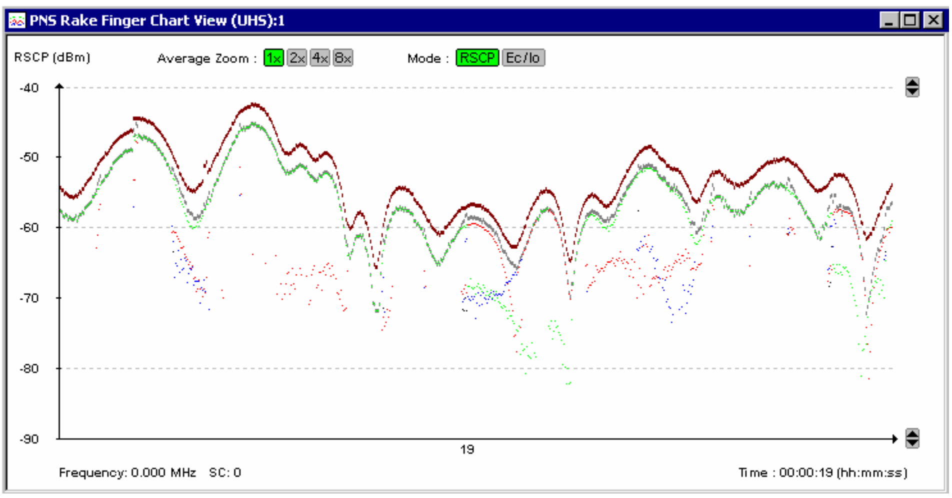


Fig. 4-217 PNS Rake Finger Chart View

Diagram

The diagram shows the Received Signal Code Power (RSCP) or the ratio of the received energy per PN chip of the CPICH to the total transmit power spectral density (Ec/Io) as a function of time. The results are displayed for the different multipath echoes of a Node B signal and for the complete signal:

- The upper (brown) trace represents the total received power on all channels, including the data channels.
- The second (gray) trace represents the aggregated P-CPICH power, i.e. the CPICH code power of all individual echoes captured by the different rake fingers. The aggregated power is not exactly equal to the sum of the individual measured CPICH code powers because a correction for each pair of signals with similar timing is taken into account.
- The remaining traces represent the CPICH power of the individual echoes. The color scale for these signals is defined in the *PNS Rake Finger Chart View* configuration menu.

Diagram settings

The carrier frequency/UTRAN channel and scrambling code (SC) of the cell are displayed below the diagram; they must be selected in the UMTS PNS driver configuration menu (see chapter 6).

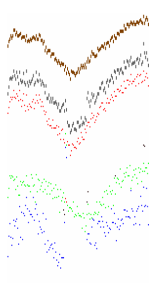
The signal powers are displayed as dots. The vertical position of the dots corresponds to the power (RSCP in dBm or Ec/Io, depending on the Mode: RSCP Ec/Io selection); their horizontal position corresponds to the measurement time. The horizontal spacing between the dots depends on the *Display Update Rate* defined in the *Measurements* tab of the *R&S UMTS PNS* driver configuration menu. The *Average Zoom* buttons 1x 2x 4x 8x smooth the traces, replacing the raw signal powers by the arithmetic mean value of 2, 4, or 8 consecutive powers. If an average is calculated, then the individual echo traces are all gray to avoid misleading results in the case of rake finger exchanges (see p. 4.338).

The maximum number of captured signals is limited by the properties of the TSMU's rake receiver (maximum number of rake fingers) and depends on the measurement rate. It is 4 for a 333 Hz measurement rate, 8 for 250 Hz, and 12 for all other rates.

Diagram scaling

The diagram can be scaled vertically using the buttons. Additional scaling options are provided in *PNS Rake Finger Chart View* configuration menu described below.

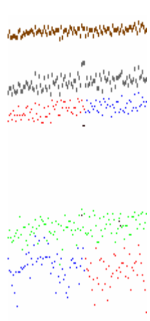
Interpreting the traces



Lost echoes

A dip in the traces indicates a temporary decrease of the RF channel quality. In such a situation, some of the rake fingers may no longer be able to trace their echo.

In the example to the left, the weakest (blue) echo was lost when the RSCP suddenly decreased. As a result of the missing contribution one the difference between the total received power (brown trace) and the aggregated CPICH power (gray trace).

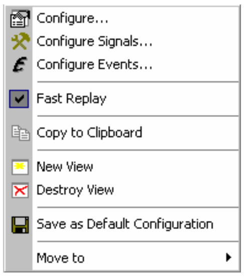


Finger exchange

The colors of the echo traces are assigned to rake fingers rather than to individual signals. A changed trace color therefore indicates that the signal was received by another finger.

Typically the fingers for two signals with a small relative timing delay are simply exchanged. In the example to the left this happened for the blue and red traces.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, activate the fast replay mode, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

PNS Rake Finger Chart View Configuration

The *PNS Rake Finger Chart View* configuration menu sets zoom options and defines the color scheme for the traces in the *PNS Rake Finger Chart View*. It is opened via a right mouse click on a point inside the view or via the *Configuration – Settings* command (see chapter 3).

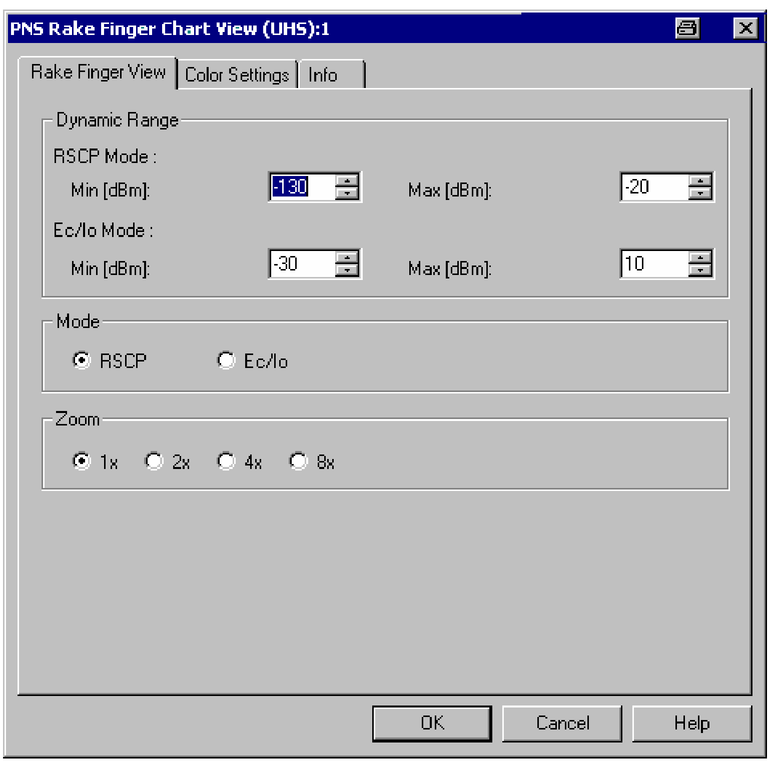


Fig. 4-218 PNS Rake Finger Chart View Configuration

Dynamic Range Defines the scale of the vertical (RSCP or Ec/Io) axis, i.e. the minimum and maximum RSCP or Ec/Io displayed.

Mode Selection of the diagram scaling in terms of either the RSCP or the Ec/Io. The two option buttons are equivalent to the Mode : RSCP Ec/Io buttons in the diagram.

Zoom Selection of a factor for smoothing the curves in the diagram. The four option buttons are equivalent to the 1x 2x 4x 8x buttons in the diagram.

The *Color Settings* tab of the *PNS Rake Finger Chart View* configuration menu is analogous to the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310. Note that the colors are assigned to rake fingers rather than to a particular echo. An changed color in the view may indicate a finger exchange (see p. 4.338).

PNS BCH View

The *PNS BCH View* shows a list of all System Information Blocks (SIBs) and Master Information Blocks (MIBs) decoded from the UMTS BCH. The contents of each block appears in a tree view as soon as the block is selected. The SIB types and their information elements are described in standard 3GPP TS 25.331.

The SIB and MIB information is available only if the PN scanner data are recorded with a TSMU equipped with option TSMU-K14, *BCH Demodulation*. Decoding of each SIB type must be enabled explicitly in the UMTS PNS driver configuration menu; see description in chapter 6.

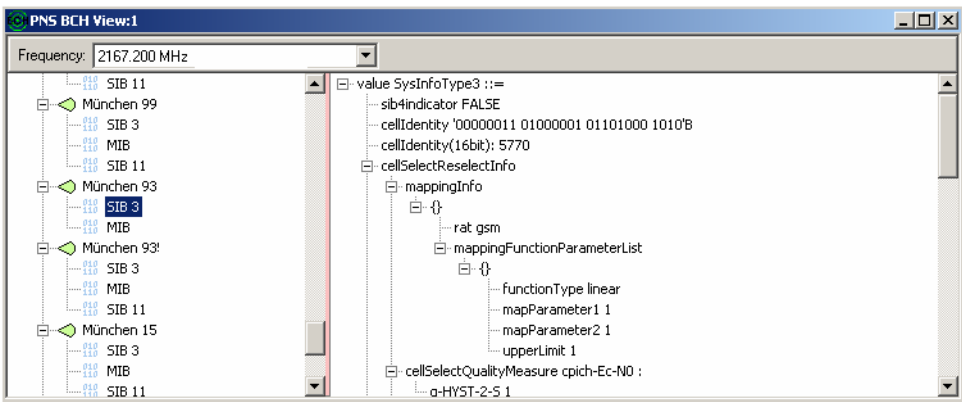
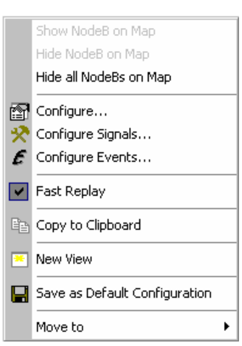


Fig. 4-219 PNS BCH View

Note:

In the tree view the scrambling code is always displayed in decimal format, irrespective of the format settings made in the TEC for UMTS PNS tab of the ROMES Configuration menu.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, activate the fast replay mode, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2. The context menu provides the following additional, view-specific commands:

Show Node B …

Use the color selected in the *PNS BCH View* configuration menu (see below) to mark the selected UMTS cells in the *Route Track* view. This feature is only available while a cell is selected in the view. The UMTS layer / GSM BTS layer in the *Route Track* view must be visible to use this feature.

Hide Node B…

Hide the selected UMTS cell in the *Route Track* view.

Hide all Node Bs…

Hide all selected UMTS cells in the *Route Track* view.

PNS BCH View Configuration

The *PNS BCH View* configuration menu defines the color for the selected Node B / BTS symbols in the *Route Track View*. It is opened via a right mouse click on a point inside *PNS BCH View* or via the *Configuration – Settings* command (see chapter 3).

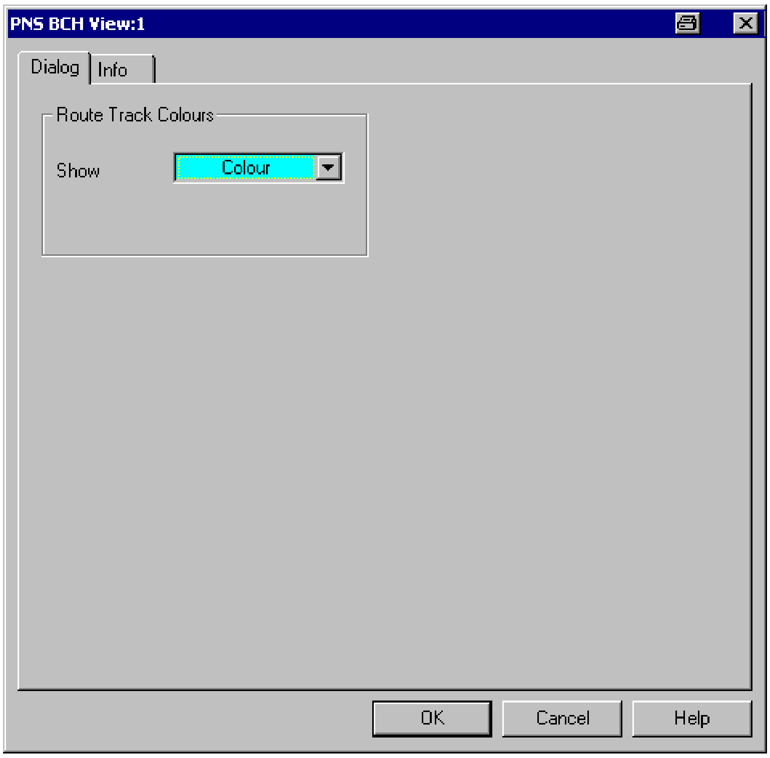


Fig. 4-220 PNS BCH View Configuration

QoS Views

The *QoS Views* display the results of the Data Quality Tester (DQA) ROMES-Z6. The purpose of the DQA measurement is to evaluate the Quality of Service (QoS) of any kind of data transfer connection.

DQA measurements are performed using the DQA driver (see chapter 6, Hardware Components). Loading the driver does not require any hardware or additional test devices. An example procedure for setting up and testing a connection is described in chapter 2; see section *Data Quality Tester*.

Many of the QoS results can also be displayed in other ROMES views, e.g. in the *Alphanumeric View*, the *2D Chart View*, and in the *Route Track View*.

The QoS views can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *QoS Views*.

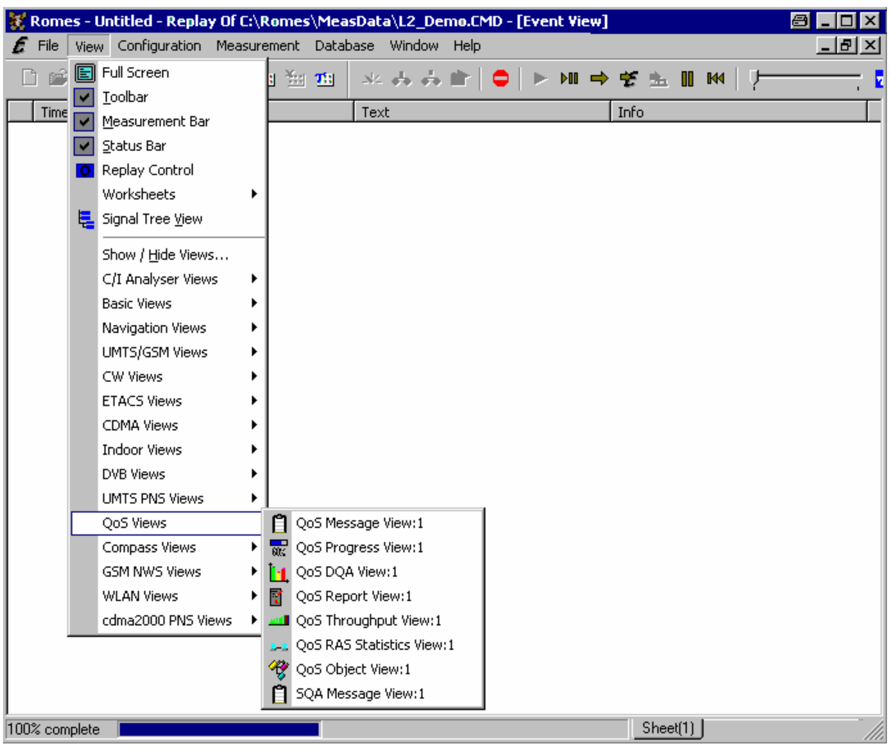


Fig. 4-221 QoS views

QoS Message View

The *QoS Message View* monitors all actions of the current job. Each action is described with a message and the associated time. The causes of possible errors are reported with the messages.

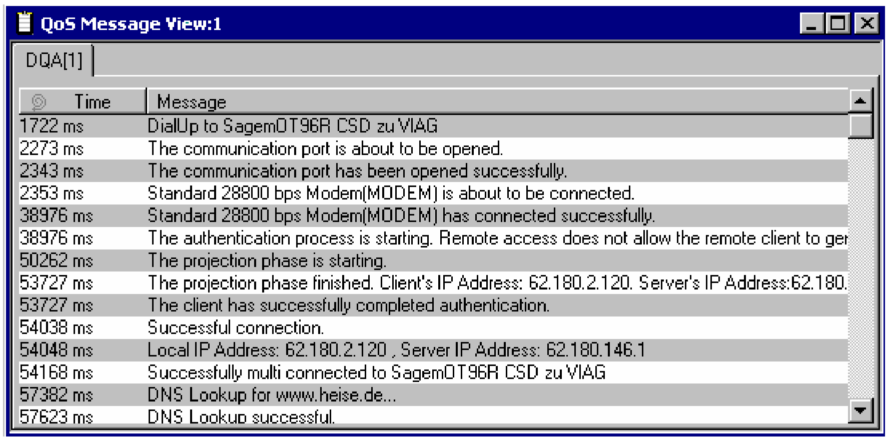
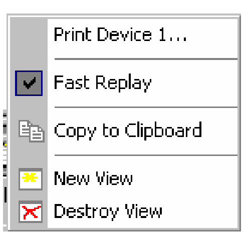


Fig. 4-222 QoS Message View

View contents

The messages depend on the job that is being executed but are all self-explanatory. *Fig. 4-222 above* shows the messages generated during an *Connect to Network* job.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet, see *Context menu* description on p. 4.2.

The *QoS Message View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

QoS Progress View

The *QoS Progress View* monitors the progress and the status of the current job. The view contents depend on the job that is being executed. For *Video Streaming,* the current frame rate and the video quality is displayed in two bar graphs.

Video Streaming is available with option ROMES-Z7. A packet-switched network connection is set up to a server using a GPRS or UMTS test mobile or commercial mobile. The server provides a stream of MP4 video data at constant frame rate. The test system performs an analysis of the received data, evaluates the received frame rate and estimates the quality of the transferred video stream. No data is returned or retransmitted.

For more information refer to the description of the DQA driver configuration menu in chapter 6.

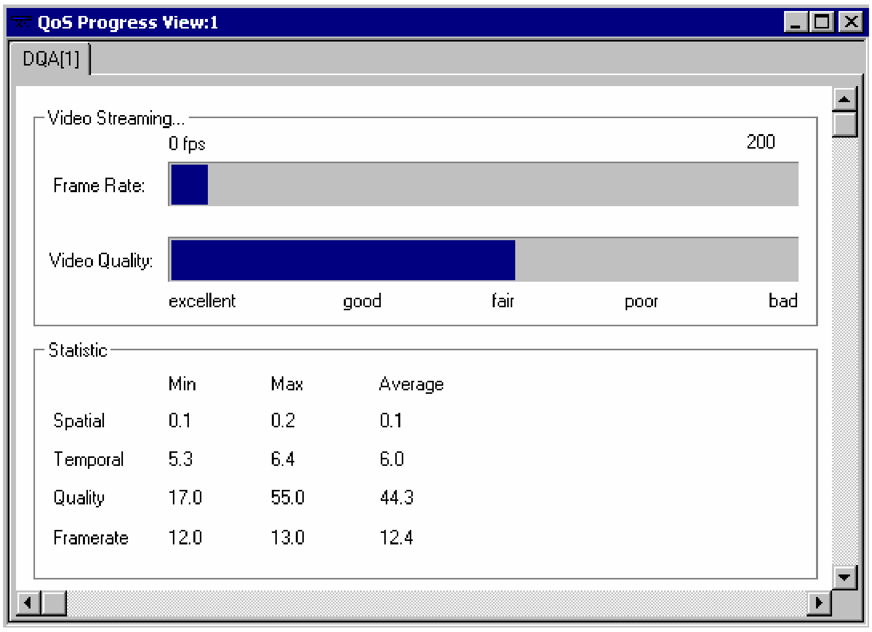


Fig. 4-223 QoS Progress View (Video Streaming)

View contents

While the data connection to the video server is being set up, the *QoS Progress View* displays a series of messages to comment the progress. As soon as the test system receives video data,. the quality of the connection is monitored by means of the following parameters:

Frame Rate
: Number of frames that the mobile actually receives per second. The received frame rate is smaller or equal to the transmitted frame rate of the video source, depending on the transferred MP4 file. The frame rate is shown in a bar graph and in the statistics table.

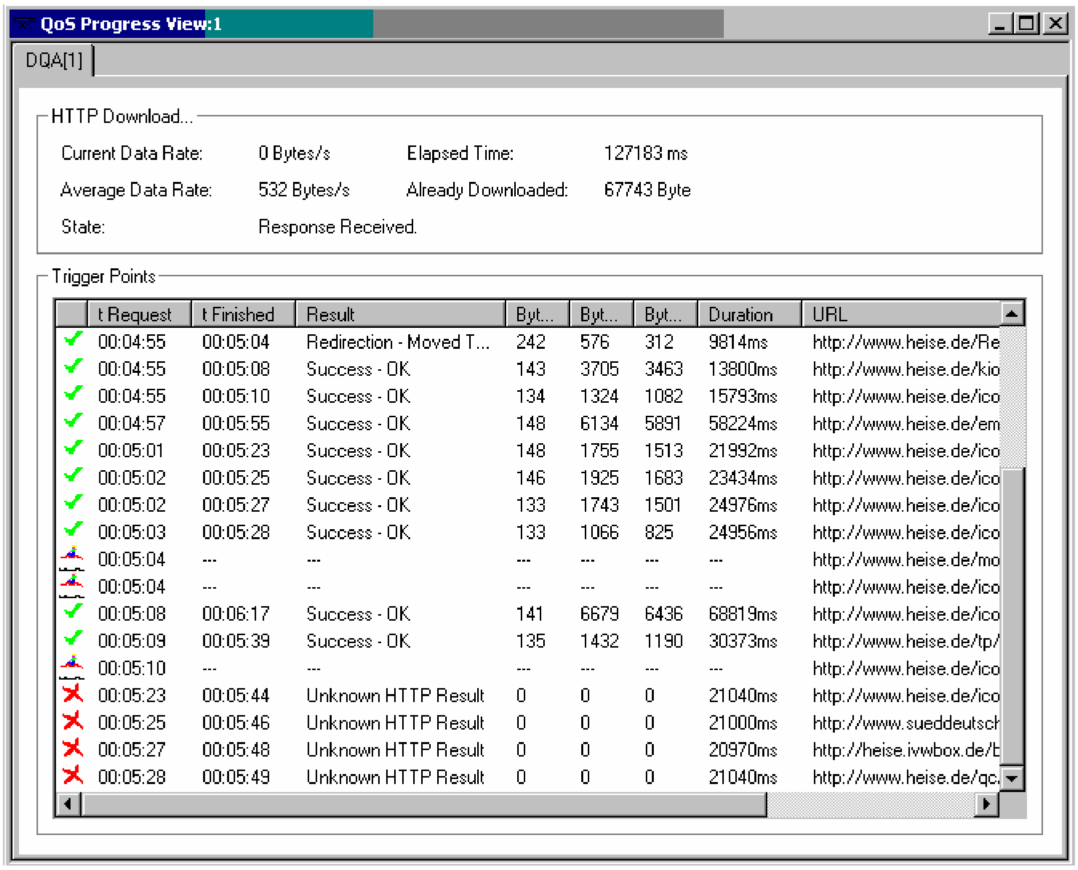
Video Quality
: Quality of the received video, as it would be experienced by an end user. The video quality is displayed on a scale between excellent and bad; its evaluation relies on a comparison of the adjacent pixels at the block borders of the transmitted image, where transmission errors introduce visible transitions. For more information refer to the operating manual for the *Digital Video Quality Analyzer R&S DVQ,* available for download on the Rohde & Schwarz internet.

Spatial/Temporal
: Degree of variation of the video picture in space and time.

The statistical evaluation of the four parameters is based on the moving *Time window for Averaging* defined in the driver configuration menu. The *Average* column contains the results averaged over the last n ms, where n is the width of the time window. *Min* and *Max* denote the smallest and largest values ever measured. The numbers for the video *Quality* translate the values in the bar graph, 0 corresponding to bad, 100 to excellent quality.

Note:
Video Streaming can be monitored in some of the other QoS views as well. The QoS Message View indicates whether or not a video streaming job was successful, depending on the video quality criterion defined in the driver configuration menu.

The view contents for the other jobs involving data transfer are similar.



	t Request	t Finished	Result	Byt...	Byt...	Byt...	Duration	URL
	00:04:55	00:05:04	Redirection - Moved T...	242	576	312	9814ms	http://www.heise.de/Re
	00:04:55	00:05:08	Success - OK	143	3705	3463	13800ms	http://www.heise.de/kio
	00:04:55	00:05:10	Success - OK	134	1324	1082	15793ms	http://www.heise.de/ico
	00:04:57	00:05:55	Success - OK	148	6134	5891	58224ms	http://www.heise.de/em
	00:05:01	00:05:23	Success - OK	148	1755	1513	21992ms	http://www.heise.de/ico
	00:05:02	00:05:25	Success - OK	146	1925	1683	23434ms	http://www.heise.de/ico
	00:05:02	00:05:27	Success - OK	133	1743	1501	24976ms	http://www.heise.de/ico
	00:05:03	00:05:28	Success - OK	133	1066	825	24956ms	http://www.heise.de/ico
	00:05:04	---	---	---	---	---	---	http://www.heise.de/mo
	00:05:04	---	---	---	---	---	---	http://www.heise.de/ico
	00:05:08	00:06:17	Success - OK	141	6679	6436	68819ms	http://www.heise.de/ico
	00:05:09	00:05:39	Success - OK	135	1432	1190	30373ms	http://www.heise.de/tp/
	00:05:10	---	---	---	---	---	---	http://www.heise.de/ico
	00:05:23	00:05:44	Unknown HTTP Result	0	0	0	21040ms	http://www.heise.de/ico
	00:05:25	00:05:46	Unknown HTTP Result	0	0	0	21000ms	http://www.sueddeutsch
	00:05:27	00:05:48	Unknown HTTP Result	0	0	0	20970ms	http://heise.ivwbox.de/b
	00:05:28	00:05:49	Unknown HTTP Result	0	0	0	21040ms	http://www.heise.de/qc.

Fig. 4-224 QoS Progress View (HTTP Download)

View contents

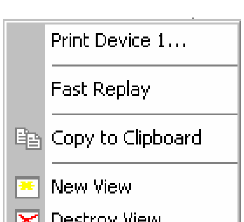
The job name forms the heading of the upper panel, which also shows the most important properties of the job and its current state.

A detailed list of the different actions involved in the job is given in the *Trigger Points* table. The entries in the table are self-explanatory. In particular, the table contains the duration of each action and the number of transmitted and received bytes.

TIP

An alternative record of the actions of all jobs in the measurement including detailed timing information is provided in the QoS Object View; see section QoS Object View on p. 4.358.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet, see *Context menu* description on p. 4.2.

The *QoS Progress View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

QoS DQA View

The *QoS DQA View* shows a bar graph to monitor the percentage of *Good*, *Blocked*, and *Dropped* data transfer jobs in the current session. Only connections that the system sets up to a remote network are evaluated. In principle a remote network connection can be a radio link to a network established by means of test mobiles or a connection via dial-up network. At present the *Session* tab evaluates the *Connect to Network/Disconnect from Network* jobs; it is empty for all other jobs.

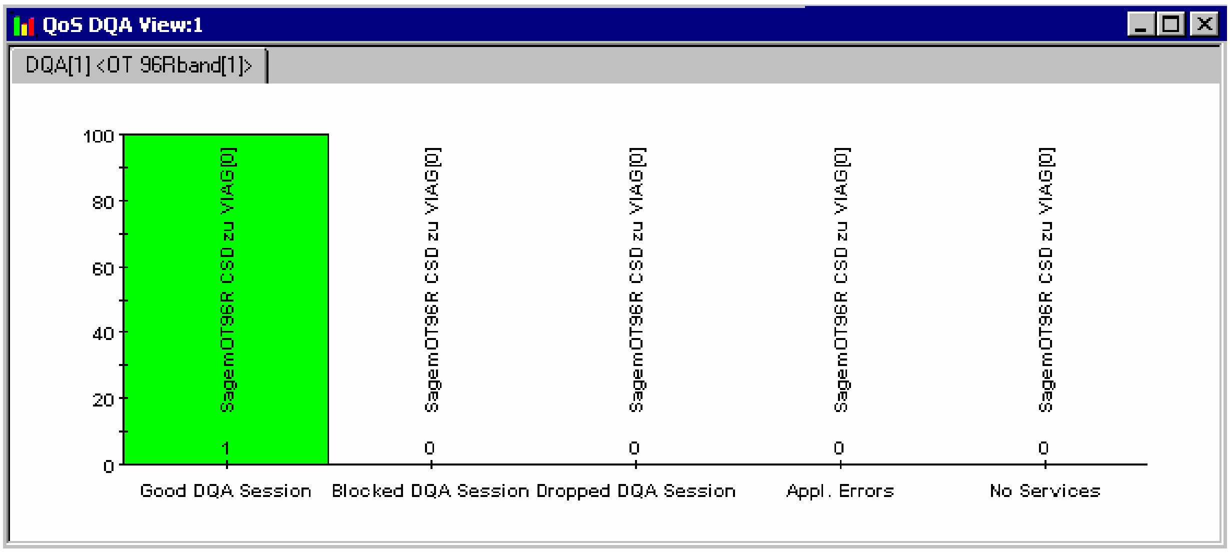
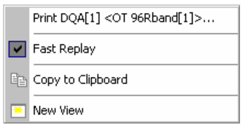


Fig. 4-225 QoS DQA View

The definition of *Good Sessions, Blocked Sessions*, *Dropped Sessions* and *No Services* is analogous to the call classes in the GSM Network Quality Analysis (NQA); see chapter 6. *No Services* and *Application Error* are similar; they both mean that the remote network was out of service:

- *No Services* counts the failed connection setups via a radio link.
- *Application Error* counts the failed connection setups due to problems with other system components (e.g. because a wrong e-mail address was used, authentication failed, an addressed server was out of service).

Context menu

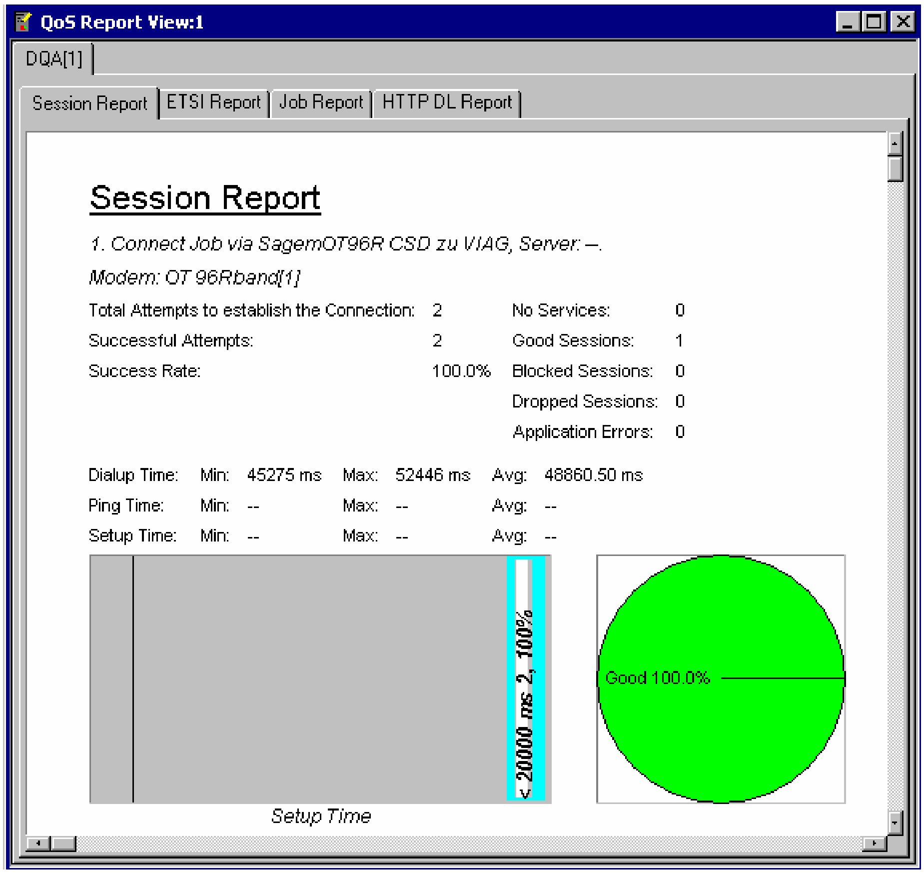


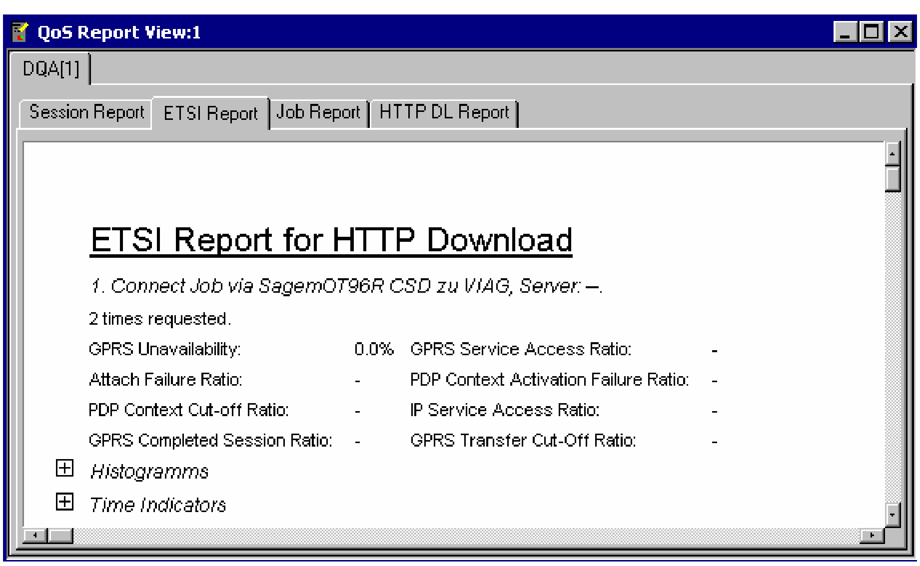
A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see *Context menu* description on p. 4.2.

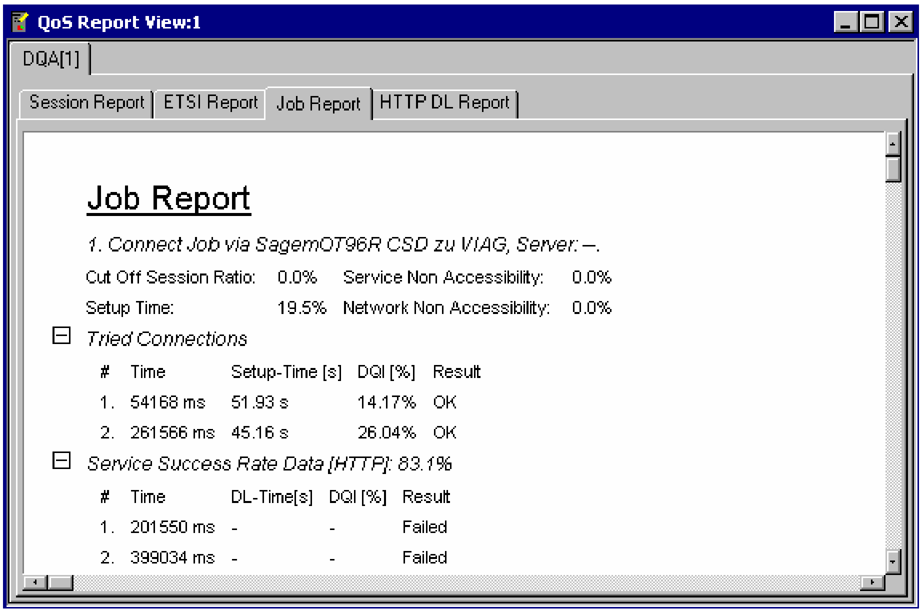
The *QoS DQA View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

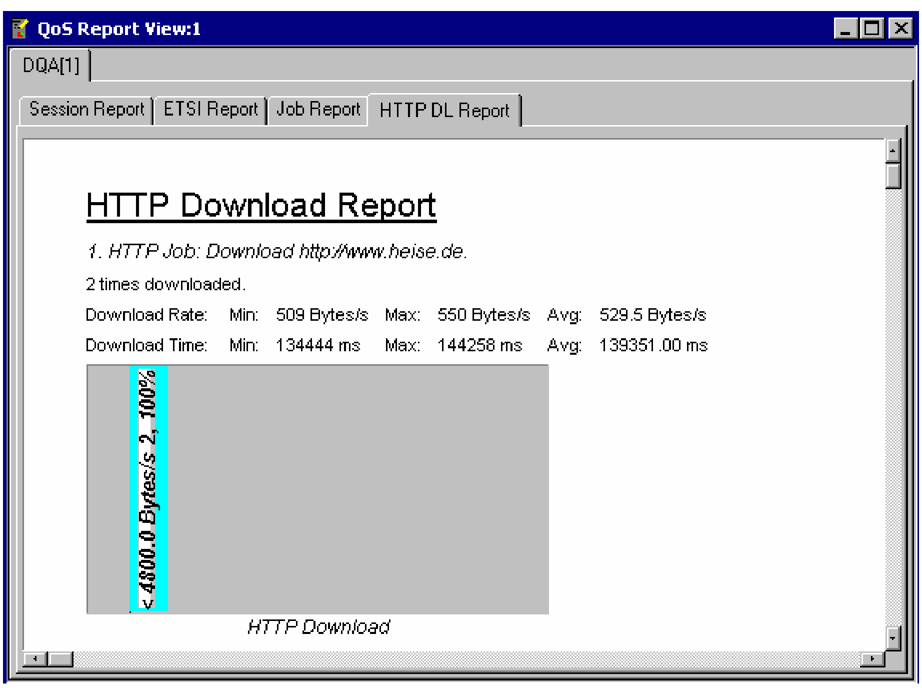
QoS Report View

The *QoS Report View* contains several tabs to separately monitor the jobs in the current session.






QoS Report View:1
DQA[1]
Session Report
ETSI Report
Job Report
HTTP DL Report
Job Report
1. Connect Job via SagemOT96R CSD zu VIAG, Server: –.
Cut Off Session Ratio: 0.0% Service Non Accessibility: 0.0%
Setup Time: 19.5% Network Non Accessibility: 0.0%
Tried Connections
Time Setup-Time [s] DQI [%] Result
1. 54168 ms 51.93 s 14.17% OK
2. 261566 ms 45.16 s 26.04% OK
Service Success Rate Data [HTTP]: 83.1%
Time DL-Time[s] DQI [%] Result
1. 201550 ms - - Failed
2. 399034 ms - - Failed


QoS Report View:1
DQA[1]
Session Report
ETSI Report
Job Report
HTTP DL Report
HTTP Download Report
1. HTTP Job: Download http://www.heise.de.
2 times downloaded.
Download Rate: Min: 509 Bytes/s Max: 550 Bytes/s Avg: 529.5 Bytes/s
Download Time: Min: 134444 ms Max: 144258 ms Avg: 139351.00 ms
< 4800.0 Bytes/s, 2, 100%
HTTP Download

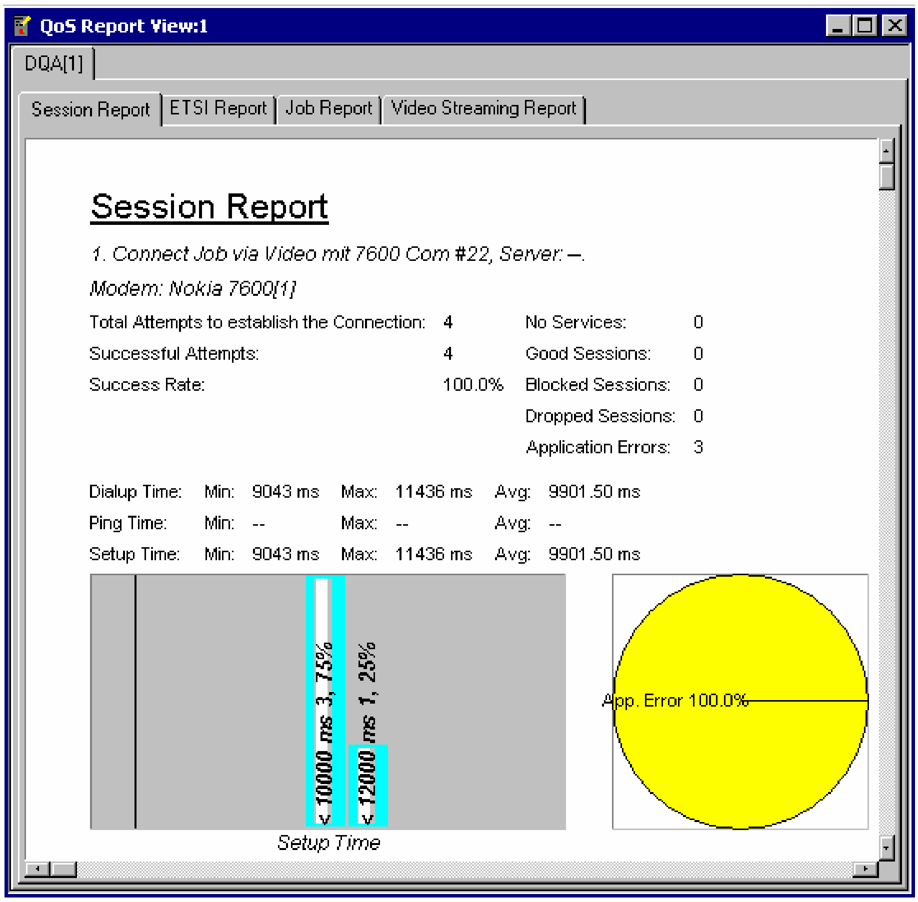


Fig. 4-226 QoS Report View – Session, ETSI, Job Report, HTTP Download and Video Streaming

The view contents are similar for all jobs.

View contents: Session Report

The *Session Report* tab (see *Fig. 4-226 above*) monitors the statistics of a connection that the system sets up to a remote network. This can be a radio link to a network established by means of test mobiles or a connection via dial-up network. At present the *Session Report* tab evaluates the *Connect to Network/Disconnect from Network* jobs. Connections via existing links, e.g. for *FTP Download* from a local network server, can be monitored in the other tabs.

The view shows the name of the job as set in the driver configuration menu, an overview of the attempted connections and the time statistics of the connections. The definition of *No Services, Application Errors, Good Sessions, Blocked Sessions* and *Dropped Sessions* is analogous to the call classes in the GSM Network Quality Analysis (NQA); see chapter 6 and section *QoS DQA View* on p. 4.348.

The *Session Report* tab contains a bar graph showing the percentage of good, blocked, failed and no service/application error sessions classified according to their time. The percentage of the session classes is also visualized in a pie chart. A bar graph corresponding to the pie chart is shown in the *QoS DQA View*; see p. 4.348.

View Contents: ETSI Report

The *ETSI Report* (if generated) shows a statistical evaluation of the attempted connections including the relative number of successful service activations *(GPRS Service Access Ratio etc.)* and the numeric and graphical time statistics *(Time Indicators, Histograms)*.

To verify whether or not an *ETSI Report* was generated, please consult the header of the applicable CMD file. If the *ETSI Report* was generated, the CMD file header contains the line "ETSI Report: generated" and the corresponding *ETSI Report* tab is visible. If not, the *ETSI Report* tab is not visible in the QoS Report View.

View Contents: Job Report

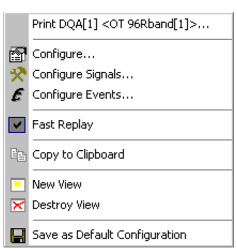
The *Job Report* monitors the success rate of the HTTP, FTP, or UDP connection that the system attempts to a remote network. For network connections the *Job Report* shows a weighted evaluation of the success rate.

ROMES uses a model where the success rate is described by a single percentage depending on the criteria *Cut-off Session Ratio, Service Non Accessibility, Set-up Time, Network Non Accessibility*, and *Data Quality* displayed in the *Job Report*. Each criterion enters into the calculation of the success rate with a coefficient or weighting factor between 0% (criterion does not influence the success rate) and 100% (criterion fully contributes to the success rate). The coefficients can be set in the *QoS Report View* configuration menu; refer to this section for more information.

View Contents: Local Network connections

The tabs for the *Ping, HTTP Download, FTP and UDP Upload* and *Download, EMail Upload* and *Download* jobs show an overview of the attempted local connections and the time statistics. A bar graph shows the successful and failed connections together with their time statistics.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, access the configuration menus, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

QoS Report View Configuration

The *QoS Report View* configuration menu sets the coefficients for the different criteria that can contribute to the calculation of the success rate. It is opened via a right mouse click on a point inside the *QoS Report View* or via the *Configuration – Settings* command (see chapter 3).

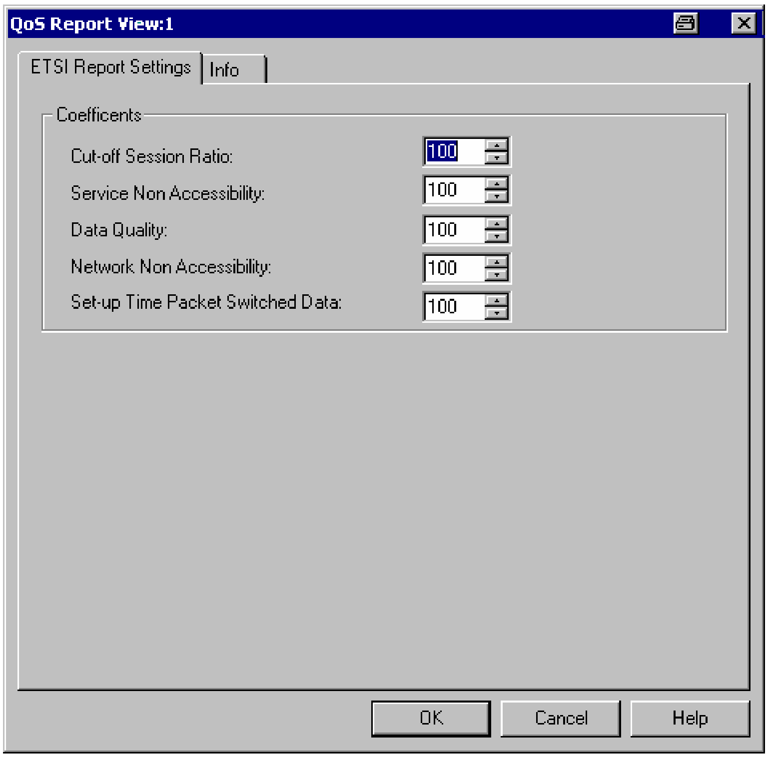


Fig. 4-227 QoS Report View configuration

Coefficients The coefficients are weighting factors for the different criteria that enter into the calculation of the success rate displayed in the *Job Report* tab of the *QoS Report View*. All coefficients can be set in the range between 0% (criterion does not influence the success rate) and 100% (criterion fully contributes to the success rate). The following criteria are provided:

Cut-off Session Ratio
The session had to be terminated irregularly, e.g. because the test mobile encountered a silent zone

Service Non Accessibility
The selected service (e.g. GSM, GPRS) is not available

Data Quality
Error rate of transferred data, e.g. data throughput

Network Non Accessibility
The selected network is not available

Set-up Time Packet Switched Data
Time interval needed to set up a packet switched data connection: from pressing the *Connect* button until the packet switched data connection is established

QoS Throughput View

The *QoS Throughput View* monitors the current, maximum and mean/average data rate in uplink/upload and downlink/download direction. To obtain valid results, the option *Record the computer's network throughput* must be enabled in the *Connection's Statistics* tab of the DQA driver configuration menu (see chapter 6). The data is recorded and displayed with the update rate selected in the driver configuration menu.

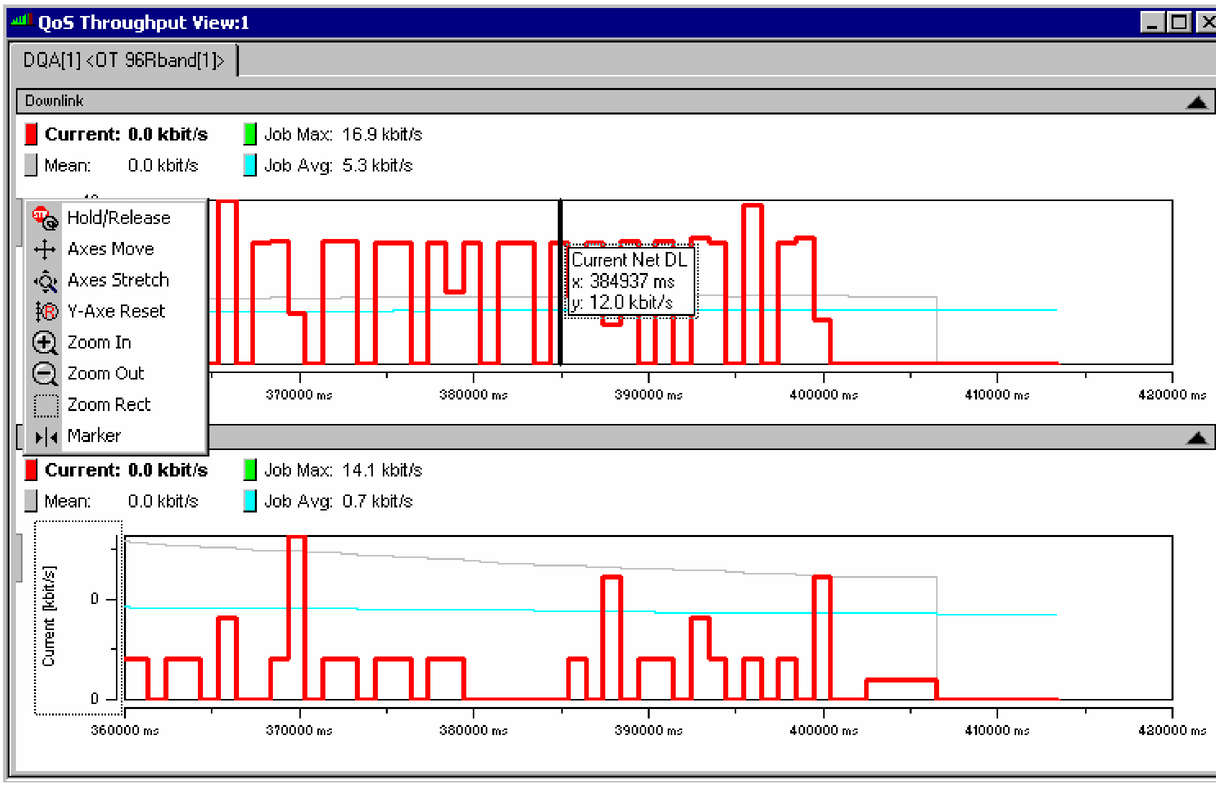


Fig. 4-228 QoS Throughput View

View contents

The uplink and downlink data rate is shown in two 2D charts. The scale and appearance of the two diagrams (downlink and uplink throughput) can be modified using the configuration menu and various context menus. The diagram configuration is analogous to the *2D Chart View* described on p. 4.11.

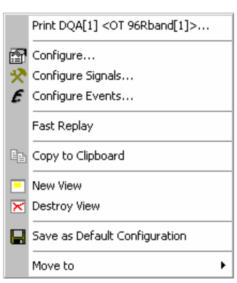
In the diagrams, the most recent data rates are always displayed at the right edge of the diagram. Each diagram contains four curves, corresponding to the following results:

- The *Current* curve shows the net throughput vs. time.
- The *Mean* curve shows the average throughput since the beginning of the current job, DQA session, or measurement session, depending on the *Throughput View Configuration* settings in the configuration menu.
- The *Job Max.* curve shows the maximum throughput since the beginning of the current job.
- The *Job Max.* curve shows the average throughput since the beginning of the current job.

The most recent *Current, Mean, Job Max,* and *Job Avg* values are displayed in the legend above the diagrams. Selecting one of the items in the legend will highlight the corresponding curve.

In the configuration menu, it is possible to modify the *Mean* calculation and the appearance of the diagram.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, access the configuration menus, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

QoS Throughput View Configuration

The *QoS Throughput View* configuration menu selects the range for the average calculation, modifies the appearance of the diagrams, and provides information about the view version. It is opened via a right mouse click on a point inside the *QoS Throughput View* or via the *Configuration – Settings* command (see chapter 3).

The *Throughput View Configuration* tab selects the range for the average calculation.

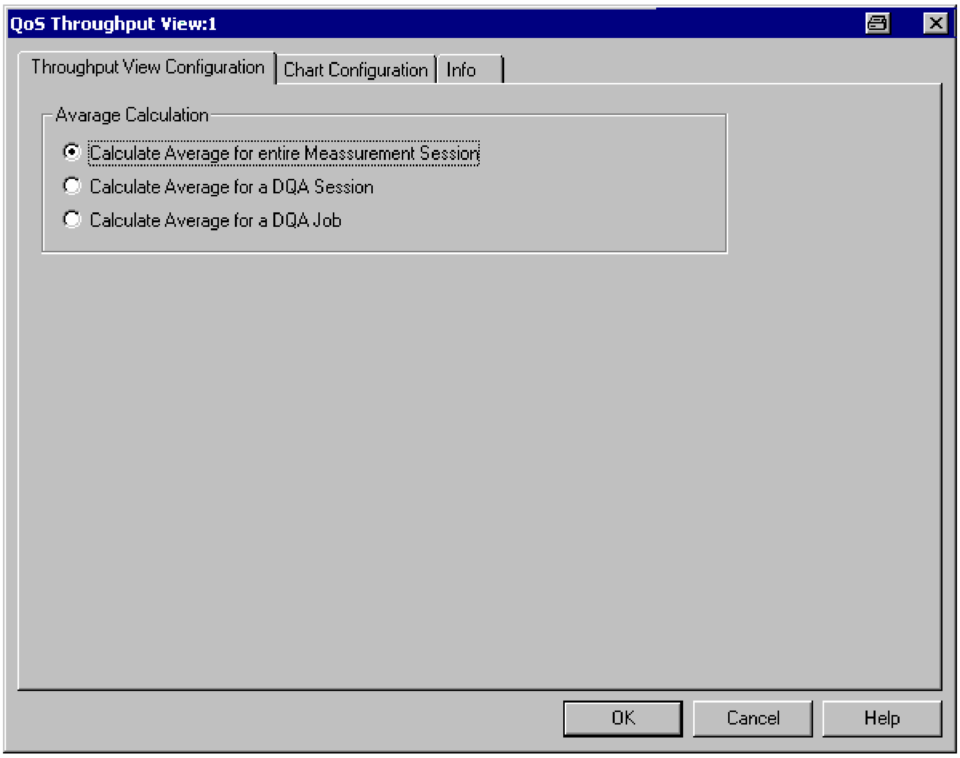


Fig. 4-229 QoS Throughput View configuration

Average Calculation Defines whether the *Mean* curves in the *QoS Throughput View* are calculated over the entire measurement session or over a shorter time interval (DQA session or single DQA job). A measurement sessions consists of an arbitrary number of periodically repeated DQA sessions, each DQA session contains one or more DQA jobs; see description of the Data Quality Tester driver in chapter 6.

The *Chart Configuration* tab scales the axes of the chart and defines its contents and its appearance. All controls are also available in the *Chart Configuration* tab of the *2D Chart Configuration* menu and have the same effect; see Fig. 4-11 on p. 4.15.

QoS RAS Statistics View

The *QoS RAS Statistics View* displays important parameters describing the network traffic during the measurement. To obtain valid results, the option *Record the connection's statistics* must be enabled in the *Connection's Statistics* tab of the DQA driver configuration menu (see chapter 6). The data is recorded and displayed with the update rate selected in the driver configuration menu.

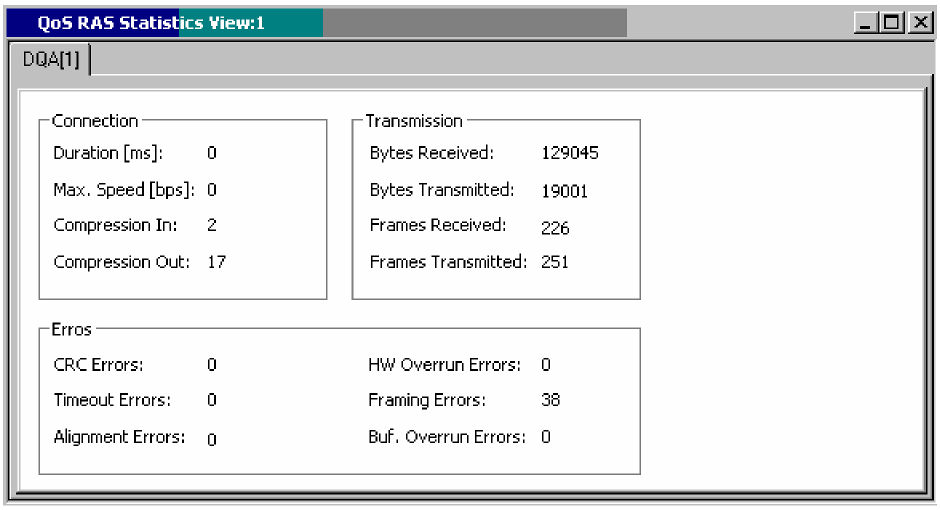
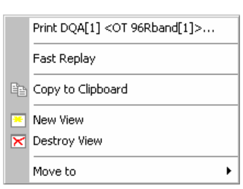


Fig. 4-230 QoS RAS Statistics View

The Remote Access Service (RAS) parameters are grouped together in three panels, describing the characteristics of the *Connection,* the data traffic *(Transmission),* and the data quality *(Errors).*

Context menu

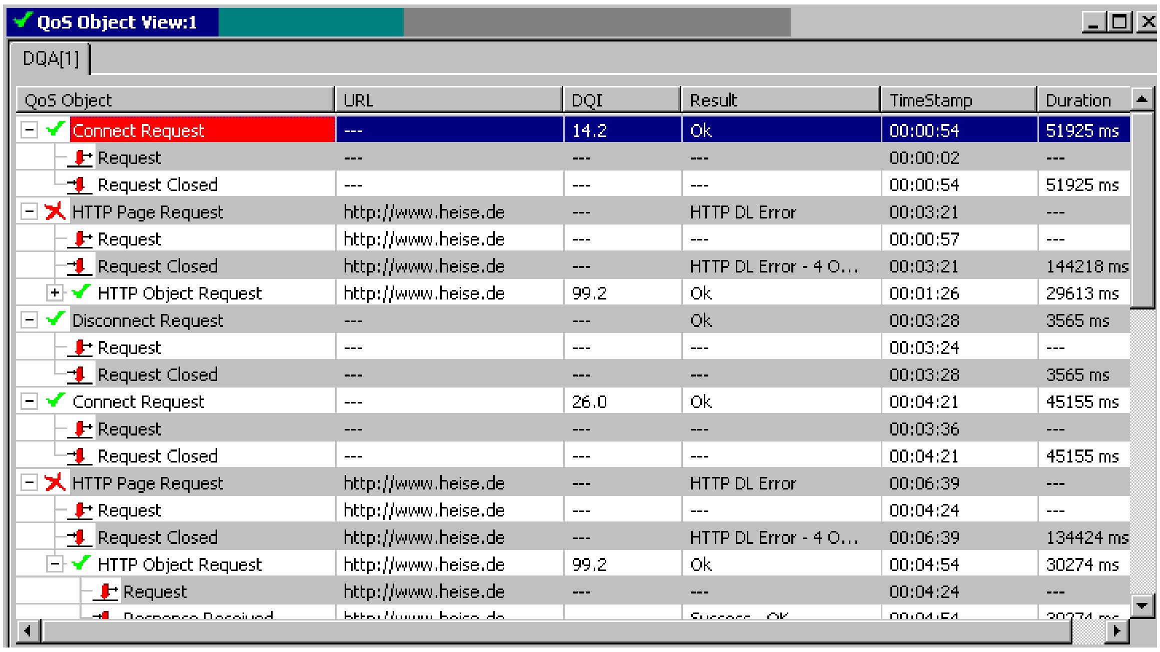


A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *QoS RAS Statistics View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

QoS Object View

The *QoS Object View* displays a record of the different actions involved in all DQA jobs of the measurement.



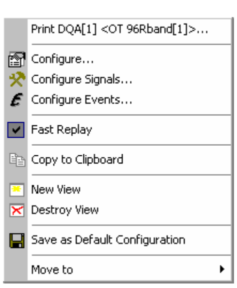
QoS Object	URL	DQI	Result	TimeStamp	Duration
Connect Request	---	14.2	Ok	00:00:54	51925 ms
Request	---	---	---	00:00:02	---
Request Closed	---	---	---	00:00:54	51925 ms
HTTP Page Request	http://www.heise.de	---	HTTP DL Error	00:03:21	---
Request	http://www.heise.de	---	---	00:00:57	---
Request Closed	http://www.heise.de	---	HTTP DL Error - 4 O...	00:03:21	144218 ms
HTTP Object Request	http://www.heise.de	99.2	Ok	00:01:26	29613 ms
Disconnect Request	---	---	Ok	00:03:28	3565 ms
Request	---	---	---	00:03:24	---
Request Closed	---	---	---	00:03:28	3565 ms
Connect Request	---	26.0	Ok	00:04:21	45155 ms
Request	---	---	---	00:03:36	---
Request Closed	---	---	---	00:04:21	45155 ms
HTTP Page Request	http://www.heise.de	---	HTTP DL Error	00:06:39	---
Request	http://www.heise.de	---	---	00:04:24	---
Request Closed	http://www.heise.de	---	HTTP DL Error - 4 O...	00:06:39	134424 ms
HTTP Object Request	http://www.heise.de	99.2	Ok	00:04:54	30274 ms
Request	http://www.heise.de	---	---	00:04:24	---

Fig. 4-231 QoS Object View

The entries in the table are self-explanatory. In particular, the table contains detailed timing information about each action. The Data Quality Indicator (DQI) is a measure for the quality of the transmission, calculated in analogy to the success rate described in paragraph *ETSI Report* on p. 4.352; it is in the value range between 0 and 100.

An alternative record of the actions in a particular job including the number of exchanged bytes is displayed in the QoS Progress View; see section QoS Progress View on p. 4.344.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, access the configuration menus, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

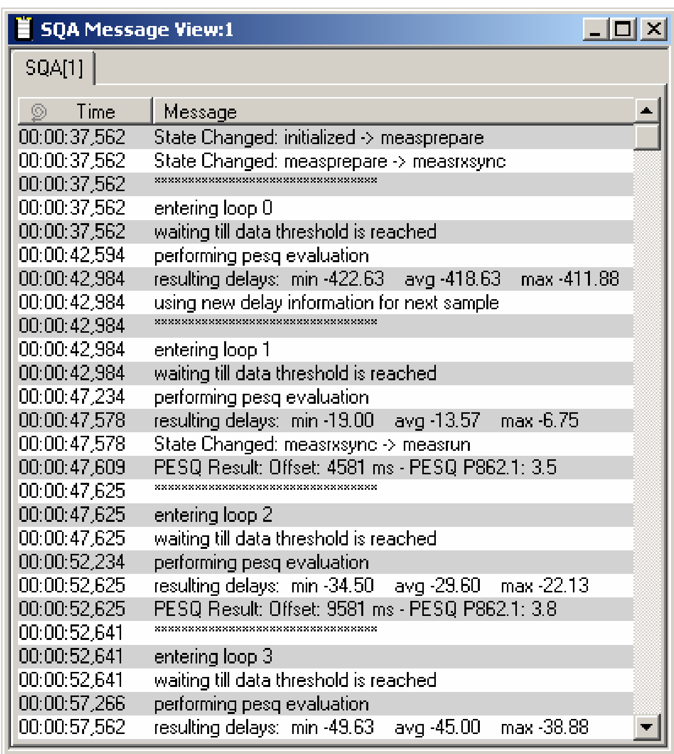
The configuration menu displays information about the view version.

SQA Message View

The *SQA Message View* shows the result of the Speech Quality Analysis (SQA, with option ROMES-Z8, *Voice Quality PESQ)*. The SQA must be enabled and configured using the *Speech Quality* tab of the test mobile drivers. For a detailed description of the driver configuration, the SQA procedure, and the test setup refer to chapter 6. SQA is provided for many mobile types and technologies (GSM, GPRS, UMTS, cdmaOne/IS-95, CDMA2000).

TIP

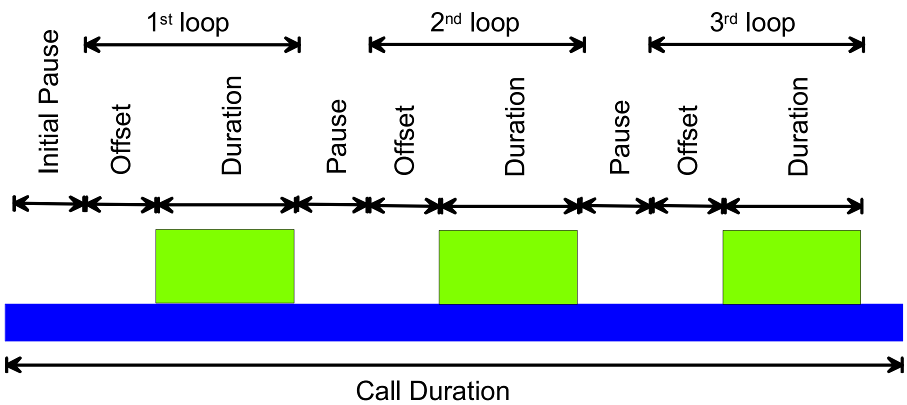
In addition to the results in the SQA Message View, *ROMES generates a wide range of SQA signals. The signals are under the* SQA Tester *node of the data tree (Configuration – Preferences – Available Signals). You can analyze the signals in one of the basic views, e.g. you can display the PESQ score in a series of consecutive loops and calculate average, minimum and maximum values using the* Statistic Histogram *view.*



Time	Message
00:00:37,562	State Changed: initialized -> measprepare
00:00:37,562	State Changed: measprepare -> measrxsync
00:00:37,562	************************************
00:00:37,562	entering loop 0
00:00:37,562	waiting till data threshold is reached
00:00:42,594	performing pesq evaluation
00:00:42,984	resulting delays: min -422.63 avg -418.63 max -411.88
00:00:42,984	using new delay information for next sample
00:00:42,984	************************************
00:00:42,984	entering loop 1
00:00:42,984	waiting till data threshold is reached
00:00:47,234	performing pesq evaluation
00:00:47,578	resulting delays: min -19.00 avg -13.57 max -6.75
00:00:47,578	State Changed: measrxsync -> measrun
00:00:47,609	PESQ Result: Offset: 4581 ms - PESQ P862.1: 3.5
00:00:47,625	************************************
00:00:47,625	entering loop 2
00:00:47,625	waiting till data threshold is reached
00:00:52,234	performing pesq evaluation
00:00:52,625	resulting delays: min -34.50 avg -29.60 max -22.13
00:00:52,625	PESQ Result: Offset: 9581 ms - PESQ P862.1: 3.8
00:00:52,641	************************************
00:00:52,641	entering loop 3
00:00:52,641	waiting till data threshold is reached
00:00:57,266	performing pesq evaluation
00:00:57,562	resulting delays: min -49.63 avg -45.00 max -38.88

Fig. 4-232 SQA Message View

SQA measurement An SQA measurement consists of a specified number of test loops. In each test loop, ROMES uploads or downloads voice data for a specified duration and calculates the PESQ score according to ITU-T recommendation P.862. An offset time preceeds each data transfer. Moreover the individual loops are separated by a pause time. All timing parameters can be set in the driver configuration menu.



SQA messages

The *SQA Message View* contains a chronological record of the generated SQA messages. An SQA message either describes an event (i.e. the beginning of a particular stage of the measurement), a measurement result, or an error. The messages depend on the measurement mode (download, upload). The basic events and results are repeated for each loop.

Events and Results: Downlink

Entering loop <nr>

Start time of the loop, beginning of the transferred file. The actual data transfer starts after the *Offset* defined in the configuration menu. The system waits until enough data have been transferred to start the PESQ evaluation.

Performing pesq evaluation

Start time of the PESQ evaluation in the current loop.

Resulting delays: ...

Time delay between reference file and acquired sample in ms. The speech codec can introduce variable delays within the sample, therefore the PESQ result contains the minimum, average, and maximum delay. If the average delay exceeds 30 ms, the system corrects the timing and repeats the PESQ evaluation.

PESQ Result

Offset between the start of the loop and the calculation of the result. The offset includes the transmission time through the communication system; it is not identical to the offset defined in the driver configuration menu. The *PESQ P862.1* result is the calculated PESQ score which is converted to a scale between 1 and approx. 4.55; see Table 3 below and the following background information.

Searching for next valid sample data

The PESQ evaluation failed or crashed in a first attempt, however, the system tries to repeat the evaluation in the current loop with a shifted evaluation interval.

Repeating this sample using new delay information

The PESQ evaluation failed or crashed in a first attempt, the delay between the acquired sample and the reference file was larger than 30 ms. The system tries to repeat the evaluation in the current loop with a shifted evaluation interval.

Using new delay information for next sample

The delay between the acquired sample and the reference file was larger than 30 ms, the evaluation of the current sample cannot be repeated (e.g. because the beginning of the sample was lost). The system tries to synchronize to the next sample (next loop) using the delay information; the PESQ result in the current loop is omitted.

Waiting till data threshold is reached

Audio data is acquired (recorded) until the length of the recorded sample is identical to the lenth of the reference sample.

Events and Results: Uplink

Playing initial silence

Initial pause before the start of the first loop (loop 0). The length of the initial pause is defined in the driver configuration menu.

Playing sample

The loop was started; the sample file (play file) is being played.

Playing silence between samples

Pause time between two consecutive loops of the sample file (play file).

Errors: Downlink *PESQ evaluation failed*

The system could not determine a PESQ result, e.g. because the delay between the acquired sample and the reference file was too big, or because the two files were hardly correlated. The PESQ evaluation is repeated with a shifted evaluation interval until the end of the loop is reached.

PESQ evaluation crashed…

The system crashed during the PESQ evaluation (possible reason see above). The PESQ evaluation is repeated with a shifted evaluation interval until the end of the loop is reached.

Abort requested

The measurement was aborted.

Errors: Uplink *Abort requested*

The measurement was aborted.

Table 3 ITU P.800 PESQ scale

PESQ 826.1	Speech Quality	Impairments
5	Excellent	Imperceptible
4	Good	Perceptible, but not annoying
3	Fair	Slightly annoying
2	Poor	Annoying
1	Bad	Very annoying

Mapping of PESC score and ITU P.800 values

The PESC score according to ITU-T recommendation P.862 expresses the speech quality on a scale between –0.5 and +4.5. The PESC score values can be mapped to the ITU P800 scale of Table 3 above; an appropriate conversion formula has been standardized by the ITU in P.862.1. The conversion formula maps the PESQ score values to a range between approx. +1 and +4.55; ROMES displays the converted values as *PESQ P862.1* results.

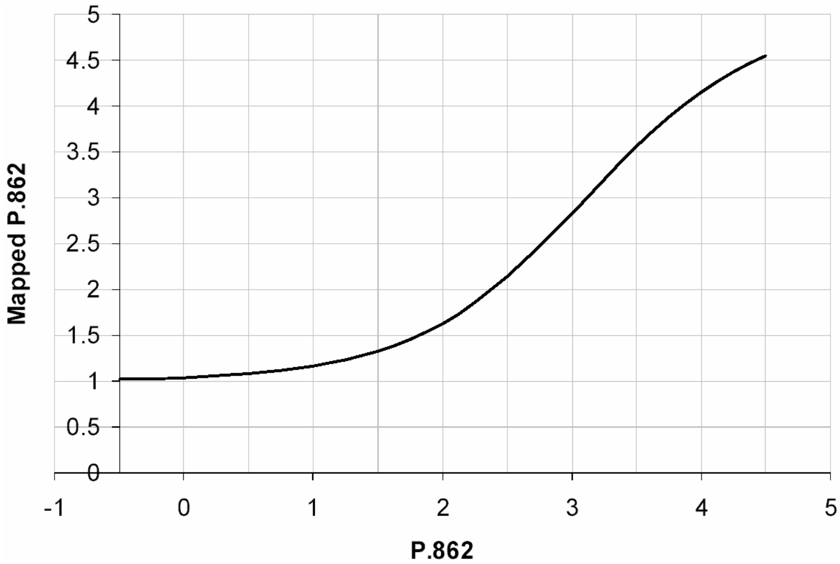
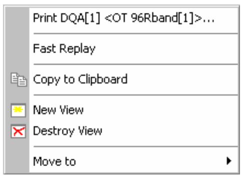


Fig. 4-233 Mapping of PESC score (P862) and ITU P.800 values according to ITTU P862.1

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see *Context menu* description on p. 4.2.

The *SQA Message View* has no configuration menu assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

Spectrum Views

The *Spectrum Views* show the signal strength of an RF signal in a specified frequency range and its evolution in time. The spectrum can be measured with a R&S FSP spectrum analyzer or a R&S ESPI test receiver using the *ESPI (Spectrum)* driver.

The *Spectrum View* can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *Spectrum Views*.

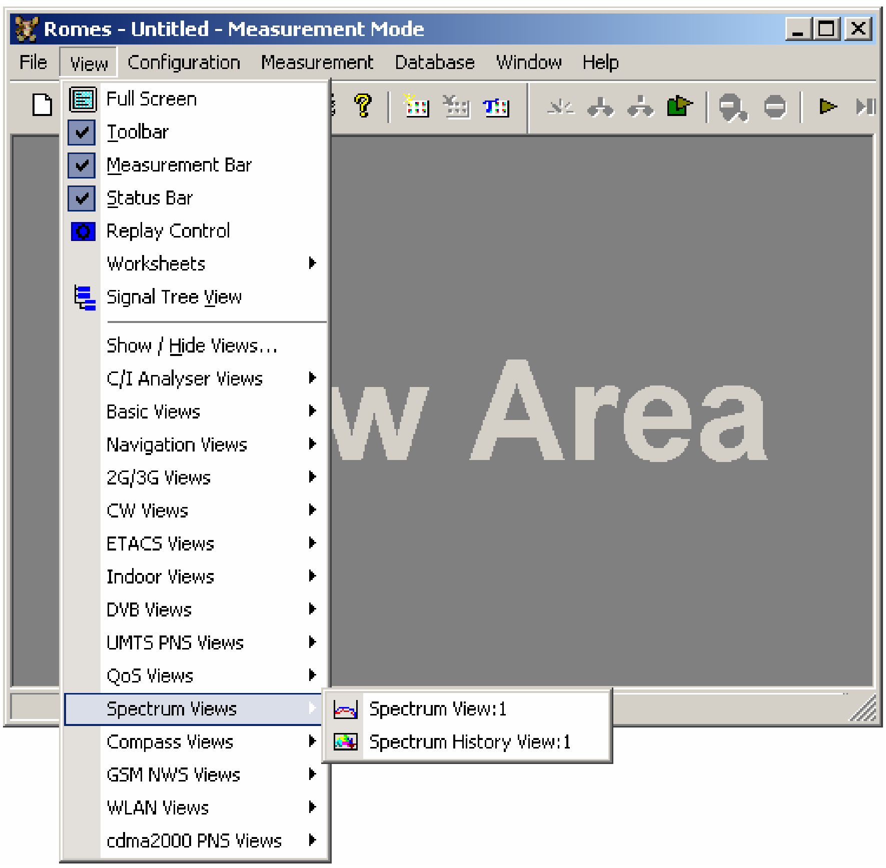


Fig. 4-234 Spectrum views

Spectrum View

The *Spectrum View* displays the total signal power in the frequency ranges selected in the driver configuration menu.

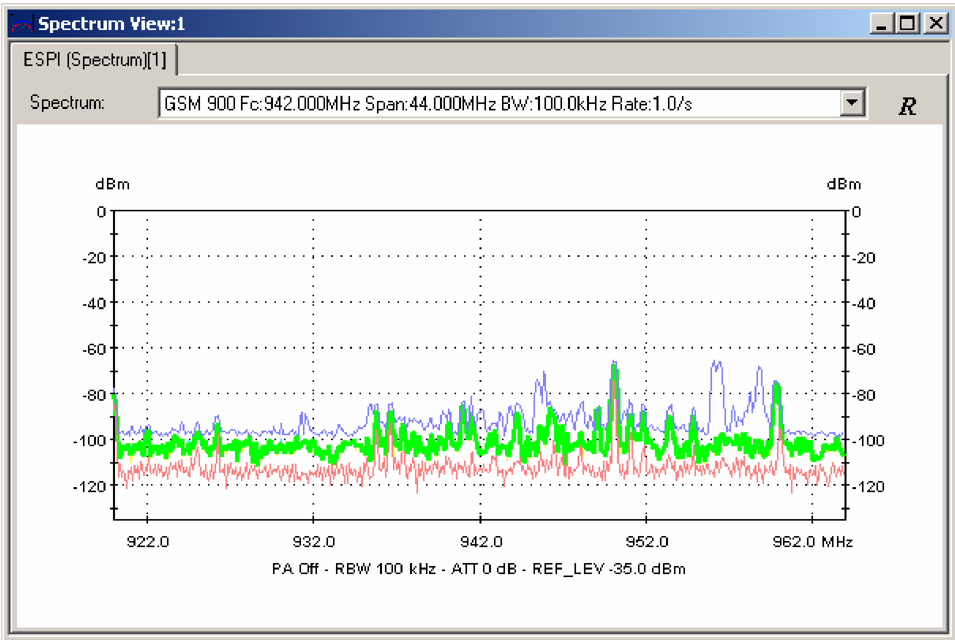


Fig. 4-235 Spectrum View

The results provided by each analyzer or test receiver are arranged in a separate tab. The view area is divided into a drop-down list to select a spectrum and the diagram, as shown below:

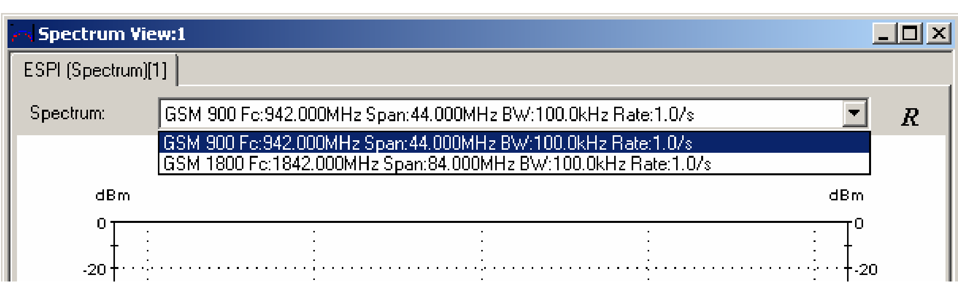


Fig. 4-236 Spectrum Selection

Spectrum Drop-down list of all spectra defined in the *Settings* tab of the driver configuration menu. Each spectrum has a name and a specific frequency range, measurement rate and resolution bandwidth.

The *Reset Envelope* button to the left of the *Spectrum* list deletes the *Envelope Min. Hold* and *Envelope Max. Hold* curves in the diagram and restarts the envelope calculation.

View area

The view area contains a 2D-chart for the selected spectrum. The 2D-chart shows the received signal power in dBm as a function of the frequency. The diagram is updated with the *Measurement Rate* set in the driver configuration menu:

The diagram contains up to 5 different measurement curves, colored according to the settings in the configuration menu. The three *Current* curves between the envelopes represent the results of the current sweep. The number of measurement results (sweep points) per curve is fixed (e.g. 501 for an ESPI receiver). If the diagram is narrower than the number of sweep points times the pixel width of the screen, then the minimum, the maximum, and the average of all results mapped on each pixel is displayed. If the diagram is large enough, only one value is mapped on each pixel, so the three *Current* curves are equal.

Current Average
Average of all power values at each pixel.

Current Minima
Minimum of all power values at each pixel. The minimum is shown only if it differs from the *Current Average.*

Current Maxima
Maximum of all power values at each pixel. The maximum is shown only if it differs from the *Current Average.*

Envelope Min Hold
Minimum of all power values in the current measurement, comprising all sweeps performed since the start of the measurement or since the *Reset Envelope* button was pressed last time.

Envelope Max Hold
Maximum of all power values in the current measurement, comprising all sweeps performed since the start of the measurement or since the *Reset Envelope* button was pressed last time.

Reduce the diagram width to observe the Current Average, Minima and Maxima. Continue the measurement over several sweeps to observe the widening gap between the two envelopes.

Diagram subtitles

The parameters displayed below the downlink and uplink spectrum diagrams represent test device settings that are important for the interpretation of the results.

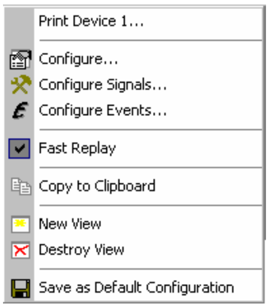
PA
Setting of the preamplifier *(On* or *Off)*. The preamplifier is automatically set at the test device.

RBW
Resolution bandwidth of the measurement (IF) filter of the test device as set in the driver configuration menu. The wideband signal power measured by a spectrum analyzer is a function of the RBW.

ATT
Setting of the receiver attenuator; a large attenuation factor (i.e. a low mixer level) suppresses distortions but increases the noise level and reduces the dynamic range.

REF_LEV
Reference level of the test device: Input signals will not overload the input path of the receiver as long as they are below the reference level.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

Spectrum Configuration

The *Spectrum* configuration menu defines the y-axis scale, i.e. the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *Spectrum View* and the colors of the different curves. It is opened via a right mouse click on a point inside the *Spectrum View* or via the *Configuration – Settings* command (see chapter 3).

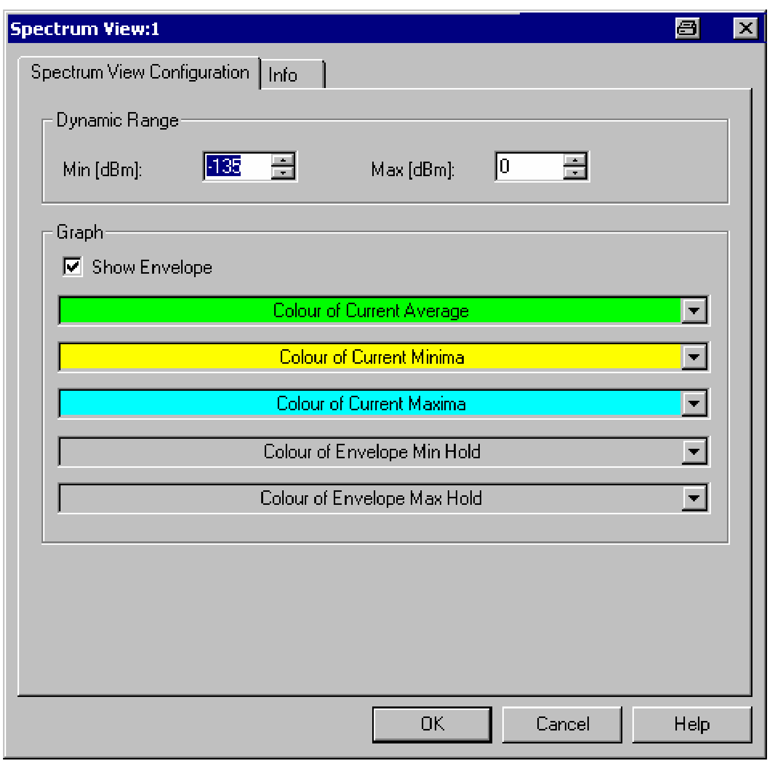


Fig. 4-237 Spectrum configuration

Dynamic Range The two input fields in the *Dynamic Range* panel define the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *Spectrum View.*

Graph The controls in the *Graph* panel select the curves to be displayed and the colors of each curve.

Show Envelope
If the box is checked, the two envelope curves are displayed. Otherwise, the *Spectrum* view shows the *Current* curves only.

Colors
Drop-down lists for the colors of the five curves described in paragraph *View area* on p. 4.366.

Spectrum History View

The *Spectrum History View* displays the evolution in time of the total signal power in the frequency ranges selected in the driver configuration menu of the *ESPI (Spectrum)* driver.

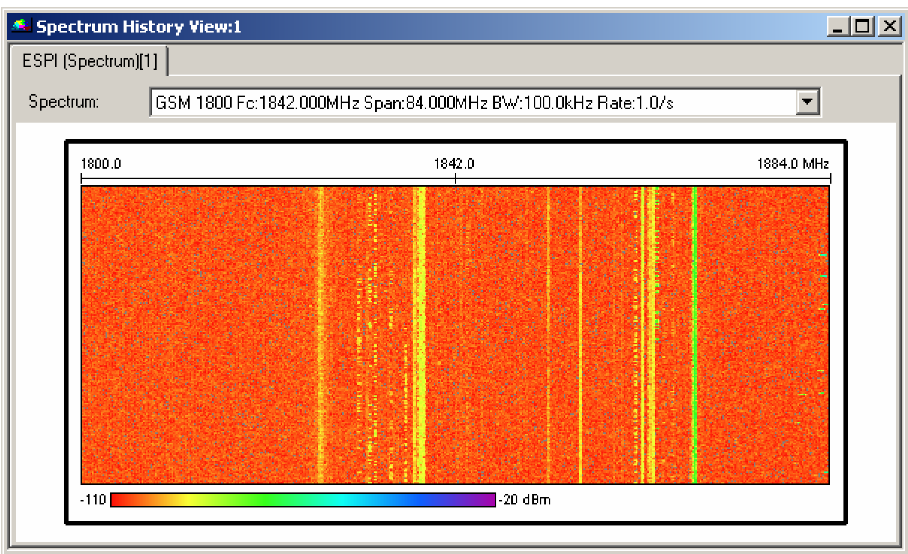


Fig. 4-238 Spectrum History View

The results provided by each analyzer or test receiver are arranged in a separate tab. The view area is divided into a drop-down list to select a spectrum and the diagram.

Spectrum Drop-down list of all spectra defined in the *Settings* tab of the driver configuration menu. Each spectrum has a name and a specific frequency range, measurement rate and resolution bandwidth.

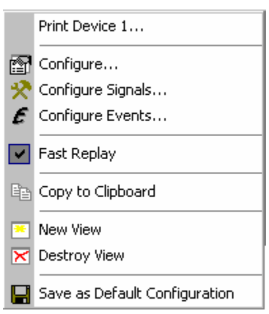
Diagram

The colored rectangular diagram shows the total signal power received in consecutive frequency sweeps. The power is displayed as a function of the frequency and time using the color scheme defined in the configuration menu. The rectangular view area represents the time/frequency plane and is automatically adjusted to the selected spectrum:

X-axis (frequency)
: Measured frequency range of the spectrum. If the view window is narrower than the diagram width, a scrollbar appears across the bottom of the diagram.

Y-axis (time)
: Linear time scale of the measurement. The diagram consists of 100 to 800 lines, arranged from top to bottom. Each line shows the result of a single sweep across the specified frequency range. The diagram is continuously updated during the measurement or replay by adding new lines. It is automatically scrolled as soon as a line reaches the bottom of the diagram.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

Spectrum History Configuration

The *Spectrum History* configuration menu defines the number of lines, selects the frequency range and sets the colors in the *Spectrum History View*. It is opened via a right mouse click on a point inside the *Spectrum History View* or via the *Configuration – Settings* command (see chapter 3).

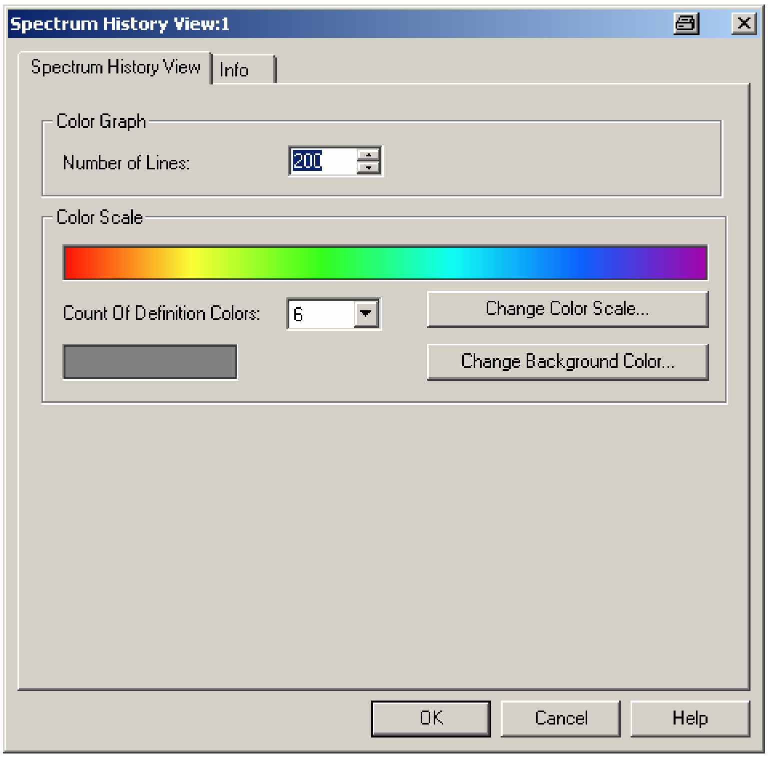


Fig. 4-239 Spectrum History configuration

The settings are also provided in the *UMTS PNS Spectrum History* configuration menu; see description in section *PNS Spectrum View* on p. 4.317.

Compass Views

The *Compass Views* visualize data recorded with the *Compass* driver. This driver provides the true geographic orientation of the test vehicle carrying the compass and the measurement equipment.

The compass views can be selected from a submenu displayed to the right of the *View* menu when the mouse pauses over *Navigation Views*.

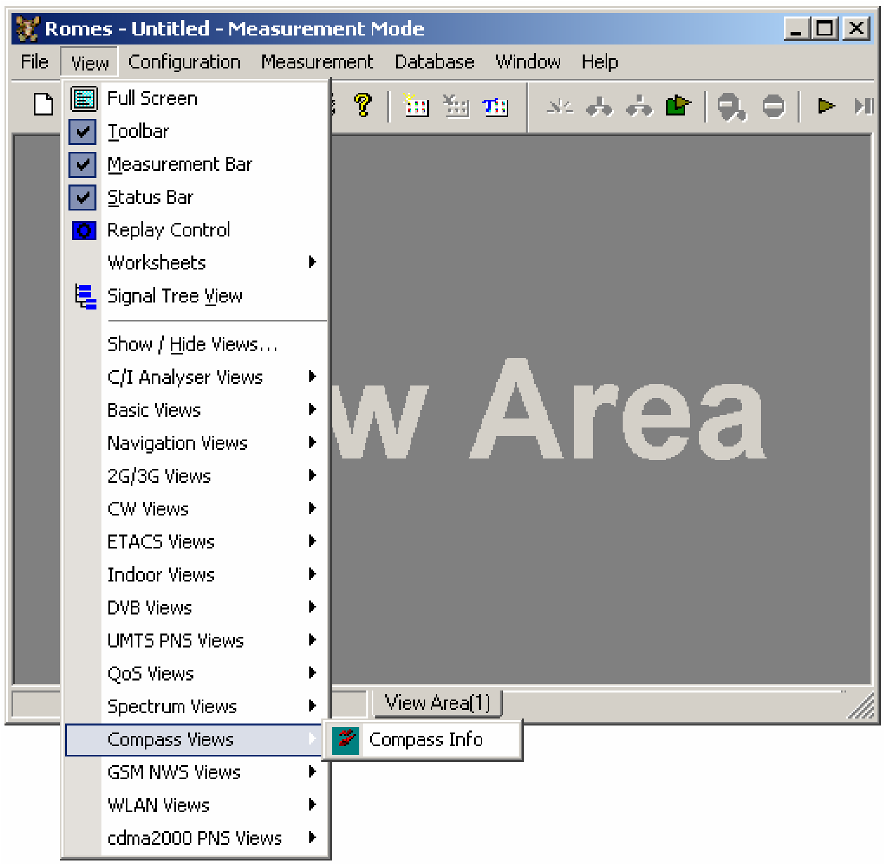


Fig. 4-240 Compass Views

Compass Info

The *Compass Info* view shows the direction *(True Heading)* of the test vehicle carrying the compass and the measurement equipment. The *True Heading* is used to calculate the geographic orientation of the receiving directional antenna *(Mast Position* in degrees).

This view is a complement to the *Polar View* (see p. 4.30), where an arbitrary signal can be displayed as a function of the *Mast Position.*

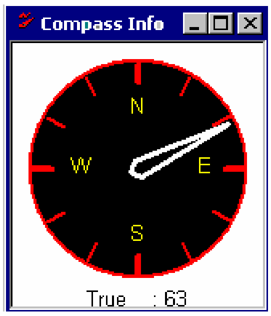


Fig. 4-241 Compass Info view

The *Compass Info* view has no context menu for configurations assigned. The *Info* tab can be accessed via *Configuration – Settings*.

GSM NWS Views

The *GSM NWS Views* shows the GSM information obtained in the GSM network scans performed by a TSMU radio network analyzer. GSM network scans require option ROMES-GS3, *GSM Network Scanner.* The GSM Network Scanner driver is described in chapter 6.

The *GSM NWS Views* can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *GSM NWS Views*.

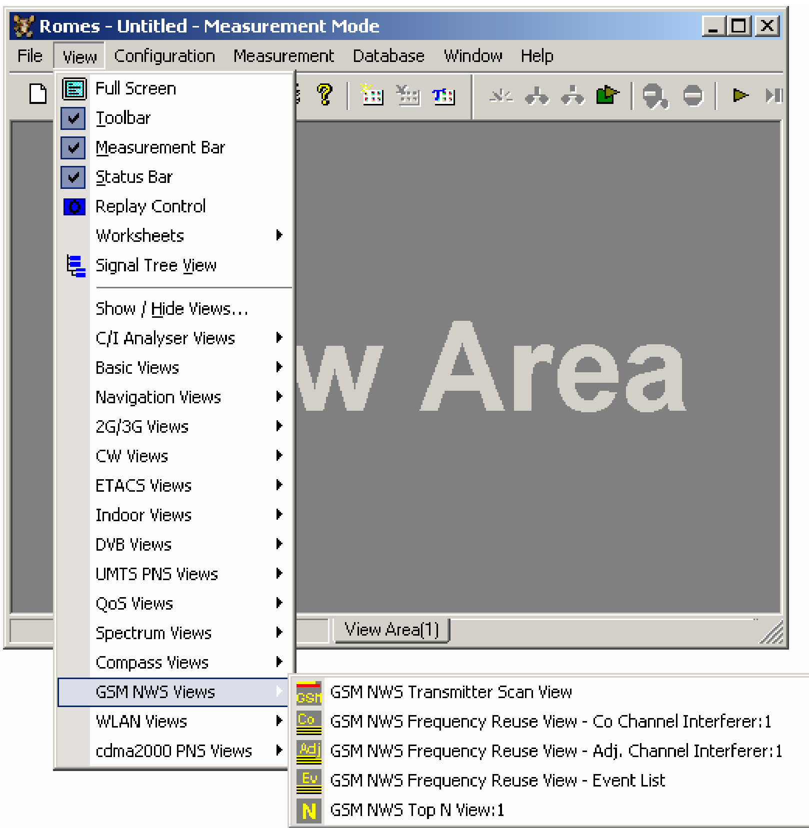
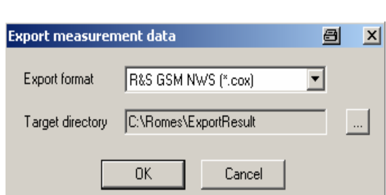


Fig. 4-242 GSM NWS views

The GSM network scan data can be exported to a C0 scan export file; see description in chapter 7. To export the data, use the File – Export CMD File(s)… *command and select the appropriate file format:*

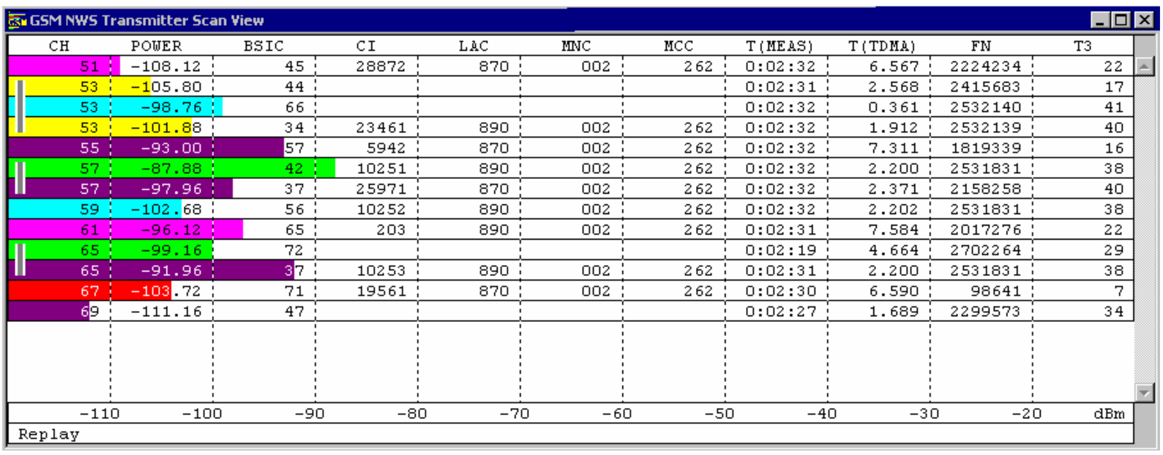


Note that a GSM BTS List Database *must be loaded in order to export scan data. The database does not have to contain any BTS entries, it is sufficient to load an empty database. For this export to a C0 scan export file it is recommended to open an instance of the* Message View*, which contains useful information in case of problems.*

GSM NWS Transmitter Scan View

The *GSM NWS Transmitter Scan View* displays the demodulated data acquired by the TSMU radio network analyzer during the GSM Network Scan. The data also contains information transmitted on the Synchronization Channel (BSIC and TDMA frame number) and the *System Information Type 3* of the BCCH.

The measured and detected sectors in the air are displayed, sorted and updated in different rows:



GSM NWS Transmitter Scan View

CH	POWER	BSIC	CI	LAC	MNC	MCC	T(MEAS)	T(TDMA)	FN	T3
51	-108.12	45	28872	870	002	262	0:02:32	6.567	2224234	22
53	-105.80	44					0:02:31	2.568	2415683	17
53	-98.76	66					0:02:32	0.361	2532140	41
53	-101.88	34	23461	890	002	262	0:02:32	1.912	2532139	40
55	-93.00	57	5942	870	002	262	0:02:32	7.311	1819339	16
57	-87.88	42	10251	890	002	262	0:02:32	2.200	2531831	38
57	-97.96	37	25971	870	002	262	0:02:32	2.371	2158258	40
59	-102.68	56	10252	890	002	262	0:02:32	2.202	2531831	38
61	-96.12	65	203	890	002	262	0:02:31	7.584	2017276	22
65	-99.16	72					0:02:19	4.664	2702264	29
65	-91.96	37	10253	890	002	262	0:02:31	2.200	2531831	38
67	-103.72	71	19561	870	002	262	0:02:30	6.590	98641	7
69	-111.16	47					0:02:27	1.689	2299573	34

-110 -100 -90 -80 -70 -60 -50 -40 -30 -20 dBm

Replay

Fig. 4-243 GSM NWS Transmitter Scan View

The *GSM NWS Transmitter Scan View* is analogous to the *K7 Transmitter Scan View* described in chapter 5.

Each table row corresponds to a GSM downlink signal received from one BTS. It is underlined with a gray or colored bar, where the color denotes the measured BCC (the second digit of the octal BSIC), where the color denotes the measured BCC, with the same color legend as in the *K6 TS View* (see chapter 5). Gray bars and brackets in the table row characterize how complete or how recent the displayed results are; refer to the description of the *Info Levels* in the *K7 Transmitter Scan View* section in chapter 5. The length of this bar corresponds to the received SCH power, according to the dBm scale displayed across the bottom of the view.

The power bars in the K7 Transmitter Scan *view indicate the power on the Synchronization Channel (SCH). This power generally differs from the GSM downlink signal power obtained in a CW measurement.*

The view contents and the configuration menus are equal to the *K7 Transmitter Scan View* (see chapter 5). The *GSM NWS Transmitter Scan View* provides the following additional features:

- The SCH power *(POWER)* of the signals is displayed in the second column.
- The dynamic range is extended to –120 dBm to 0 dBm.
- Several BTSs can be measured on the same channel, provided that their signal power does not differ by more than a few dB so that the TSMx can still decode the data. Signals with the same channel number but different BSIC are marked with a vertical gray bar (e.g. the three signals with channel no. 53 in the figure Fig. 4-243 above).
- In the context menu it is possible to freeze the view input so that no new measurement results are displayed.

GSM NWS Frequency Reuse Views

Interference in Mobile Networks is either caused by co-channel or adjacent channel, broadcast control channel or traffic channel Interference, or other sources like spurious emissions and intermodulation.

The *GSM NWS Frequency Reuse View* is an analysis tool for the interference situations detected with a GSM test mobile and with a TSMx radio network analyzer (GSM network scanner).

The scanner continuously measures the bands and delivers the base data for the interference process when a potential interference situation has been reported from the mobile. This can be either specific RxLev/RxQual combinations or exceed C/I thresholds on C0 and Cx of the serving cell.

When this is the case, the interference analysis process accesses the scanner data and combines it with the Test Mobile data and the Base Station database, so that an immediate picture on the interference situation on co-channel and adjacent channels is given. This way interference on C0/C0, C0/Cx, Cx/C0 and Cx/Cx can be detected, the source of interference analyzed and possibly eliminated.

NOTE

The GSM network scanner-based interference analysis with option TSMU-K13/ROMES-GS3 is different from the interference analysis based on the option ROMES-GS1 described in chapter 2. Details and an example for the interference analysis are available in the R&S newsletter ***No. 190 - 2006/II***.

The *GSM NWS Frequency Reuse View* lists all events during interference analysis, which include time-stamp, details of the interference event, description of the serving cell, channel / frequency hopping, C/I value from the test mobile (if available), and the test mobile triggering the interference analysis.

ROMES provides three different versions of the view named *Co Channel Interferer, Adj. Channel Interferer,* and *Event List.*

GSM NWS Frequency Reuse View – Co Channel Interferer

The *GSM NWS Frequency Reuse View – Co Channel Interferer* provides detailed information about the serving cell, the potential co-channel interferers, and the characteristics of the interference situations encountered during the measurement tour.

A co-channel interferer is a neighbor cell that has a C0 channel (BCCH, SCH…) or a Cx channel (TCH) in common with one of the channels of the serving cell. To analyze possible adjacent channel interferers use the *GSM NWS Frequency Reuse View – Adj. Channel Interferer* described on page 4.381.

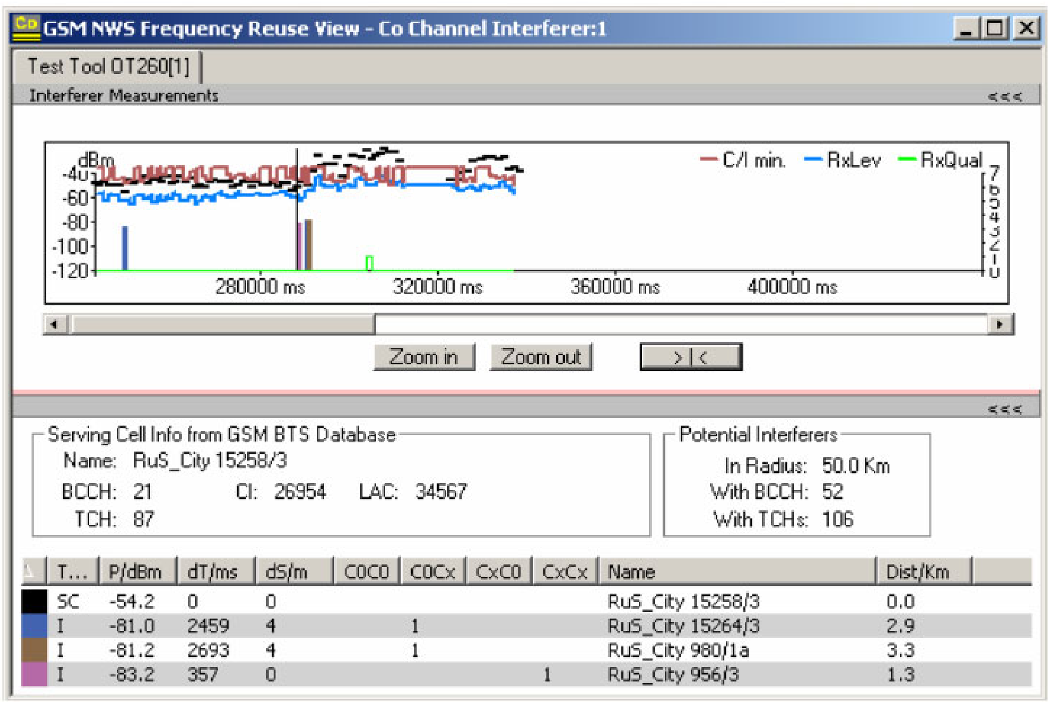


Fig. 4-244 GSM NWS Frequency Reuse View: Co Channel Interferer

View area

The entire view area is horizontally split to accommodate a 2D chart *(Interferer Measurements)* and different tables with detailed information about the current serving cell and interference situation.

A click on the upper *(Interferer Measurements)* or lower title bar compresses and expands the corresponding section in the view area. A compressed section leaves more space for the other section. A compressed table is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

Various settings in the configuration menu control the contents and the appearance of the view areas.

2D Chart (Interferer Measurements)

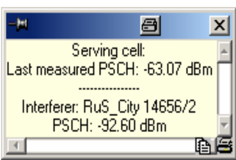
The diagram in the upper view section shows the changes of the interference situation over time. The diagram contains measurement curves with the following mobile data:

- Carrier-to-Interference ratio *C/I* measured by the mobile in dedicated mode. This value is only measured by Sagem test mobiles. In frequency hopping mode, the minimum C/I value of all channels is displayed.
- *RxLev* and *RxQual* values from the mobile measurement reports, measured in dedicated mode.

In addition, colored bars show the following TSMx network scanner data:

- Measured SCH power of the serving cell in dBm (horizontal, black bars).
- Measured SCH power of the potential interferers in dBm (vertical, colored bars). The colors distinguish between the different interferers; they are also used in the top N list below.

The *Zoom In* and *Zoom out* buttons shrink or enlarge the chart. If *Scan File* is activated, the "> | <" button restores the original view scale.



Clicking a colored interferer bar opens a window with the SCH power of the serving cell, the name of the interferer, and the exact SCH power result. The view also supports the coupled focus (use *ALT* plus a double-click inside the view). A BTS data base is required to obtain these results.

Serving Cell Info

The *Serving Cell Info…* panel shows the parameters of the current serving cell extracted from the GSM BTS database: serving cell name *(Name)*, *BCCH* channel number, *TCH* channel number, cell identity *(CI)*, Location Area Code *(LAC).* The parameters are not available if no BTS data base is provided.

Potential Interferers

The *Potential Interferers…* panel shows the number of the potential interferers in the vicinity of the serving cell. Potential interferers are extracted from the network data base:

In Radius	Maximum distance between the current position and the potential interferer as specified in the *Threshold Values* tab of the configuration menu.
BCCH	Number of neighbor base stations using the same BCCH as the serving cell.
TCH	Number of neighbor base stations using one or more TCH in common with the serving cell.

The parameters are not available if no BTS data base is provided.

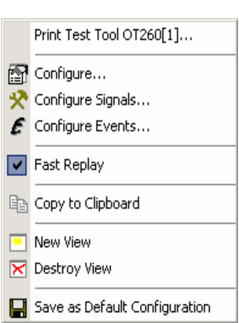
Top N List

The table below the *Serving Cell Info* and the *Potential Interferers* panels shows the parameters of the serving cell and the strongest neighbor cells (Top N pool), sorted according to their SCH power *(P/dBm)*. In contrast to the information above, the values are measured by the test mobile and the TSMU network scanner. The contents of the list, in particular the number of displayed cells, can be configured in *Threshold Values* tab of the configuration menu.

Type	Cell type as detected by the test mobile: *SC* (serving cell) or *I* (interferer)
P/dBm	Measured SCH power in dBm. The top N pool for the *GSM NWS Frequency Reuse View* contains the cells with the strongest SCH power.
dT/ms	BCCH time offset of the interferers relative to the serving cell, obtained by the network scanner.
dS/m	Distance between the measurement position of the SC and the interferer. 0 means that both cells were measured in the same network scan.
C0C0	A channel number (ARFCN) indicates a C0C0 interference: The BCCH numbers of the interferer and the serving cell are equal.
C0Cx	A channel number (ARFCN) indicates a possible C0Cx interference: One of the TCH channel numbers of the interferer is equal to the BCCH number of the serving cell.
CxC0	A channel number (ARFCN) indicates a possible CxC0 interference: One of the TCH channel numbers of the serving cell is equal to the BCCH number of the interferer.
CxCx	A list of channel numbers (ARFCNs) indicates possible CxCx interferences: One or more of the TCH numbers of the interferer and the serving cell are equal.
Name	BTS name and sector number from the BTS data base.
Dist./km	Distance between the potential interferer and the serving cell in km, calculated from the BTS data base. 0 km means that the interferer is a different sector of the same BTS.

A click on an interferer highlights the SC and the interferer in the *Route Track* view. A click on a SC highlights this SC.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

GSM NWS Frequency Reuse View – Co Channel Interferer Configuration

The *GSM NWS Frequency Reuse View – Co Channel Interferer* configuration menu selects the contents of the view tables, sets general view options, and defines conditions for the generated alarm messages and the displayed potential interferers. It is opened via a right mouse click on a point inside *GSM NWS Frequency Reuse View – Co Channel Interferer* or via the *Configuration – Settings* command (see chapter 3).

The *Frequency Reuse View Configuration* tab selects the contents of the view tables and sets general view options

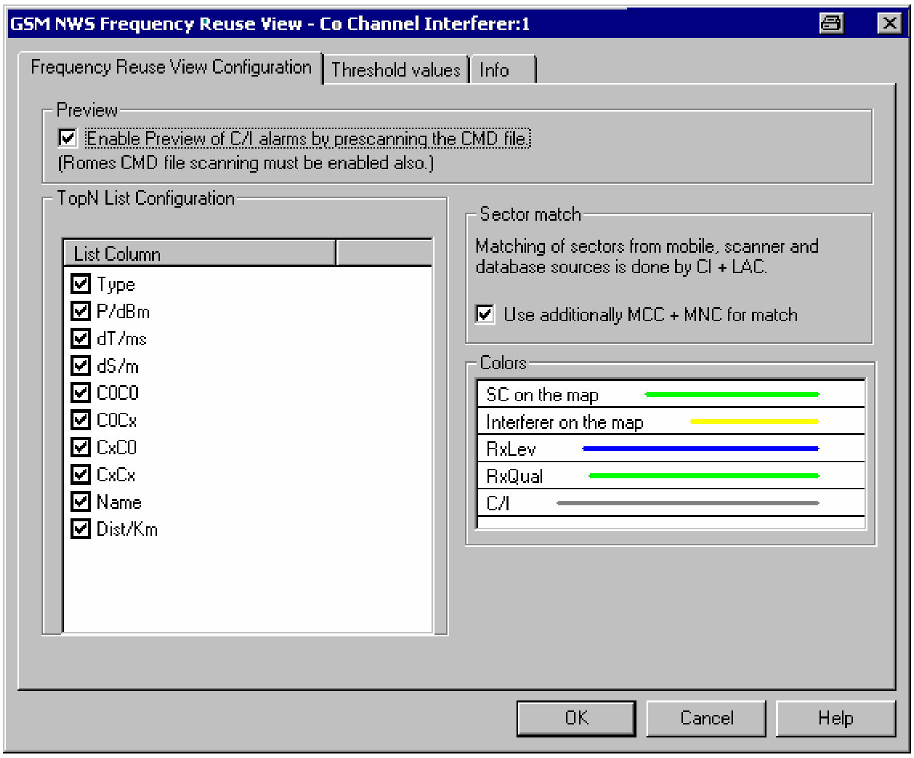


Fig. 4-245 GSM NWS Frequency Reuse View: Configuration

Preview Enables a prescan of the CMD file at the beginning of the replay session in order to display all alarm messages in the *GSM NWS Frequency Reuse View – Event List*. As a precondition, *Enable CMD File Scanning* must be enabled in the *General* tab of the *ROMES Configuration* menu *(Configuration – Preferences)*.

An alarm is created if the conditions specified in the *Threshold Values* tab are met. The coupled focus can be used to place the marker line in the diagram to the time of the alarm and study the top N table for a detailed analysis of the interferer situation.

Top N list configuration

All results selected as *List Columns* are displayed in the top N list in the lower section of the view. Cleared results are omitted.

Restricting the viewed results makes it easier to read the tables if only a subset of the available parameters is needed; it also saves system resources required for post-processing of measured data. To restrict the number of parameters measured and enhance the system performance during the measurement, use the settings in the driver configuration menus (see chapter 6).

Sector match

Defines the way ROMES assigns a measured signal to a BTS sector in the GSM BTS database:

- If the MCC and MNC is not considered, the assignment is based on a matching Cell Identity (CI) and Location Area Code (LAC). This may result in ambiguities because providers assign the same CIs in different countries and networks.
- If the MCC and MNC is considered in addition, the assignment is unambiguous, however, the BTS database must contain the MCC and MNC information.

Colors

Selects the color scheme for the displayed elements in the *Interferer Measurements* chart.

The *Threshold Values* tab sets conditions for the generated alarm messages and the displayed potential interferers.

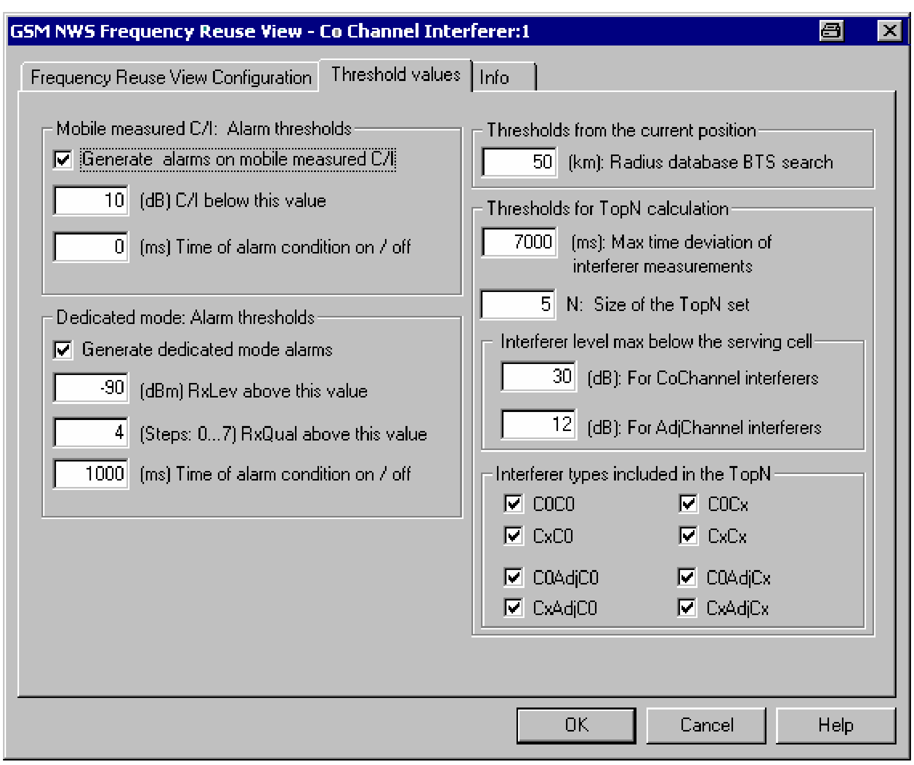


Fig. 4-246 GSM NWS Frequency Reuse View: Threshold Values

Alarm thresholds

Depending on the parameters for the reception quality that the mobile provides in its measurement reports, ROMES can generate two different and independent alarm types:

- A C/I alarm can be generated if the reported C/I values fall below a specified threshold. C/I alarms require a Sagem or Siemens mobile phone.
- A dedicated mode alarm can be generated if the reported RxQual is above a specified value (i.e. the bit error rate is high) although RxLev is sufficiently high (see definition of RX Level and RX Quality in chapter 8). A bad RxQual at high RxLev is likely to be caused by interfering signals.

For both alarm types it is possible to specify a minimum time interval during which the alarm conditions must be met. A zero time of alarm means that the alarm is already generated if the alarm conditions are met in a single measurement.

The alarm events are displayed in the *GSM NWS Frequency Reuse View – Event List.* The list remains empty while no alarm situation is detected.

Thresholds from the current position

The BTS search threshold limits the database search for potential interferers to a circle around the current position with specified radius. Base stations outside this radius are not considered as *Potential Interferers.* They are also discarded for the top N list in the lower part of the *NWS Frequency Reuse View*.

Thresholds for top N calculation

The values in this panel limit the number of entries in the top N list in the lower part of the *NWS Frequency Reuse View*.

Max. time dev.…
: Maximum time offset between 0 and 60 s. The selected value should at least cover a measurement cycle.

Size of the Top N set
: Maximum number of entries (BTS sectors) in the top N list.

Interferer level…
: Minimum interferer level relative to the carrier level. In general there is no need to analyze very weak interfering signals. The effect of adjacent channel interferers is due to their out-of-channel emissions, so it makes sense to select a larger threshold for them.

Interferer Types…
: Restriction of the top N lists to interferers of specific types (see description of the top N lists). The interferer types for co-channel and adjacent channel interferers can be selected independently.

GSM NWS Frequency Reuse View – Adj. Channel Interferer

The *GSM NWS Frequency Reuse View – Adj. Channel Interferer* provides detailed information about the serving cell, the potential adjacent channel interferers, and the characteristics of the interference situations encountered during the measurement tour.

An adjacent channel interferer is a neighbor cell that has a C0 channel (BCCH, SCH…) or a Cx channel (TCH) adjacent to one of the channels of the serving cell (the channel numbers differ by ±1). To analyze possible co-channel interferers use the *GSM NWS Frequency Reuse View – Co Channel Interferer* described on page 4.376.

The view contents of the *Adj. Channel Interferer* view are analogous to the *Co Channel Interferer* view. Both views use the same configuration menu (i.e. all configuration settings are valid for both views).

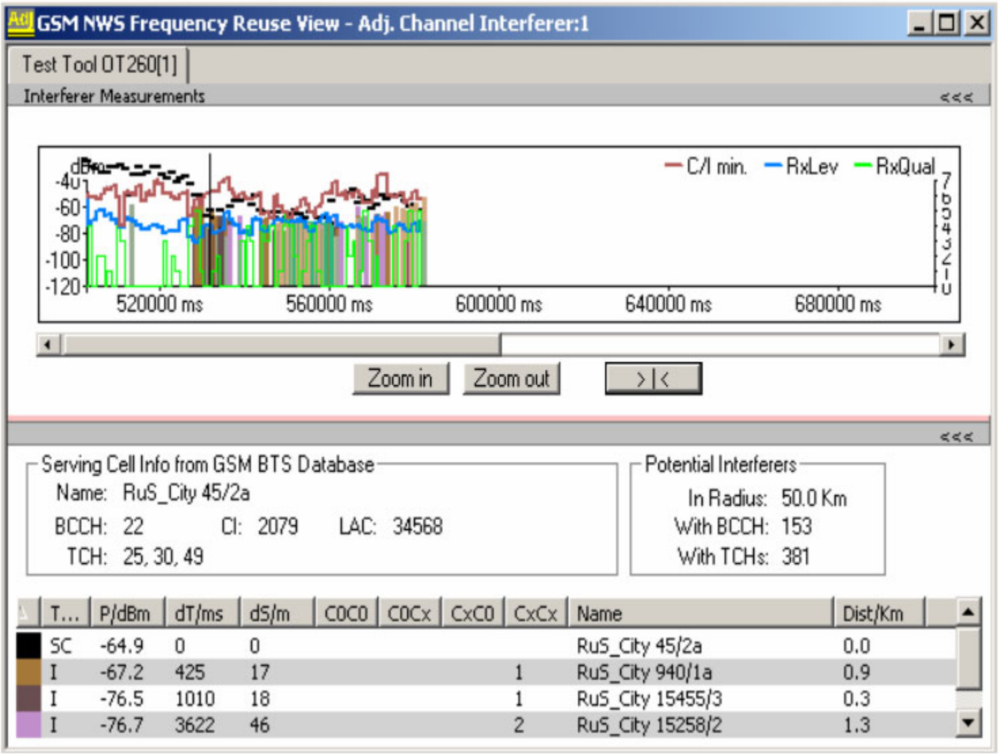
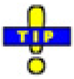


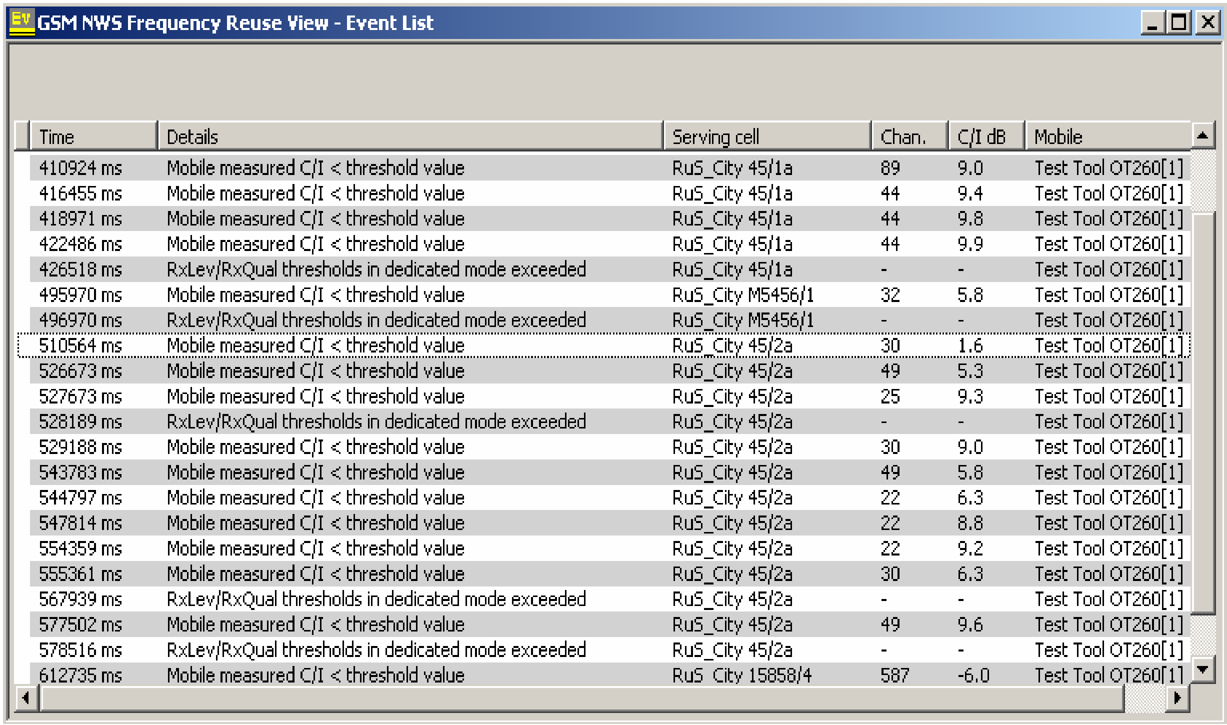
Fig. 4-247 GSM NWS Frequency Reuse View: Adj. Channel Interferer

GSM NWS Frequency Reuse View – Event List

The *GSM NWS Frequency Reuse View – Event List* contains a list of alarm messages generated according to the C/I and RxQual values measured by the test mobile. Conditions for alarm messages (alarm thresholds) can be set in the *Thresholds* tab of the *Co Channel Interferer* configuration menu; see *Fig. 4-246* on p. 4.380. Therefore, the contents of the *Event List* are not fixed for a given measurement file but vary depending on the alarm thresholds.



Activate the preview feature in the Frequency Reuse View Configuration *tab of the co-channel or adjacent channel interferer configuration menu (see Fig. 4-245* on p. *4.379) if you want to prescan the .CMD file in order to display all alarm messages at the beginning of the replay session.*



GSM NWS Frequency Reuse View - Event List

Time	Details	Serving cell	Chan.	C/I dB	Mobile
410924 ms	Mobile measured C/I < threshold value	RuS_City 45/1a	89	9.0	Test Tool OT260[1]
416455 ms	Mobile measured C/I < threshold value	RuS_City 45/1a	44	9.4	Test Tool OT260[1]
418971 ms	Mobile measured C/I < threshold value	RuS_City 45/1a	44	9.8	Test Tool OT260[1]
422486 ms	Mobile measured C/I < threshold value	RuS_City 45/1a	44	9.9	Test Tool OT260[1]
426518 ms	RxLev/RxQual thresholds in dedicated mode exceeded	RuS_City 45/1a	-	-	Test Tool OT260[1]
495970 ms	Mobile measured C/I < threshold value	RuS_City M5456/1	32	5.8	Test Tool OT260[1]
496970 ms	RxLev/RxQual thresholds in dedicated mode exceeded	RuS_City M5456/1	-	-	Test Tool OT260[1]
510564 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	30	1.6	Test Tool OT260[1]
526673 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	49	5.3	Test Tool OT260[1]
527673 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	25	9.3	Test Tool OT260[1]
528189 ms	RxLev/RxQual thresholds in dedicated mode exceeded	RuS_City 45/2a	-	-	Test Tool OT260[1]
529188 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	30	9.0	Test Tool OT260[1]
543783 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	49	5.8	Test Tool OT260[1]
544797 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	22	6.3	Test Tool OT260[1]
547814 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	22	8.8	Test Tool OT260[1]
554359 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	22	9.2	Test Tool OT260[1]
555361 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	30	6.3	Test Tool OT260[1]
567939 ms	RxLev/RxQual thresholds in dedicated mode exceeded	RuS_City 45/2a	-	-	Test Tool OT260[1]
577502 ms	Mobile measured C/I < threshold value	RuS_City 45/2a	49	9.6	Test Tool OT260[1]
578516 ms	RxLev/RxQual thresholds in dedicated mode exceeded	RuS_City 45/2a	-	-	Test Tool OT260[1]
612735 ms	Mobile measured C/I < threshold value	RuS_City 15858/4	587	-6.0	Test Tool OT260[1]

Fig. 4-248 GSM NWS Frequency Reuse View: Event List

Alarm List

The event list indicates all alarm events during the measurement. The alarm messages are displayed together with a timestamp, the serving cell name (if a BTS data base is available), and the name of the test mobile. For C/I alarms, the channel number and the C/I value in dB is displayed in addition.

The test mobile and PN scanner can generate the C/I and RxQual alarm types described on p. 4.381 (see paragraph on *Alarm thresholds*).

GSM NWS Frequency Reuse View – Event List Configuration

The *GSM NWS Frequency Reuse View – Event List* configuration menu selects the contents of the event list and shows information about the view version.

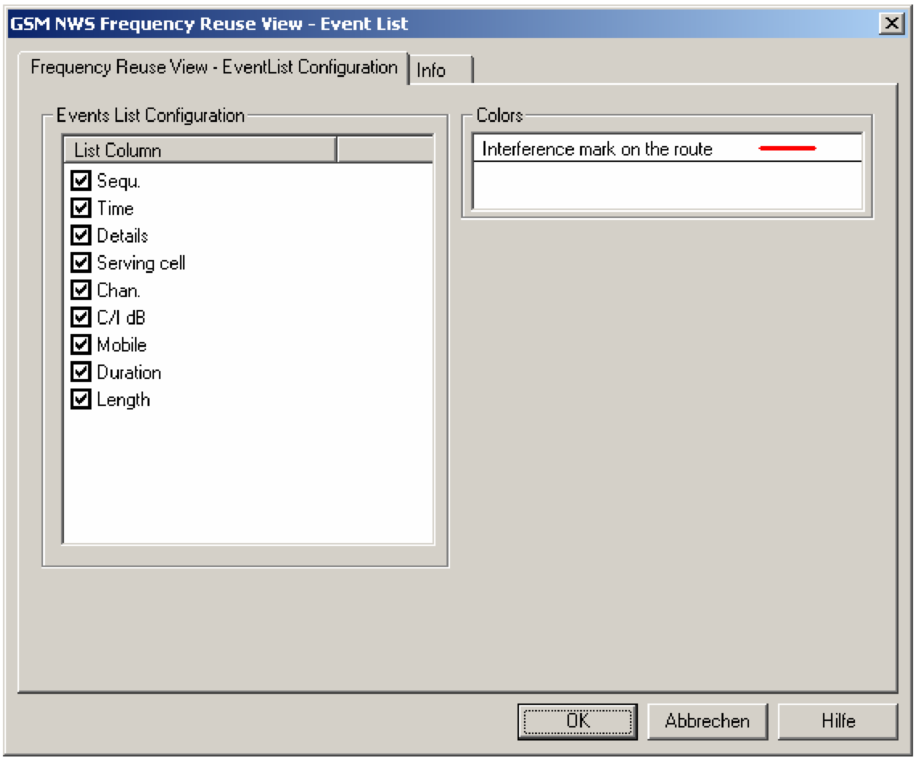


Fig. 4-249 GSM NWS Frequency Reuse View: Event List Configuration

Colors Selects the color scheme for the displayed elements in the *event list*.

GSM NWS Top N View

The *GSM NWS Top N View* displays the properties of the signals from the base transceiver stations that are elements of the *Top N Pools* defined in the driver configuration menu. A Top N Pool contains up to N BSICs with specific characteristics providing the strongest synchronization channel P(SCH) level at a given position and time; for more information refer to the description of the driver configuration menu in chapter 6.

The view area is divided into a list and a chart panel:

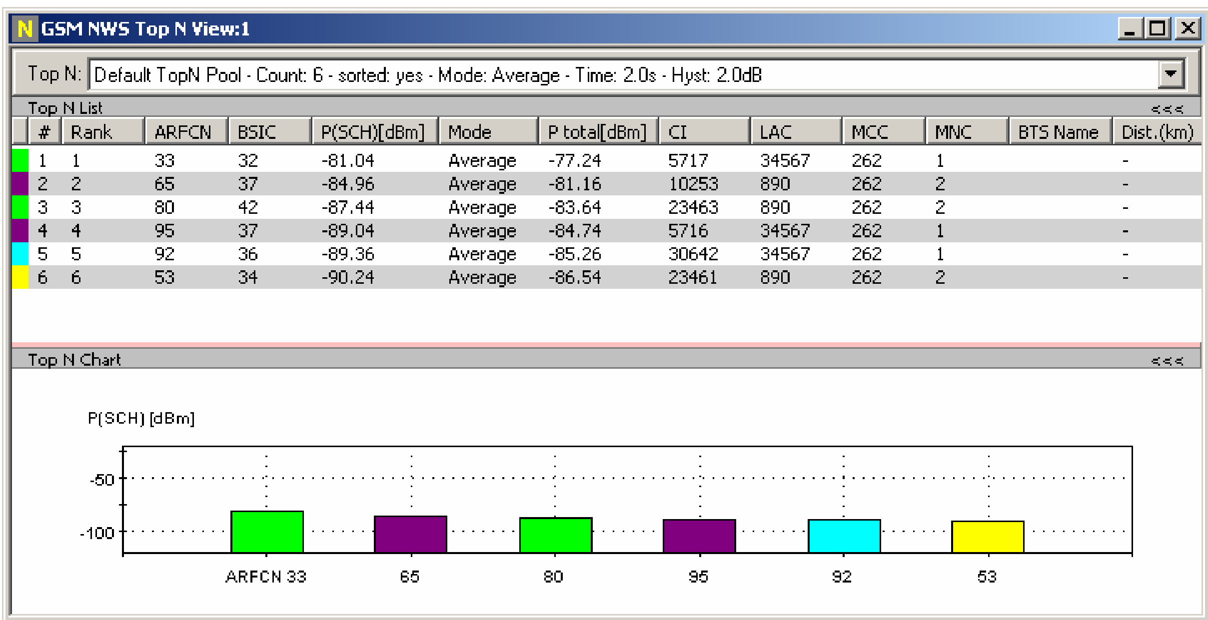


Fig. 4-250 GSM NWS Top N View

View area The entire view area is horizontally split to accommodate a list with all defined *Top N* measurements, and a bar chart.

A click on the *Top N List* or *Top N Chart* title bars compresses and expands the table or chart. A compressed chart leaves more space for the table and vice versa. A compressed subpanel is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

Top N List

Below the view title, the *Top N* list contains all top N pools defined in the *Top N* tab of the driver configuration menu.

The *Top N List* gives an overview of the received signals in the current top N pool together with their measured power parameters, frequency and timing information. On mouse rollover, each cell in the table header provides a short explanation of the corresponding column. The *Top N List* contains the following columns:

#	Number of the measured SCH within the Top N pool. The SCHs are numbered in ascending order, according to the time when they enter the Top N pool. This means that the current numbers tend to increase as the measurement progresses.
Rank	Current rank of the measured SCH within the Top N pool, according to its average or maximum Ec/Io (see driver configuration menu). The ranks are reassigned every time the pool is updated; they are in the range $1 \leq Rank \leq N$.
ARFCN	Absolute Radio Frequency Channel Number, the GSM channel number of the measured SCH.
BSIC	Base transceiver station (BTS) identity code. In this view, the BSIC is always octal (so that BSIC = ab where a is the NCC and b is the BCC), irrespective of the format selected in the *Available Signals* tab of the *Preferences* menu (octal/decimal/hex).
P(SCH) [dBm]	Code power of the measured SCH (synchronization channel)
Mode	Valuation method (average, min./max.)
P total [dBm]	Max. slot power measured in the GSM channel
CI	Cell Identity (16 bit)
LAC	Location Area Code
MCC	Mobile Country Code
MNC	Mobile Network Code
BTS Name	Name of the closest base transceiver station with matching MNC, MCC, LAC, and CI. This parameter is displayed if a valid BTS list is available. Detailed information can be obtained by double-clicking the BTS name.

Note:
ROMES uses the BCCH and the BSIC to identify the BTS name. If the BTS assignment is ambiguous because several BTS with the same BCCH and BSIC are encountered, then a plus "+" sign preceeds the BTS name.

Dist. (km)	Distance to the BTS (in kilometers)

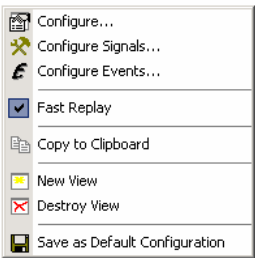
In the view configuration menu, it is possible to show or hide each individual table column.

Diagram

Below the table, the *Top N Chart* shows the code power of the measured SCH (synchronization channel) for all ARFCN signals in the current top N measurement as a bar chart.

In the configuration menu, it is also possible to select the upper and lower P(SCH) levels for the y-axis of the chart.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or save the current configuration; see *Context menu* description on p. 4.2.

GSM NWS Top N Configuration

The *GSM NWS Top N* configuration menu defines the y-axis scale, i.e. the minimum *(P(SCH) Min [dBm])* and the maximum *(P(SCH) Max [dBm])* level to be displayed in the *GSM NWS Top N View* and selects the contents of the table. It is opened via a right mouse click on a point inside the *GSM NWS Top N View* or via the *Configuration – Settings* command (see chapter 3).

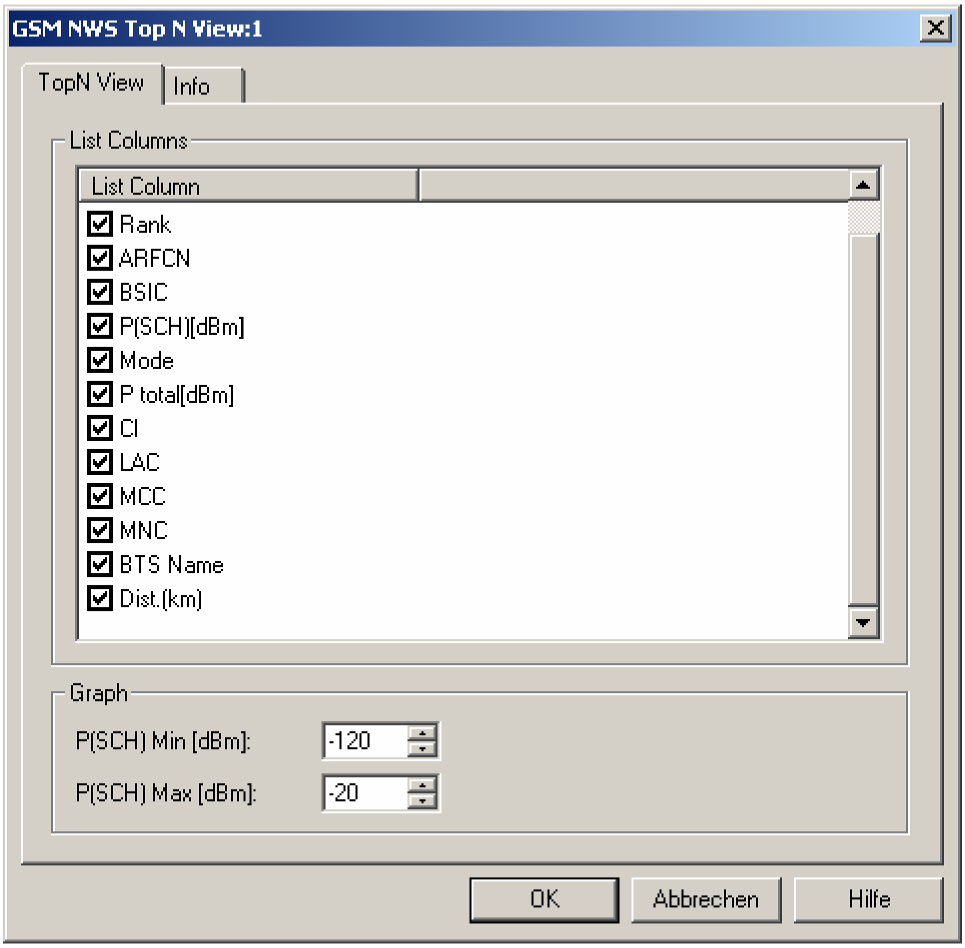


Fig. 4-251 GSM NWS Top N configuration: Top N View

Graph	*P(SCH) Min/Max [dBm]*	Sets the upper and lower P(SCH) levels for the y-axis of the chart.

WLAN Views

The *WLAN Views* show the WLAN information obtained in the network scans performed by a WLAN adapter in regular intervals. WLAN data can be acquired with Wireless LAN Client Adapters supporting Network Device Interface Specification (NDIS) V5.1 or higher using the *R&S IEEE 802.11 Wireless LAN NDIS* driver.

The *WLAN Views* can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *WLAN Views*.

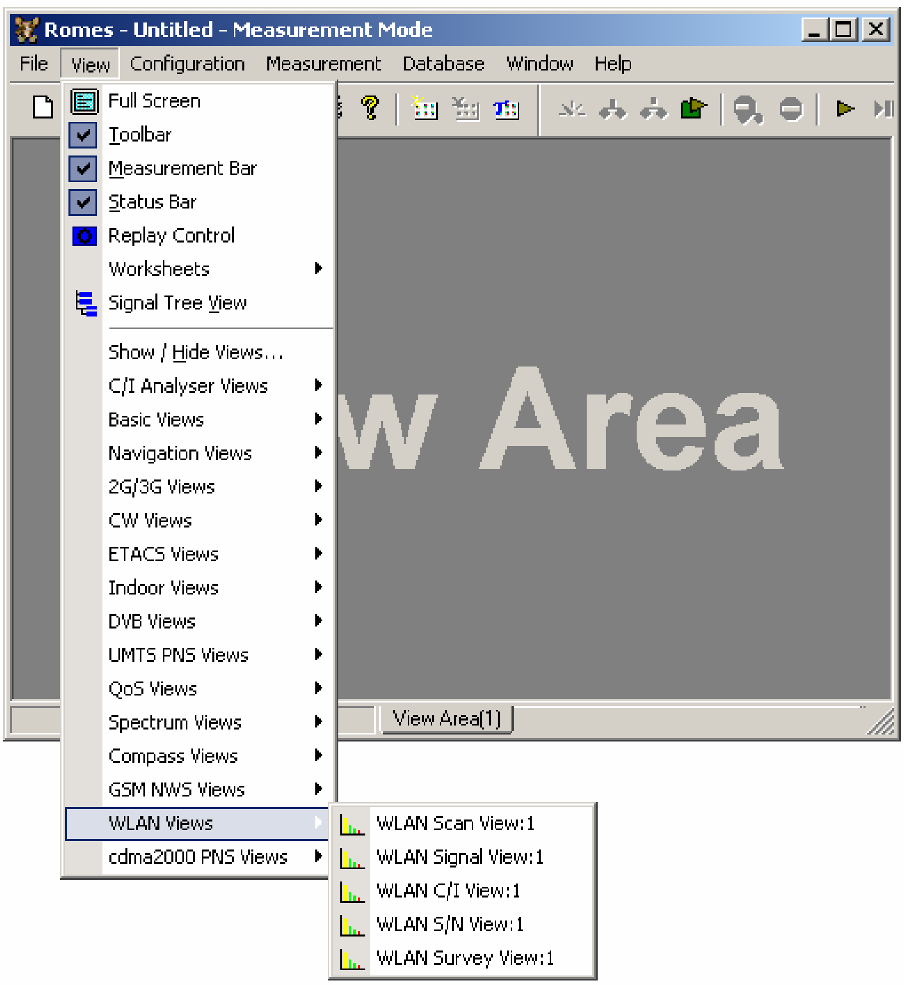


Fig. 4-252 WLAN views

WLAN adapters constantly monitor and report a large number of parameters describing the current signal quality and data traffic. The parameters are used to generate the signals in the WLAN section of the data tree shown in the figure Fig. 4-146 above. The signals complement the WLAN network scan information; they can be viewed in the *Basic Views*.

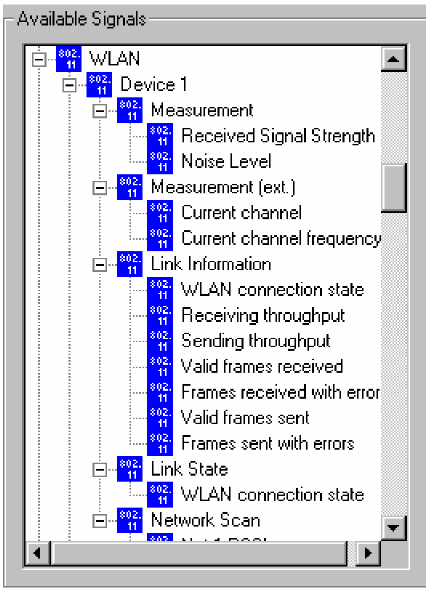


Fig. 4-253 WLAN signals

Note:

The data to be displayed in the WLAN views is collected by the test device during the network scan. It is only transferred to ROMES and stored to a measurement file after the network scan is complete. In contrast the Received Signal Strength, the Link Information and the Link State signals (see Fig. 4-253 above) are continuously monitored. As a consequence, the current Received Signal Strength is generally not equal to the RSSI displayed in the Scan View.

WLAN Scan View

The *WLAN Scan View* displays basic information acquired in a WLAN network scan (WLAN BSSID list information).

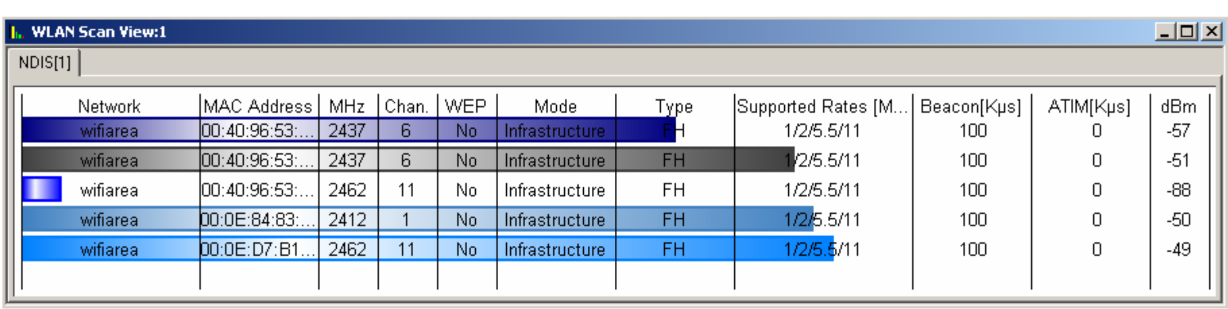


Fig. 4-254 WLAN Scan View

The results provided by each test device are displayed in a separate tab. Each tab shows the WLAN parameters of the signals from the access points detected by the test device in a network scan. The results are updated every time the test device terminates a network scan.

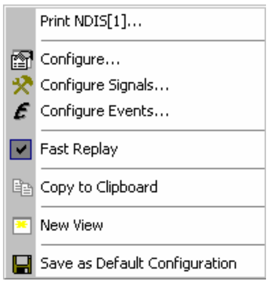
WLAN Parameters

Each access point generates a table row with a colored analog bar. The columns displayed and the maximum number of rows (access points) can be limited in the configuration menu. The length of each bar is a measure for the received signal strength *(RSSI)* of the signal from the access point; the numeric RSSI value appears in the *dBm* row. The scale settings in the configuration menu define the length of the bars.

The table contains the following parameters:

Network	Network name
MAC Address	Media Access Control (MAC) address of the access point or other client, depending on whether the test device operates in infrastructure or ad hoc mode. The MAC is a unique serial number assigned to a networking device by the manufacturer.
Chan.	Channel identifier of the radio channel that the test device uses for communication.
MHz	Center frequency of the used channel. According to standard IEEE 802.11b, the channel numbers 1 to 14 correspond to center frequencies of 2412 MHz, 2417 MHz … 2484 MHz. Depending on the regulatory domain, the channel range may be restricted.
WEP	Use of Wired Equivalent Privacy *(Yes/No)*. WEP is an optional security mechanism defined within the 802.11 standard designed to protect the data as it is transmitted through the wireless network.
Mode	*Infrastructure* or *Ad hoc* mode. In *Infrastructure* mode the test device can communicate with access points and other network infrastructure devices; in *Ad hoc* mode, it can also communicate with other client devices.
Type	Spread-spectrum type used for the physical layer: Direct Sequence *(DS)* or Frequency Hopping *(FS).*
Rates [MBit/s]	Data rate at which the test device should transmit or receive data. *1/2/5/11/18/24/36/54* means that a 5-GHz test device uses Auto Rate Selection.
Beacon [Kμs]	Beacon period in the range between 20 Kμs and 976 Kμs, specifies the duration between beacon packets, which are used to help clients find each other in ad hoc mode. (Kμs is a measurement unit in software terms, K = 1024, μ = 10^{-6}, s = seconds, therefore 1 Kμs = 0.001024 seconds = 1.024 ms.)
ATIM [Kμs]	Wake duration, specifies the amount of time following a beacon that the test device stays awake to receive announcement traffic indication message (ATIM) packets, which are sent to the adapter to keep it awake until the next beacon.
dBm	Signal strength for all received packets (RSSI).
Hop Set	Frequency hopping set including up to 78 pattern used in *FS* type transmission.
Hop Pattern	Hopping pattern number used in *FS* type transmission.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

WLAN Scan View Configuration

The *WLAN Scan View Configuration* menu specifies the scale and the contents of the view, defines the color settings, and displays information about the view version. It is opened via a right mouse click on a point inside the *WLAN View* or via the *Configuration – Settings* command (see chapter 3).

The *Configuration* tab defines the scale for the bars in the *WLAN Scan View,* specifies the maximum number of bars and selects the parameters shown in the table.

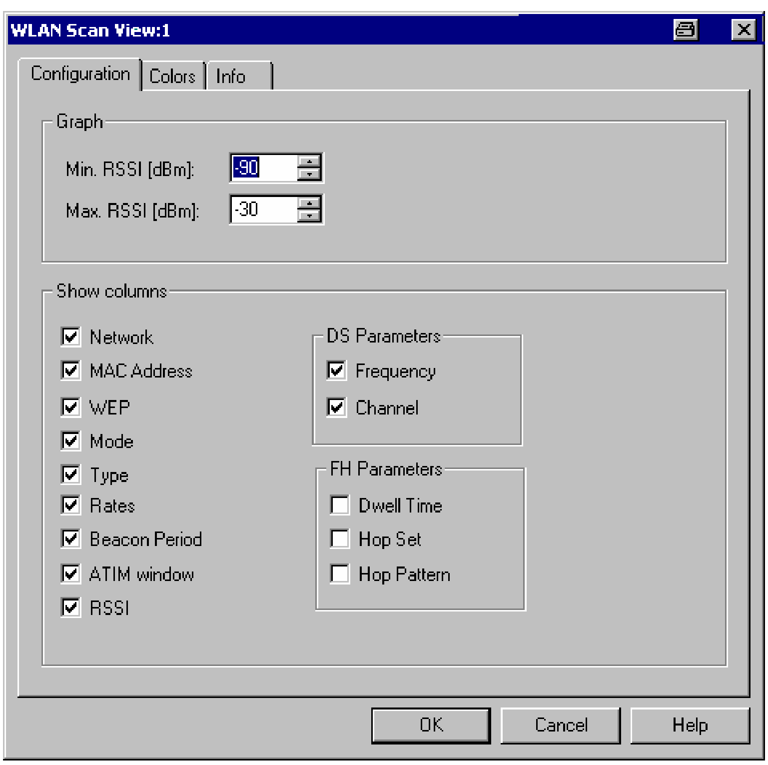


Fig. 4-255 WLAN Scan View configuration: Configuration

Graph The three input fields in the *Graph* panel define the RSSI levels corresponding to bars of zero length and full length. The actual length of the bars in the *WLAN Scan View* is equal to:

*L = RSSI [dBm] * <full length> / (Max. RSSI [dBm] – Min. RSSI [dBm])*

Max. Count
Maximum number of bars/access points displayed in the *WLAN Scan View.* The actual number can be smaller, if less than *Max. Count* access point signals are detected.

Show Columns Selects the parameters to be displayed in the *WLAN Scan View* table.

The *Colors* tab of the *WLAN Scan View* configuration menu defines the colors for all WLAN views.

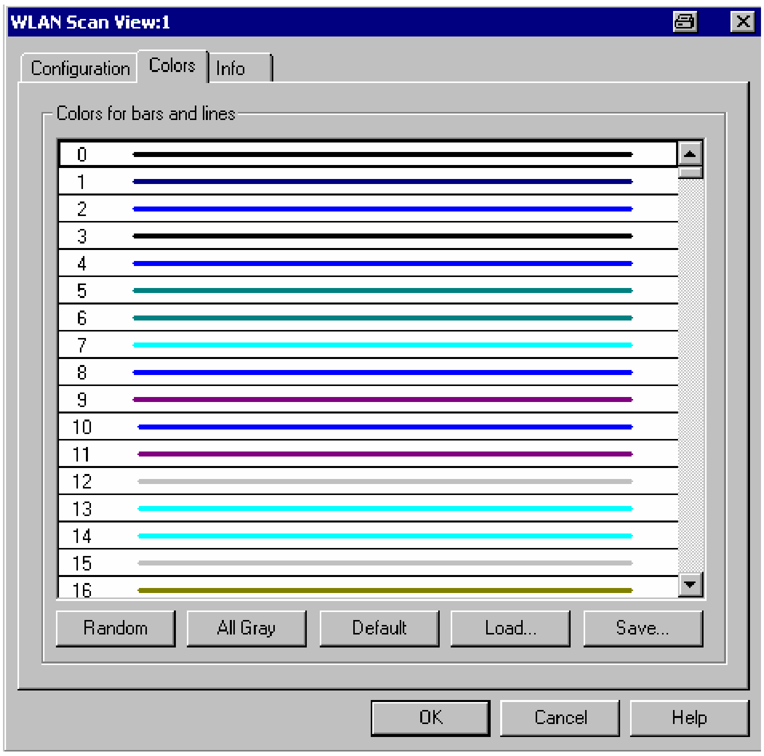


Fig. 4-256 WLAN Scan View configuration: Colors

The *Colors* menu is analogous to the *PNS CPICH* configuration menu; see section *PNS CPICH View* on p. 4.310. Note the following special features of the WLAN color settings:

- The color no. 0 is always used for the noise signal which is measured in a single, fixed channel defined in the NDIS driver configuration menu.
- The colors no. 1 to 500 can be assigned to signals from access points or other clients (the maximum number of signals received simultaneously is 39). The assignment is chronological: The first detected signal is displayed with color code no. 1, the second with color code no. 2, etc.
- The color settings in the WLAN configuration menus apply to all WLAN views; color definitions overwrite each other.

WLAN Signal View

The *WLAN Signal View* displays the RSSI of all received signals in a 3-dimensional bar graph.

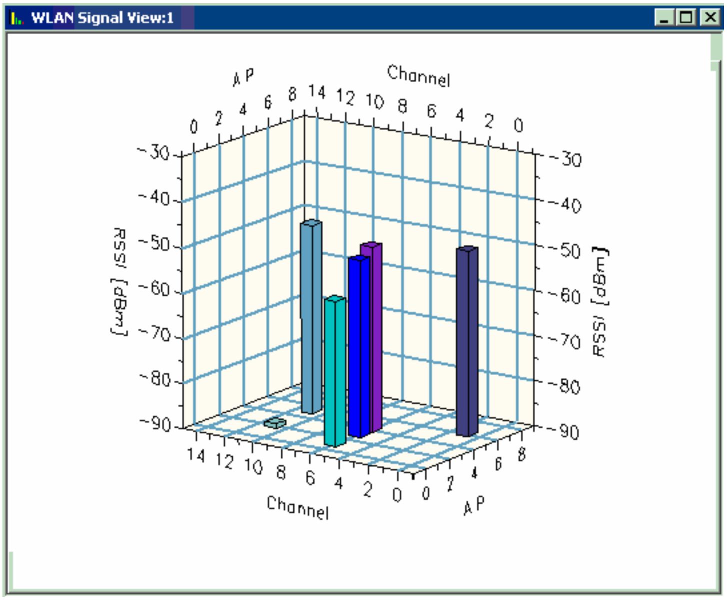
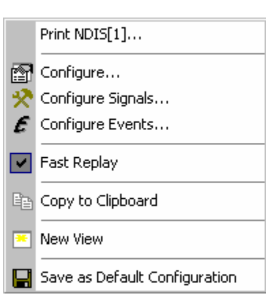


Fig. 4-257 WLAN Signal View

In the bar graph, the signals are sorted according to their channel number *(Channel)* and access point *(AP).* Each received signal generates a colored bar. The length of the bars is a measure for the received signal strength *(RSSI)*; the numeric RSSI value appears in the *dBm* row of the *WLAN Scan View* (see p. 4.390).

Note:
A test device operating in Ad hoc mode can also communicate with other clients. The Signal View does not only show access point signals but all signals used for communication.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu is analogous to the *WLAN Scan View* configuration menu. It defines the scale for the bars in the *WLAN Signal View.*

WLAN C/I View

The *WLAN C/I View* displays the Carrier-to-Interference ratio *(C/I)* in all channels.

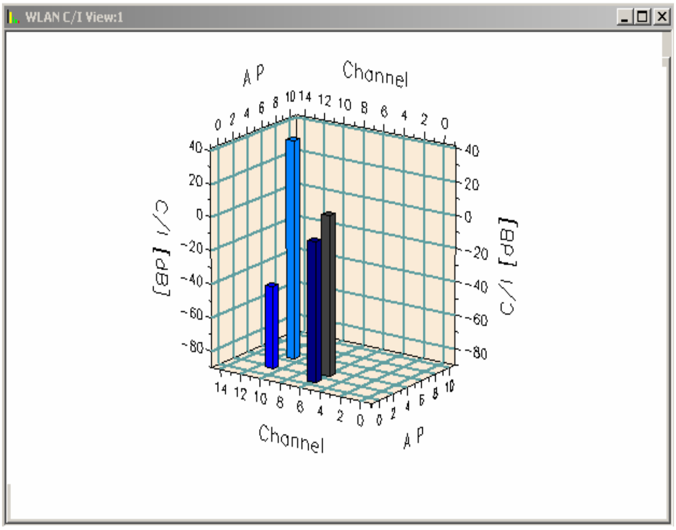
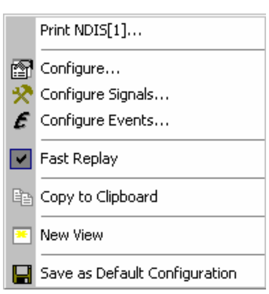


Fig. 4-258 WLAN C/I View

In the bar graph, a C/I bar is displayed in all channels *(Channel)* where the test device detected more than a single signal*.* The C/I is a positive or negative dB-value, calculated as the ratio of the RSSI of the strongest (carrier) signal to the sum of the RSSIs of all other signals in the channel.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2*.*

The configuration menu is analogous to the *WLAN Scan View* configuration menu. It defines the scale for the bars in the *WLAN C/I View* and the maximum number of access points displayed *(Max. Count).*

WLAN S/N View

The *WLAN S/N View* displays the Signal to Noise ratio *(S/N)* in a single, fixed radio channel defined in the NDIS driver configuration menu. The noise channel number is stored in the *Current Channel* signal in the WLAN section of the data tree. The noise measurement and the channel definition requires a *CISCO Aironet Series 350 IEEE 802.11 Wireless LAN Client Adapter.*

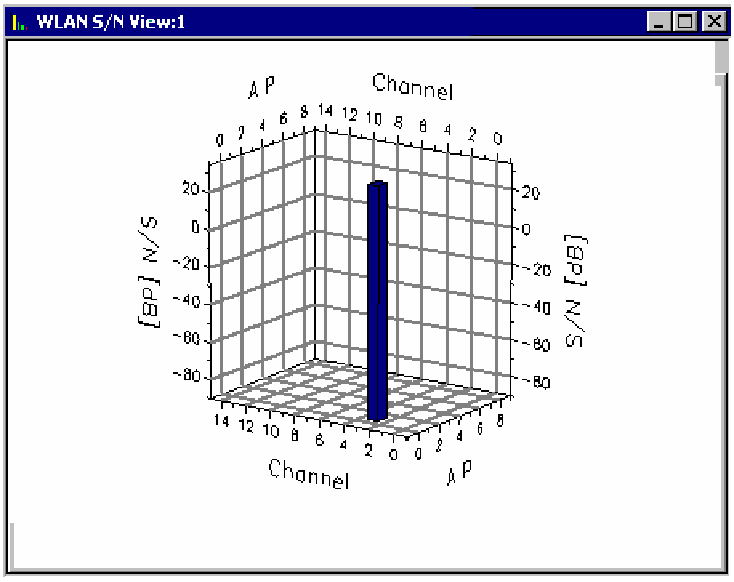
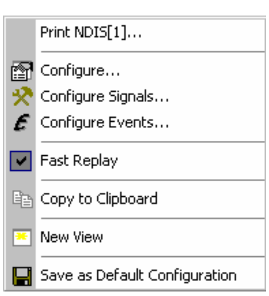


Fig. 4-259 WLAN S/N View

In the bar graph, a S/N bar appears at the position of the noise channel as soon as an additional, decodable WLAN signal is measured in this channel. The S/N is a positive or negative dB-value, calculated as the ratio of the RSSI of the strongest (carrier) signal in the noise channel to the noise level before signal decoding. The noise level contains the contribution of all signals in the noise channel that the WLAN test device is not able to decode; it does not contain signals from other WLAN access points or clients using the same channel.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The configuration menu is analogous to the *WLAN Scan View* configuration menu. It defines the scale for the bars in the *WLAN S/N View.*

WLAN Survey View

The *WLAN Survey View* gives an overview of the measured WLAN parameters from all access points including the distribution of the RSSI, C/I, and S/N values.

TIP

If a replayed measurement file was recorded in Block Mode*, the WLAN Survey View generates block-specific statistical results. Blocks are defined in the* Indoor View *as described in section* *Indoor Measurement Control on p. 4.288.*

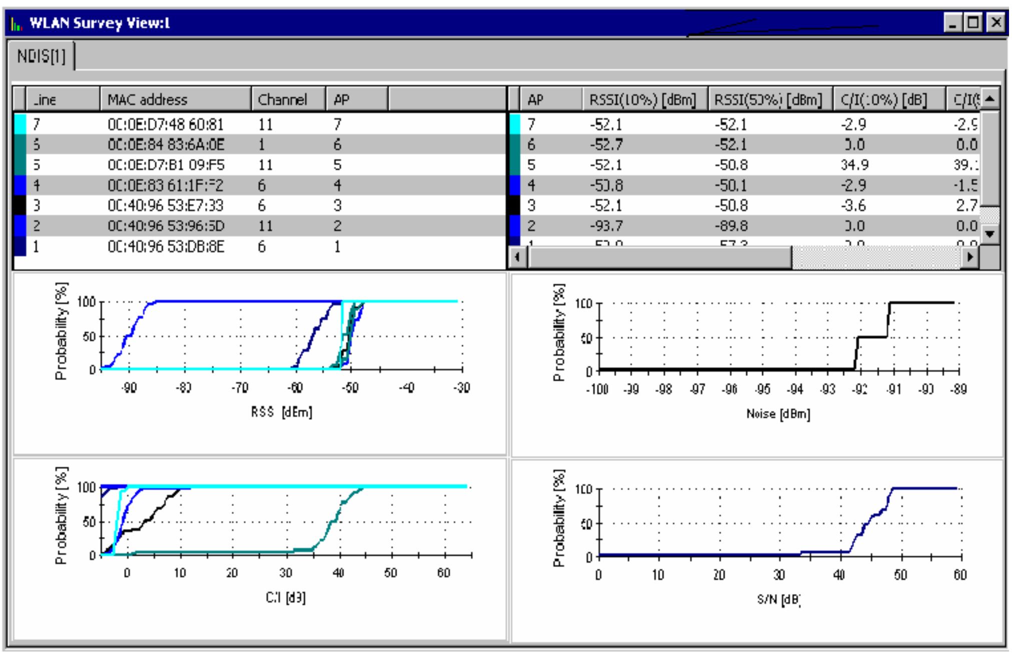


Fig. 4-260 WLAN Survey View

The WLAN Survey View contains an access point table, a percentage table, and four 2D chart diagrams.

Access point table

In the two tables, each access point generates a table row with a color code. The columns displayed and the colors can be defined in the configuration menu. The access point table in the left half of the view contains the following parameters:

Line
: Number of the table row, assigned in the order the row is created. If n rows are displayed, the line numbers are 1 to n.

AP
: Number of the access point, assigned in ascending order according to the detection time of the access point signal. New access points always receive a new (higher) AP number, so the AP numbers and line numbers can be different as soon as a signal is no longer detected.

MAC Address
: Media Access Control (MAC) address of the access point. The MAC is a unique serial number assigned to a networking device by the manufacturer.

Channel
: Channel number that the access point uses for communication.

Percentage table

The percentage table in the right half of the view contains the following parameters:

AP
: Number of the access point, assigned in the order the access point signal is detected.

RSSI (10%)
: RSSI that is reached or exceeded by 90% of the measured values (10% of the measured RSSIs are below RSSI (10%)). RSSI denotes the received signal strength of the signal from the access point in dBm.

RSSI (50%)
: RSSI that is reached or exceeded by 50% of the measured values.

C/I (10%)
: C/I that is reached or exceeded by 90% of the measured values (10% of the measured C/I are below C/I (10%)). C/I denotes the ratio of the RSSI of the strongest (carrier) signal to the sum of the RSSIs of all other signals in the channel.

C/I (50%)
: C/I that is reached or exceeded by 50% of the measured values.

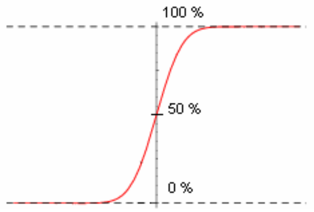
S/N (10%)
: S/N that is reached or exceeded by 90% of the measured values (10% of the measured S/N are below S/N (10%)). S/N denotes the ratio of the RSSI of the strongest (carrier) signal in the noise channel to the noise level.

S/N (50%)
: S/N that is reached or exceeded by 50% of the measured values.

RSSI chart

Shows the integrated distribution of the measured RSSI values from all access points. For a given RSSI, the curves show the percentage of measured RSSI values that fall below this RSSI. The complement, i.e. 100% minus the *Probability [%],* corresponds to the percentage of measured RSSIs above this RSSI. The color of the curves correspond to the color codes in the access point table.

For a Gaussian distribution of the measured RSSI values around the center value RSSI (50%), the integrated distribution corresponds to an error function:



The curve which rises at the highest RSSI values (i.e. in the right side of the diagram) corresponds to the access point with the strongest signal.

C/I chart

Shows the integrated distribution of the measured C/I values from all access points. The diagram is analogous to the RSSI chart.

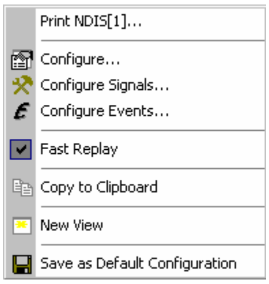
Noise chart

Shows the integrated distribution of the measured noise level in dBm in a single, fixed channel defined in the NDIS driver configuration menu. The noise channel number is stored in the *Current Channel* signal in the WLAN section of the data tree. The noise measurement and the channel definition requires a *CISCO Aironet Series 350 IEEE 802.11 Wireless LAN Client Adapter.* The diagram contains a single curve.

S/N chart

Shows the integrated distribution of the measured S/N values in the noise channel. The diagram contains a single curve.

Context menu



A right mouse click on any point in the view opens the context menu to print the view contents, access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

WLAN Survey View Configuration

The *WLAN Survey View Configuration* menu specifies the contents of the access point and percentage tables, defines the color settings, and displays information on the view version. It is opened via a right mouse click on a point inside the *WLAN View* or via the *Configuration – Settings* command (see chapter 3).

The *Access Points* tab selects the contents of the access point table.

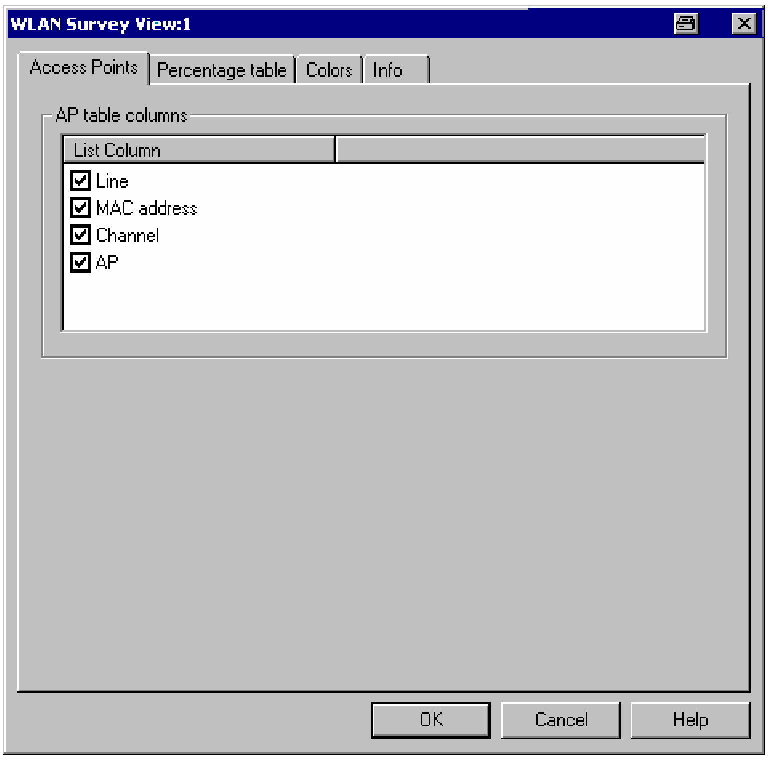


Fig. 4-261 WLAN Survey View configuration

The *Percentage table* tab is analogous to the *Access Points* tab. The *Colors* tab of the *WLAN Survey View* configuration menu corresponds to the same tab in the *WLAN Scan View* configuration menu; see Fig. 4-256 on p. 4.393.

CDMA2000 PNS Views

The *CDMA2000 PNS Views* shows the CDMA2000 information obtained in the CDMA2000 network scans performed by a TSMU radio network analyzer. The CDMA2000 Network Scanner driver is described in chapter 6.

The *CDMA2000 PNS Views* can be selected from a submenu displayed on the right side of the *View* menu when the mouse pauses over *CDMA2000 PNS Views*.

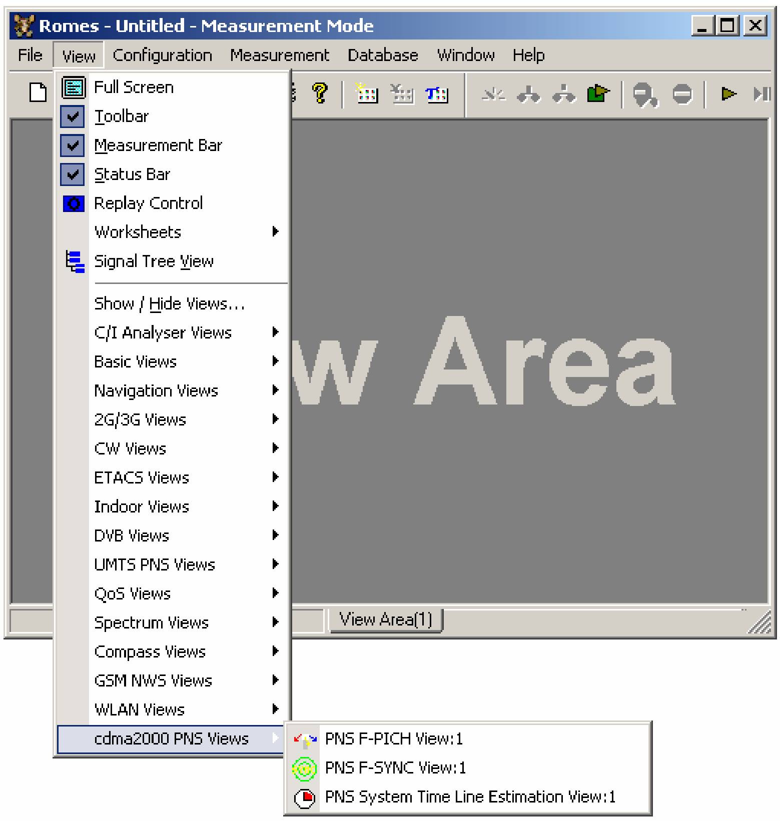


Fig. 4-262 CDMA2000 PNS views

PNS F-PICH View

The *PNS F-PICH View* shows the average signal power of the received Forward Pilot Channels (F-PICHs) and a comprehensive analysis of the properties of all DL signals received in the CDMA2000 PN scan.

The F-PICH is an unmodulated, direct-sequence spread spectrum signal transmitted continuously by each CDMA base station. The Pilot Channel allows a mobile station to acquire the timing of the Forward CDMA Channel, provides a phase reference for coherent demodulation, and provides a means for signal strength comparisons between base stations for determining when to handoff and for forward link signal strength measurement.

Different base stations are identified by different pilot PN sequence time phases *(Offset* values). Signals with different timing but equal PN offset originate from the same BTS but propagated along different paths. A comparison of those signals provides important information on reflections and possible interferences.

The TSMU provides different synchronization modes for CDMA2000 signals.

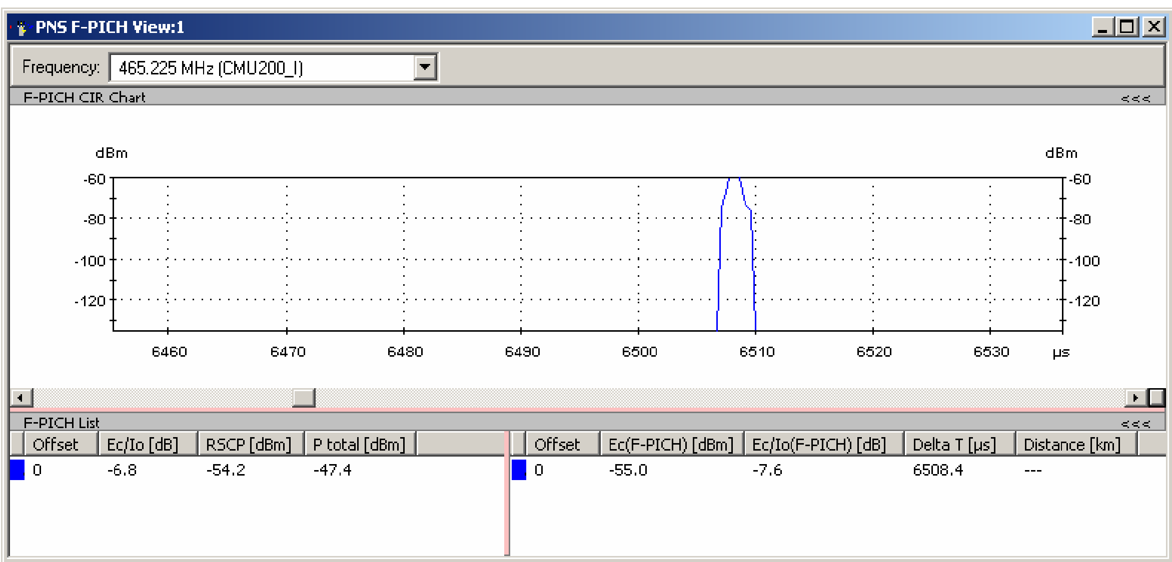


Fig. 4-263 PNS F-PICH View

Frequency

Below the view title, the *Frequency* pull-down list contains all measured frequencies selected in the *Receiver* tab of the driver configuration menu. The list is also provided in the *PNS F-SYNC View.*

Changing the frequency in one of these views automatically adapts the frequencies in all other view, provided they have the same current number in their title bar (e.g. the 1 in the figure above). Using this feature, it is possible to generate different groups of views with the same current number (opened by means of the context menu; see below) and select frequencies for an entire group with a single mouse click.

View area

The entire view area is horizontally split to accommodate a chart and a table/list. The *F-PICH CIR Chart* (Carrier-to-Interference Ratio) shows the average signal power of the F-PICHs of all received signals over the time. The displayed powers and times correspond to the *Ec (F-PICH) [dBm]* and *Delta T[μs]* values listed in the *Peak List* (right-hand part of the *F-PICH List)*.

A click on the *F-PICH CIR Chart* or *F-PICH Lists* title bars compresses and expands the 2D-chart or table. A compressed chart leaves more space for the table and vice versa. Moreover, the tables appear in several PNS views so that compressing them can help to avoid redundancies. A compressed subdiagram is characterized by the symbol >>> (instead of <<<) in its title bar. On pausing on one of the title bars, the cursor displays a compress symbol.

Diagram scale

The diagram is opened with a default x-axis scale of little more than one F-SYNC frame length (25.666 ms, the F-PICH frame is 20 ms long). If placed inside the diagram area the cursor takes the shape of a zoom-in icon (a magnifying glass with a '+' inside), and a vertical line is displayed at the cursor position.

A left mouse click magnifies the diagram in x-direction around the cursor position, *Ctrl* plus left mouse click causes the opposite. An area to become the new x-axis range (e.g. the area around a peak) can be marked while the left mouse button is pressed. *Reset Zoom* in the context menu restores the default scale. A scrollbar is provided to move the magnified diagram to the right or left.

The scale of the y-axis (power in dBm) can be set in the configuration menu.

Table entries

Below the diagram, the *F-PICH List* gives an overview of the received signals together with their scrambling codes, different power parameters, frequency and timing information. On mouse rollover, each cell in the table header provides a short explanation of the corresponding column.

The entire table is divided into the *F-PICH List* and the *Peak List.* In the configuration menu, it is possible to show or hide each individual table row in both lists.

F-PICH List

The *F-PICH List* (left-hand part of the *F-PICH Lists)* provides a general description of the received F-PICH signals from each BTS. Each signal is characterized by its PN sequence offset, corresponding to the transmitting BTS, and includes all possible peaks (reflections) indicated in the *Peak List* on the right-hand side. The list can contain the following F-PICH-related values (see also standard TIA-2000.2-D and related standards. All power results in the F-PICH List and Peak List are obtained in an unbiased measurement: The contribution of the noise floor to the powers is subtracted off.):

Offset

Pilot PN sequence offset index; time offset of the Forward Pilot Channel from CDMA System time, as transmitted by the base station. The offset is expressed in units of 64 PN chips of the F-PICH; it is in the range 0 to 511.
Each offset is identified by a color, to be customized in the configuration menu. The offset color codes are also shown in the *Route Track* menu; see paragraph on scrambling code indication on p. 4.37.

Signal power

Ec/Io [dB]

Ratio of the received energy per PN chip of the F-PICH to the total inband power spectral density. The value equals to the sum of the *Ec/Io (F-PICH) [dB]* values of all individual peaks of the same PN offset displayed in the *Peak List;* see below.

RSCP [dBm]

F-PICH Received Signal Code Power; sum of the received powers of all peaks on one code, measured within the correlation section of the F-PICH.

P total [dBm]

Total received wide-band power in the channel, measured within the correlation sections of the F-PICH. The correlation section is the same for all signals, so *P total* is the same for all BTSs. *P total* is equal to Io within the F-PICH correlation section so that the following relation holds:
P total + Ec/Io = RSCP

Peak List

The rows of the *Peak List* (right-hand part of the *F-PICH Lists)* describe the single peaks (reflections) that contribute to the different BTS signals. The list can contain the following values (see also standard TIA-2000.2-D and related standards):

Offset

Pilot PN sequence offset index.

Signal power

Ec (F-PICH) [dBm]

Average energy per transmitted PN (Pseudo Noise) chip for the F-PICH, divided by the chip period and thus converted into an average received signal power (in dBm).

Ec/Io (<Ch>) [dB]

Ratio of the received energy per PN chip for the F-PICH to the total transmit power spectral density.

Signal timing

Delta T [μs]

Time delay of the signal slot timing relative to the CDMA system time or GPS time (hardware-dependent). The reference time (left edge of the diagram) is of minor importance as the diagram extends over more than one frame, which is enough to display and separate all received signals.

Distance (km)

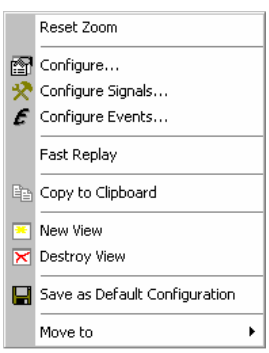
Distance to BTS in kilometers.

Special table entries

Depending on the conditions of the measurement the tables may show some particular results:

- An invalid result "---" denotes that a peak or the entire BTS signal was too weak to be accurately measured. Selecting *SR1 High Dynamic* mode in the measurements tab of the driver configuration menu generally reduces the number of invalid results.
- A number *(:1, :2* etc.) behind the offset denotes that signals with the same PN offset but with a significant difference in their time delays were received. Two different scenarios can cause multiple PN offsets:
  - If several of those signals occur at the same time, they are likely to belong to different BTSs that accidentally use the same PN offset.
  - Two signals with different numbers behind their PN offsets that are received at different times can belong to the same BTS but actually indicate a strong time drift.

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

The context menu provides the following additional commands:

Reset Zoom Resets the x-axis scale to 0 ms to approx. 26.5 ms.

PNS F-PICH Configuration

The *PNS F-PICH* configuration menu customizes the diagram in the *PNS F-PICH View* and the contents of the table. It is opened via a right mouse click on a point inside the *PNS F-PICH View* or via the *Configuration – Settings* command (see chapter 3).

The ***F-PICH View*** tab sets the y-axis scale of the *PNS F-PICH View*, selects the information to be displayed in the table and corrects the Doppler frequency.

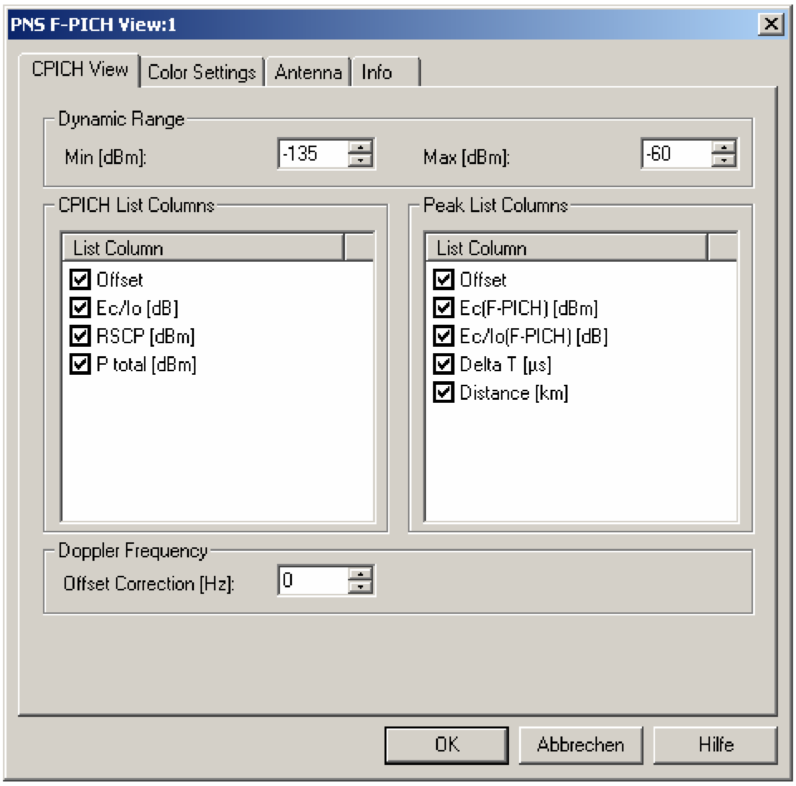


Fig. 4-264 PNS F-PICH configuration: F-PICH View

Dynamic Range The two input fields in the *Dynamic Range* panel define the minimum *(Min [dBm])* and the maximum *(Max [dBm])* level to be displayed in the *PNS F-PICH* view diagram.

CPICH List

Peak List

The *CPICH List* and *Peak List* panels select which information is displayed in the tables below the *PNS F-PICH* diagram (see *Fig. 4-201 above*). Clearing a box hides the corresponding column in the diagram

The ***Color Settings*** tab sets the color scale for the different PN offsets. The color codes are also shown in the *Route Track* menu; see paragraph on scrambling code indication on p. 4.37.

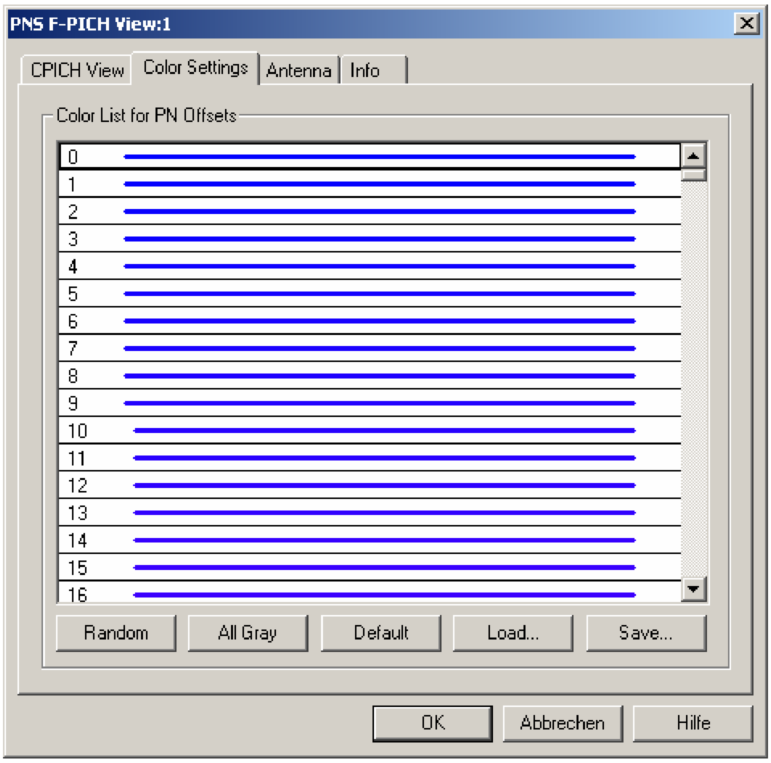


Fig. 4-265 PNS F-PICH configuration: Color Settings

The colors are displayed in the diagram (power peaks) and in the first table row (scrambling code scale). A double-click on a line in the *Color List* opens the *Colors* dialog (see p. 4.322) to change the current display color.

Random No ordering; colors are assigned to the scrambling codes at random.

All Gray Color scale suppressed; all colors are gray. This option is suitable e.g. to distinguish a single scrambling code (or a small number of scrambling codes), colored different, from all other codes, colored gray.

Default Predefined color scale: Colors change continuously as the scrambling codes increase.

Load/Save A color scale can be loaded from an SC color file (*.scc) and user-defined color scales can be stored to *.scc files to be reused in a later session.

PNS F-SYNC View

The *PNS F-SYNC View* shows the information that the TSMU decoded from the Forward Synchronization Channel (F-SYNC). The F-SYNC corresponds to code channel 32 in the forward CDMA channel which transports the synchronization message to the mobile station.

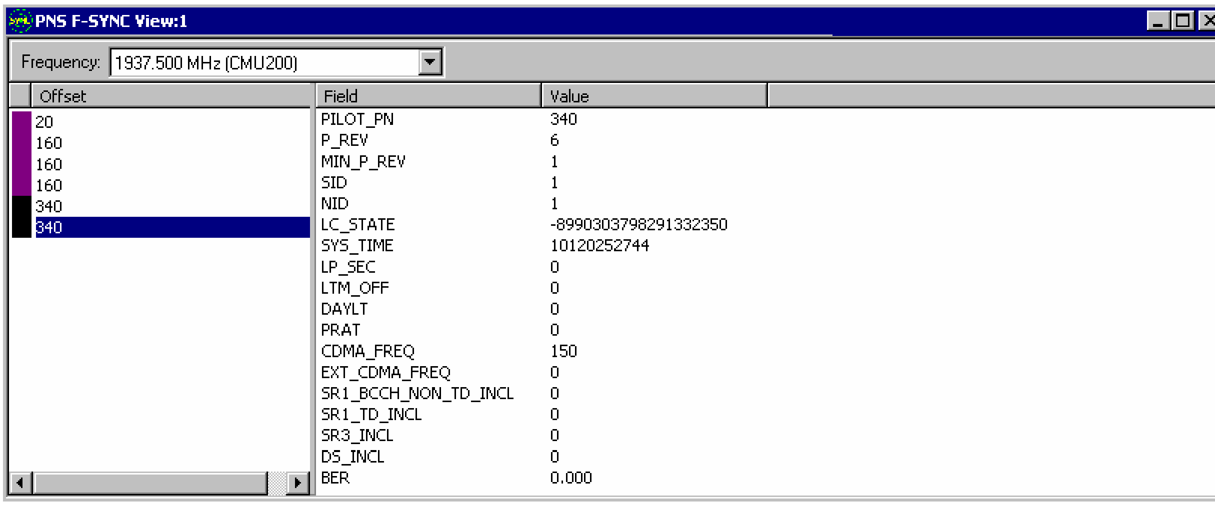


Fig. 4-266 PNS F-SYNC View

Frequency

Below the view title, the *Frequency* pull-down list contains all measured frequencies selected in the *Receiver* tab of the driver configuration menu. The list is also provided in the *PNS F-PICH View.*

Changing the frequency in one of these views automatically adapts the frequencies in all other view, provided they have the same current number in their title bar (e.g. the 1 in the figure above). Using this feature, it is possible to generate different groups of views with the same current number (opened by means of the context menu; see below) and select frequencies for an entire group with a single mouse click.

View area

The entire view area is vertically split in two parts:

- The left part displays all PN offset values decoded from the F-SYNC. The frequency of F-SYNC demodulation can be set in the *Measurements* tab of the CDMA PNS driver configuration menu (once for each frequency, once for each new pilot, or once for each new pilot but not more than once per 30 s; see chapter 6). The color code is set in the *PNS F-SYNC View* configuration menu.
- The left part displays the name of the different information elements in the synchronization message and the last decoded values.

Information elements

The contents of the synchronization message are described in standard TIA-2000.5-D.

PILOT_PN
Pilot PN sequence offset index (see description of the *PNS F-PICH* view on p. 4.402).

P_REV
Protocol revision level

MIN_P_REV
Minimum protocol revision level

SID
System identification

NID
Network identification

LC_STATE
Long code state

SYS_TIME
System time

LP_SEC
Number of leap seconds that have occurred since the start of the system time

LTM_OFF
Offset of local time from system time

DAYLT
Daylight savings time indicator

PRAT
Paging channel data rate

CDMA_FREQ
Frequency assignment

EXT_CDMA_FREQ
Extended frequency assignment

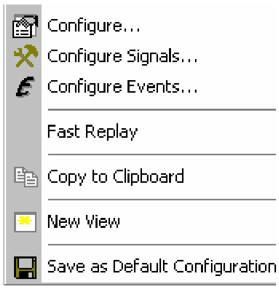
SR1_BCCH_NON_TD_INCL
SR1 Non-TD BCCH support indicator

SR1_TD_INCL
SR1 TD BCCH support indicator

SR3_INCL
SR3 support indicator

DS_INCL
Direct spread (DS) system and information available

Context menu



A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, save the current configuration, or move to another worksheet; see *Context menu* description on p. 4.2.

PNS F-SYNC Configuration

The *PNS F-SYNC* configuration menu customizes the diagram in the *PNS F-SYNC View*. It is opened via a right mouse click on a point inside the *PNS F-SYNC View* or via the *Configuration – Settings* command (see chapter 3).

The ***Color Settings*** tab sets the color scale for the different PN offsets. The color codes are also shown in the *Route Track* menu; see paragraph on scrambling code indication on p. 4.37.

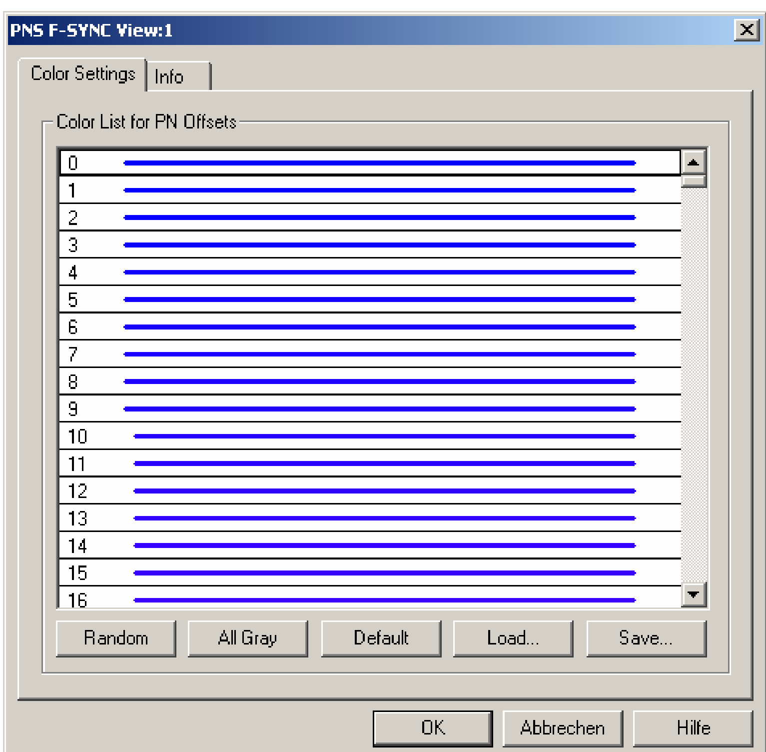


Fig. 4-267 PNS F-SYNC configuration: Color Settings

The colors are displayed in the left (PN offset) column of the diagram. A double-click on a line in the *Color List* opens the *Colors* dialog (see p. 4.322) to change the current display color.

Random No ordering; colors are assigned to the scrambling codes at random.

All Gray Color scale suppressed; all colors are gray. This option is suitable e.g. to distinguish a single scrambling code (or a small number of scrambling codes), colored different, from all other codes, colored gray.

Default Predefined color scale: Colors change continuously as the scrambling codes increase.

Load/Save A color scale can be loaded from an SC color file (*.scc) and user-defined color scales can be stored to *.scc files to be reused in a later session.

PNS Time Line Estimation View

The *PNS Time Line Estimation View* shows information about the time estimation of the PN offset arrival time intervals.

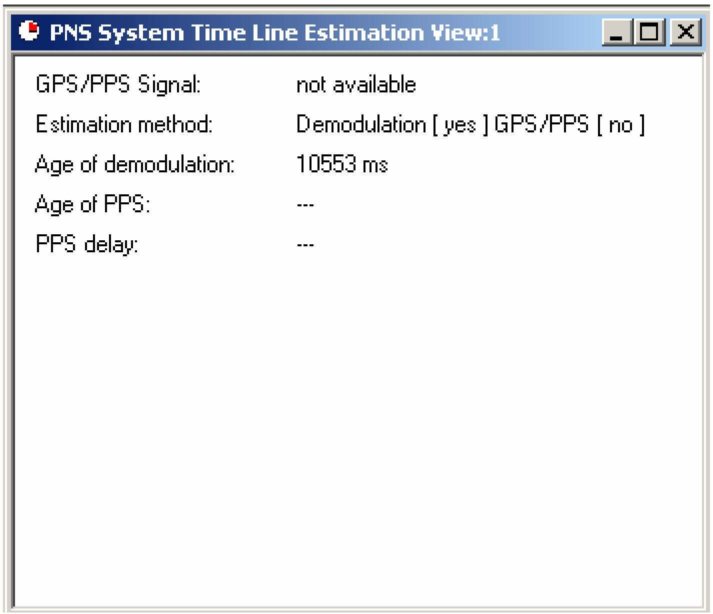


Fig. 4-268 PNS Time Line Estimation View

View area The pulse-per-second (PPS) signal from GPS and its delay have to be assessed continuously even when the GPS signal is not available.

This view shows the parameters related to the CDMA time line measurement. The *PNS Time Line Estimation View* has no configuration menu assigned.

Information elements

The contents of the PNS Time Line Estimation View are described below:

GPS/PPS Signal

Shows if arrival time was measured via GPS.

Estimation Method

The following combinations are possible:
1. No Demod. / no GPS PPS: Offset value is random, transmit time is estimated by receive time.

[2. No Demod. / GPS PPS: not used]

3. Demod. / no GPS PPS: Offset value is correct, transmit time was estimated by received pilots.

4. Demod. / GPS PPS: Offset value is correct, transmit time has GPS PPS accuracy.

Age of demodulation

Age of the last GPS PPS demodulation

Age of PPS

Age of the last PPS signal from GPS.

PPS Delay

Measured GPS PPS pulse time difference in [ns].

Range: -1 ms (-1000000) ... 999 ms (999000000)

The *PPS Delay* shows the GPS arrival time for the case that the measurement results (delays) are correct. If a time delay for a BTS signal is known, the measurement error of the PN Scanner result can be calculated. The same error applies to this value.

Example: PN Offset 271 was measured. The frame of this signal is transmitted 271*64/1228800 sec = 14114.58 µs after a frame with offset 0.
Assumption: The distance to the BTS is 5 km. So a measurement result of 14114.58 µs + 16.67 µs = 14131.31 µs is the expected measurement value. If, for instance, a delay of 14141.31 µs is measured as a delay value for this BTS, the measurement result has an error of +10 µs. Now both delay value and PPS delay value can be reduced by 10 µs to obtain the correct results.

See also *Calibration of the PPS Delay*, in *CDMA2000 PNS Driver Settings*.

Contents

5 Carrier-to-Interference Analysis (C/I).. 5.1

Graphical C/I Analysis in the Route Track View 5.2

C/I Layer Configuration 5.4

Show BTS List...5.5

Show Serving Cell/Show Interferer 5.6

DB Query...5.11

Remove All BTSs from Map..5.12

K6 CI Main View 5.13

K6 CI Measurement View 5.18

Interference Diagram for C0 Interferers 5.22

Interference Diagram for Cx Interferers 5.25

Spectrum Analysis..5.27

K6 CI Power Analysis View 5.29

K6 Remark Editor View 5.33

K6 Trigger View 5.34

Manual Start 5.35

Manual Stop 5.36

K6 TS View 5.38

K6 TS Notification...5.39

K7 Transmitter Scan View 5.41

Frame Timing 5.43

Info Levels 5.44

K7 Transmitter Scan View Configuration 5.45

Matching Entries: Range 5.48

5 Carrier-to-Interference Analysis (C/I)

The *Carrier-to-Interference* (C/I) analysis is used to analyze interferences caused by remote base stations and determine their source. Option ROMES-GS offers eight different C/I windows, which can be selected from a pop-up list displayed on the right side of the *View* menu as soon as the pointer is set onto the *CI Analyzer Views* command line. These views were especially designed for the purpose of a C/I analysis.

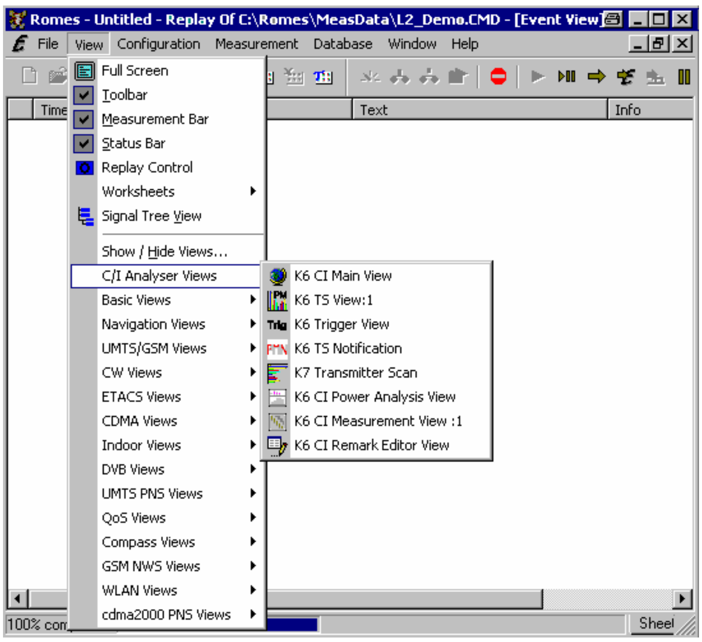


Fig. 5-1 C/I Analyzer View menu

K6 Remark Editor View	Overview of the characteristics of a BTS sector plus entry of user comments.
K6 CI Power Analysis View	Bar graph showing the distribution of the measured power from the serving cell and up to 4 interferers and the Carrier-to-Interference ratio.
K6 CI Measurement View	List of system messages recorded during the measurement.
K6 TS Notification	Graphical tool to determine the kind of interference at a particular point and locate the interferers.
K6 TS View	Bar graph showing the channels where Transmitter Scan values are recorded. The entries include the signal levels and the BCC.
K6 CI Main View	Overview of the measured interferences and central view giving access to the evaluation tools for a particular interference situation.
K7 Transmitter Scan View	Displays the data measured by the test receiver during the Transmitter Scan (requires the *R&S GSM Demodulator* driver of option ROMES-GS to be loaded).
K6 Trigger View	Display of the configuration and status of the trigger used to start and stop interference measurements.

In addition to the CI views the results of a C/I analysis can be displayed on a geographical map. To this end, the *Route Track* view provides a C/I layer with a selection of configuration tools.

Graphical C/I Analysis in the Route Track View	Map view with a C/I layer showing the location of interferences, neighboring base stations and other information.

A C/I analysis can be performed immediately during the measurement. Alternatively, a replay can be performed or a measurement file or stack file containing valid C/I data can be loaded. Typically, an interference analysis is typically started by loading a measurement file into the *K6 CI Main View* (see section *K6 CI Main View* on p. 5.13 ff.) and selecting a particular interference situation which can then be analyzed in the *K6 CI Measurement Views, K6 CI Power Analysis View* and *K6 CI Remark Editor View.*

For a quick introduction it is advisable to step through the application example outlined in chapter 2.

Graphical C/I Analysis in the Route Track View

The *Route Track* diagram visualizes a measurement tour and the behavior of the measured signals using a projection onto a background map that can be loaded and positioned into the view (see general description in chapter 4). In the framework of a C/I analysis, the *Route Track* view visualizes the location of base stations in a particular area, the position of the interference points detected and the possible sources of an interference.

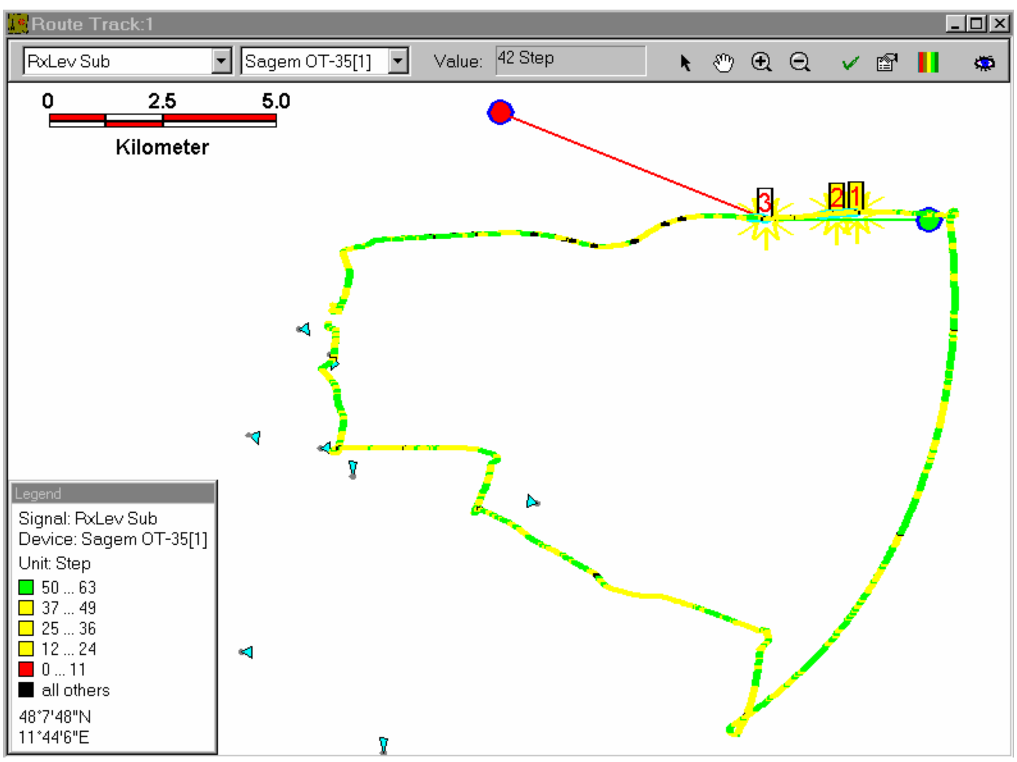


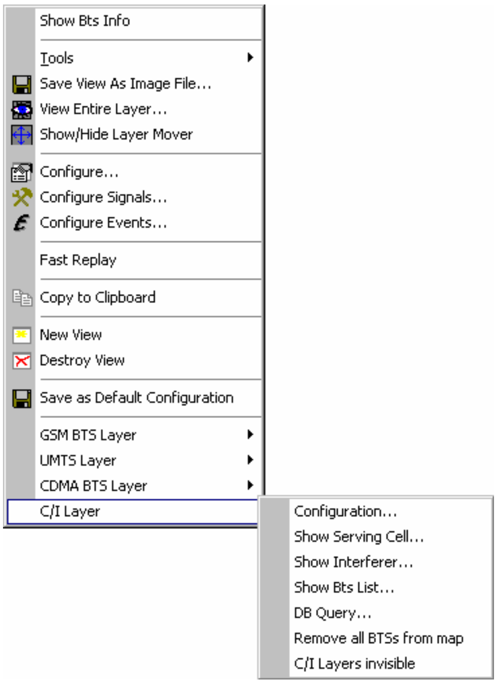
Fig. 5-2 Route Track View: C/I Layer

The example above shows a closed measurement tour. The asterisks with the numbers enclosed in rectangles denote the interferences detected along the tour. During an interference analysis, the serving cells (green circle and line in *Fig. 5-2 above*) and possible interferers (red circle and line) at each interference situation can be displayed in addition. A configuration menu is provided to modify the appearance of the display elements (see *C/I Layer Configuration* menu on p. 5.4 ff.).

The configuration of the diagram, the measurement curve and the background map as well as the toolbar and the legend in the *Route Track* view are described in chapter 4. The context menu contains one command providing specific configuration of the C/I layer.

Context menu

Right-clicking a point in the *2D Chart View* opens the context menu on the left side. All general context menu commands are described in chapter 4. The *C/ Layer* command provides the configuration tools for displaying the results of a Carrier-to-Interference analysis in the *Route Track* view:



Configuration...
Opens the *C/I Layer* dialog to set the display options for the elements in the C/I layer; see section *C/I Layer Configuration* on p. 5.4 ff.

Show Serving Cell
Opens the *BTS Information* window to display comprehensive information about the current serving cell. See section

Show Serving Cell/Show Interferer on p. 5.6 ff.

Show Interferer
Opens the *BTS Information* window to display comprehensive information about the current interferer. See section

Show Serving Cell/Show Interferer on p. 5.6 ff. The command is disabled unless an interference analysis is performed and a particular (potential) interferer is selected, see section *K6 CI Measurement View* on p. 5.18 ff.

Show BTS List
Opens the *BTS Station* dialog to retrieve a list of all base stations in the current BTS list; see section *Show BTS List* on p. 5.5 ff.

DB Query
Opens the *BTS Selection* dialog to select BTSs with particular properties or position to be loaded into the current BTS data base; see section

DB Query on p. 5.11 ff.

Remove all BTSs from map
Removes all base stations from the C/I layer in the *Route Track* view and from the current BTS database; see section *Remove All BTSs from Map* on p. 5.12 ff.

C/I layers invisible
Temporarily hide the entire C/I layer currently displayed. A checkmark before the command indicates that a C/I layer is currently available, but hidden. The layer reappears if the command is clicked for the second time.

C/I Layers Invisible is disabled if the current view contains no C/I layer.

C/I Layer Configuration

The *C/I Layer* configuration menu provides two tabs to define the display options and show information on the current *C/I Layer* version. This menu is opened by clicking the *C/I Layer – Configuration...* command in the *Route Track* context menu; see section *Graphical C/I Analysis in the Route Track View* on p. 5.2 ff.

The *Settings* tab of the *C/I Layer* dialog selects the serving cell lines to be drawn and defines their display options.

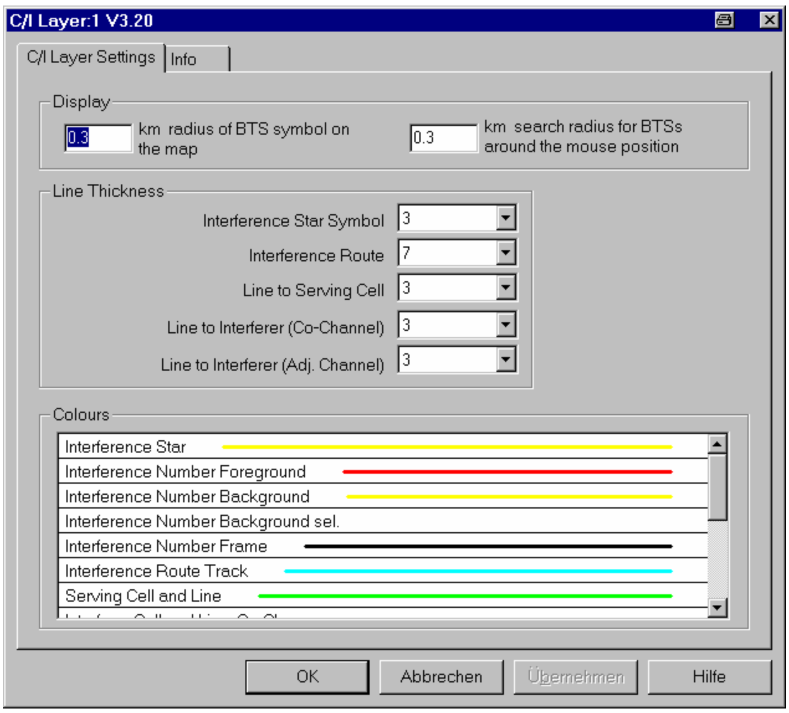
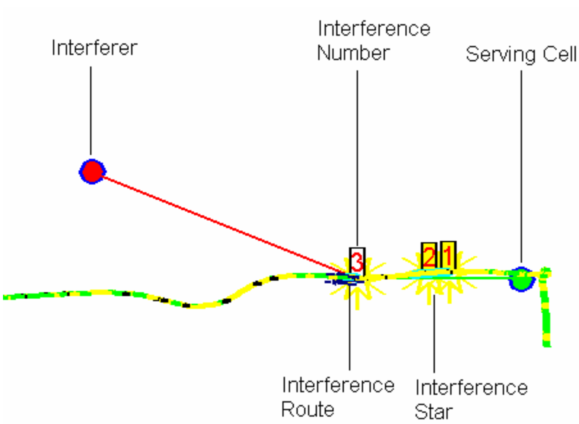


Fig. 5-3 C/I Layer dialog: Settings

Example for BTS display

The different display options are best explained with an example.



In addition the display options for BTS search results can be set; see description of *GSM BTS Layer* dialog in chapter 4.

Note:

The Interference Route corresponds to the duration of the interference measurement according to the trigger settings but can be adjusted in the K6 CI Main View (see Select range of interference situation... parameter in section K6 CI Main View on p. 5.13 ff.).

Display, Line Thickness, Colors

In the *Display* panel the size of the BTS symbols and the radius of the hot zone that can be clicked to open an info field can be adjusted.

The *Line Thickness* panel changes the different lines and thus the appearance of the diagram.

The *Colors* panel changes the colors of all display elements. Double-clicking an element of the list opens the *Colors* dialog (see chapter 4) to modify the current display color.

Show BTS List

The *C/I Layer – Show BTS List* command in the *Route Track* context menu (see section Graphical C/I Analysis in the Route Track View on p. 5.2 ff.) is used to display all base stations available in the current measurement or replay session and to obtain information on a particular base station. The base stations must be loaded from a BTS list by means of a database query *(C/I Layer – DB Query* command in the context menu). Otherwise the BTS list is empty.

Important:

A BTS has up to 3 sectors. It is always assumed that these sectors are synchronized in time. If a BTS has more than one sector and these sectors are not synchronized then each sector defines its own BTS. In order to distinguish these two situations, a so called Clock Code *has to be given for each sector: If two sectors are at the same position (within an error of 5 meters) and have the same Clock Code, they are assumed to belong to one BTS and hence to be synchronized. See chapter 7, BTS List Formats, for details.*

The *Show BTS List* command opens the *BTS Station* dialog:

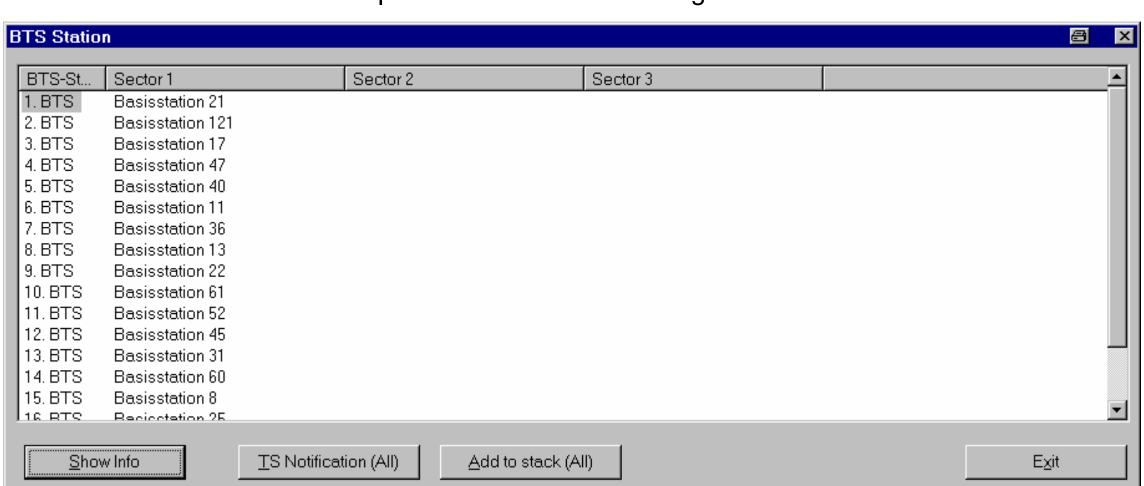


Fig. 5-4 BTS Station

BTS List The *BTS List* indicates all base stations. The base station selected is drawn in the *Route Track view* window and marked with color if it was drawn there already.

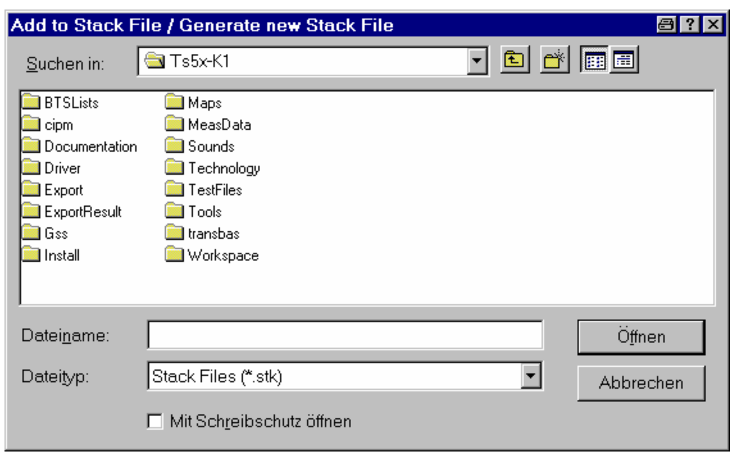
BTS-Station The base stations are numbered *1. BTS, 2. BTS, etc*.

Sector 1, 2, 3 A base station transmits in up to 3 sectors. The sector names are indicated in the columns *Sector 1, Sector 2, Sector 3*. An empty column field indicates that the sector is not used.

TS Notification (All) Transfer all BTSs in the list to the *Notification for* table in the *K6 TS Notification* view so that a notification is given in case of a successful Transmitter Scan; see section *K6 TS Notification* on p. 5.39 ff.

Add to stack (All) Stores all BTSs in the list to a stack file which can be loaded on every start of a measurement or interference analysis (see section *K6 CI Main View* on p. 5.13 ff.). Stack files store information on BTSs and interference situations so that it can be reused for later measurements or interference analyses.

Pressing the *Add to Stack File* button displays a file dialog, where the name of the stack file can be chosen from a list, or a new file can be created. It is possible to store several interference situations into the same stack file.



Show Info Displays comprehensive information about the base station selected in the list. The *Show Info* button opens the *BTS Information* window. See section

Show Serving Cell/Show Interferer on p. 5.6 ff.

Show Serving Cell/Show Interferer

The *BTS Information* menu provides comprehensive information on a base station of any type (serving cell, interferer,...) selected in a graphical diagram or list. This menu is opened e.g. by clicking the *Show Serving Cell* or *Show Interferer* commands in the *Route Track* context menu; see section *Graphical C/I Analysis in the Route Track View* on p. 5.2 ff. It is also accessible from the BTS Station dialog; see section *Show BTS List* on p. 5.5 ff.

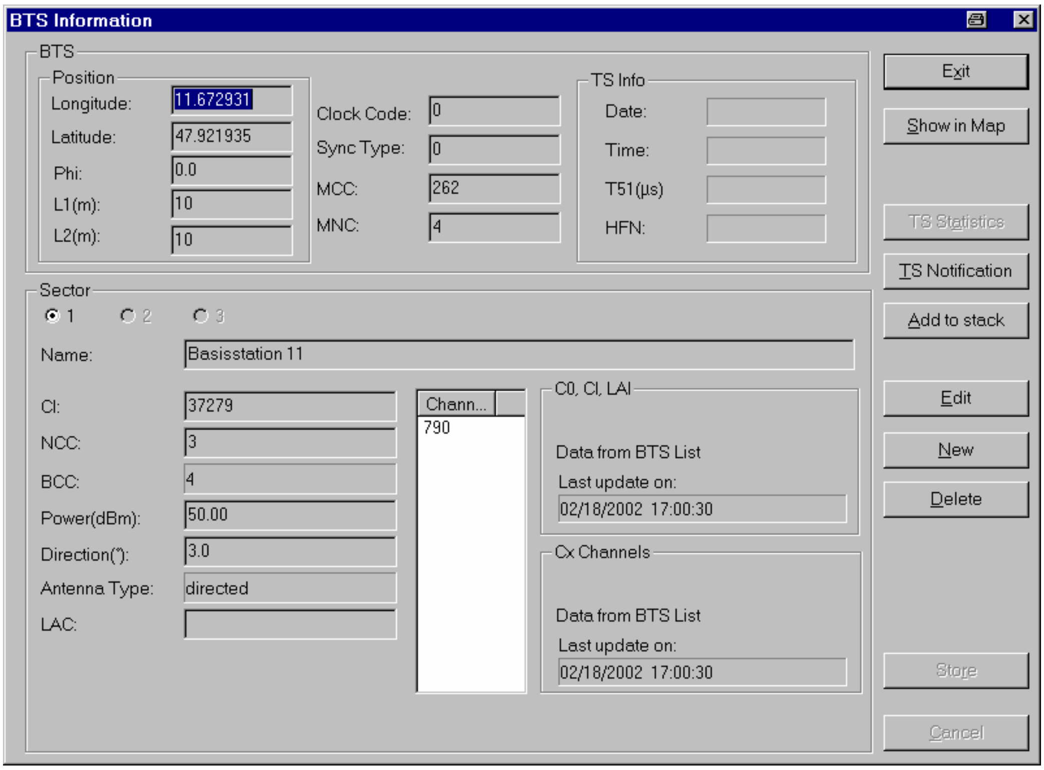


Fig. 5-5 BTS Information

The *BTS Information* window contains a panel which is split in two parts:

- **BTS:** The BTS panel shows the data common to all sectors. This includes the position, network and TS information
- **Sector:** Up to three sectors are integrated into one BTS. Sectors belong to one BTS when they are at the same position and synchronized with respect to the T51 offset time.

BTS The entries in the *BTS* field contain the following information:

Position

The Position panel displays the geographical coordinates of the base station in degrees including their uncertainty. The latter is expressed by the size of an ellipse with the axes L1 and L2 and by the orientation Phi of the main axis. In the case that the base station is given in the BTS list the corresponding ellipse is very small like in Fig. 5-5 above.

Phi:

Orientation of the main axis (L1) of the error ellipse. The orientation is measured clockwise in deg, 0 deg is north.

L1:

Length of the main axis in meters

L2:

Length of the minor axis in meters

Clock Code

Clock code of the base station. See chapter 7, BTS List Formats, for details.

Sync Type
Sync Code of the base station. See chapter 7, BTS List Formats, for details.

MCC
Mobile Country Code of the network.

MNC
Mobile Network Code of the network.

TS Info
The Transmitter Scan (TS) Info panel displays information on the last TS of the current base station (if available).

Date
Date of the last Transmitter Scan.

Time
Time of the last Transmitter Scan.

T51(μs)
Measured offset time T51 in microseconds.

HFN
TDMA frame number within the hyperframe.

Sector

The entries in the *Sector* panel contain the following information:

Name
Name of the sector as given in the BTS list or a default name if the sector was created by a Transmitter Scan.

NCC
National color code of the sector.

BCC
Base station Color Code.

Power (dBm)
Transmission level (EIRP) of the sector in dBm

Direction
Direction of maximum transmission power of the sector. The direction is measured clockwise in deg, 0 deg is north.

Antenna type
Directed antenna or omnidirectional.

LAC
Location Area Code.

Channel List
Channel list of the sector. The first channel denotes the C0, the other ones the Cx channels.

C0, CI, LAI
Denotes the validity, source and last update of these data. When a change is observed for one sector and the last measurement for this sector is older than 12 hours, there is a line *Check Validity*. This line is only for information, there are no implications on the assignment of an interferer to the transmitting sector. The next line shows the source of the sector information, i.e. whether the sector data

were taken from the BTS list (*Data from BTS List),* whether they were acquired or updated in a TS measurement (*Data from Transmitter Scan*), whether they were modified *(Data edited by user)* or never measured *(Data not measured yet,* red message). Finally, the last line shows the time of the last update, which is either the date and time of the BTS list file or of the corresponding Transmitter Scan.

Cx Channels

The data fields of this panel denote the equivalent information concerning the channel occupation of the traffic channels.

Exit Closes the *BTS Information* window and returns to the previous window.

Show in Map Shifts the current base station to the center of the *Route Track view* and highlights it with dark blue color. At the same time, the *BTS Information* window is temporarily closed, and a message box indicating the BTS name displayed.

Exit returns to the the *BTS Information* window.

TS Statistics The *TS Statistics* button retrieves a list of Transmitter Scan measurement results obtained for the current base station. The *List of Measurement Results* window is opened.

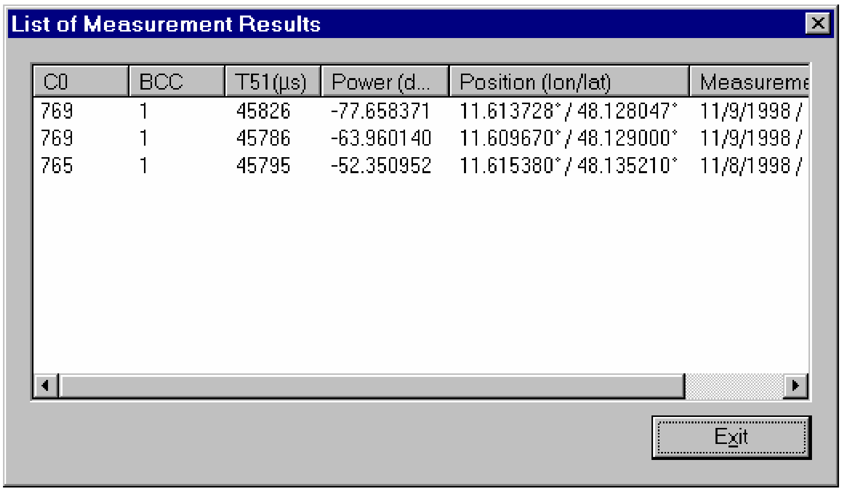


Fig. 5-6 List of Measurement Results

In the *List of Measurement Results* window the following measurement results are displayed:

C0

C0 channel number measured

BCC

Base station color code measured

T51(µs)

Reference time for the T51 frames measured

Power (dBm)

Measured signal level in dBm

Position (lon/lat)
Geographic coordinates of the measurement device

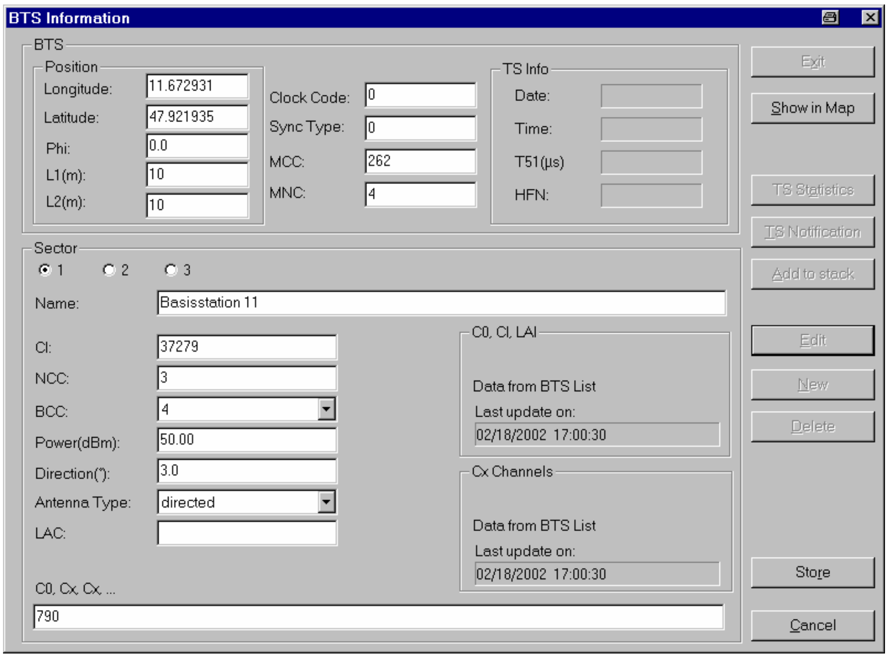
Measurement (Date)
Date and time of the measurement

The *TS Statistics* button is disabled if no TS measurement results are available for the current base station, i.e. unless the message *Data from Transmitter Scan* is displayed in the *C0, CI, LAI* panel.

TS Notification Transfer the current BTSs to the *Notification for* table in the *K6 TS Notification* view so that a notification is given in case of a successful Transmitter Scan; see section *K6 TS Notification* on p. 5.39 ff.

Add to stack Stores the current BTS in a stack file which can be loaded on every start of a measurement. See *Add to Stack File* on p. 5.6.

Edit Edits the current base station. The dialog slightly changes:



The BTS can be edited now. The *Name* field shows the existence of a sector in the BTS. So, an empty *Name* field indicates that there is no sector, irrespective of the contents of the remaining fields. Note that all sectors are synchronized, which is indicated by the common *Clock Code* in the upper part of the dialog.

Pressing *Store* saves the modifications made to the BTS database; the *CO, CI, LAI* panel shows the message *Data edited by user*. *Cancel* discards the changes made.

Internally, the BTS is edited by replacing the old BTS with the new one. this generates the two messages *BTS deleted* and *BTS appended*. This also implies that the TS information is deleted each time the BTS is edited, which is quite reasonable as any change in the BTS is usually accompanied by a reset of the BTS.

The buttons *Edit, New* and *Delete* are only available while no measurement or replay is running, because otherwise the origin of a BTS is ambiguous.

New Creates a new BTS in the database. The *BTS Information* dialog is opened in the same way as with the *Edit* function but with a set of empty fields. The remaining

Edit functionality is applied accordingly.

Delete Deletes the current BTS from the current database. Note that the BTS is only removed from the current (temporary) database and not from the *BTS list*.

Store Applies the changes when a BTS is edited or created.

Cancel Discards the changes when a BTS is edited or created.

DB Query

The *DB Query* command in the *Route Track* context menu (see section *Graphical C/I Analysis in the Route Track View* on p. 5.2 ff.) opens the *BTS Selection* dialog to select BTSs with particular properties and position to be loaded into the current BTS data base.

If appropriately applied, the *BTS selection* search criteria will considerably improve and simplify the results of the Carrier-to-Interference analysis.

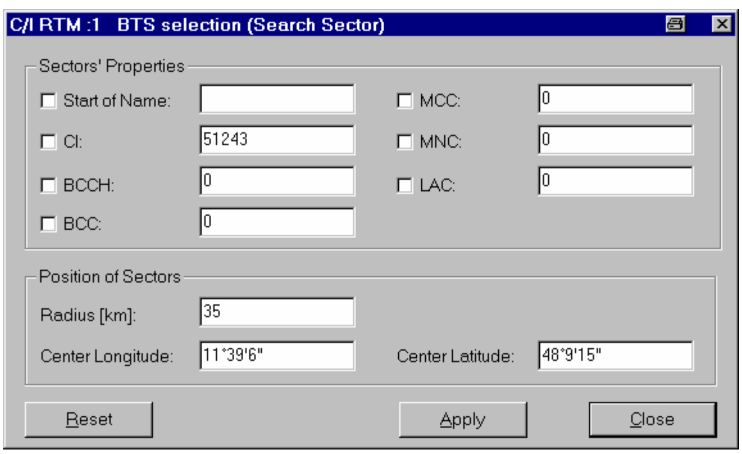


Fig. 5-7 BTS Selection (Search Sector)

Sectors' Properties In the *Sectors' Properties* panel one or several of the following conditions can be set (click one of the radio buttons and enter the desired value (name or integer number) in the input field on the right side):

Start of Name
Select BTS with a particular name or with a name starting with a particular combination of characters

CI
Select BTS with a particular Cell Identity

BCCH
Select BTS transmitting on a particular Broadcast Control Channel

BCC
BTS Color Code

MNC
Mobile Network Code

MCC
Mobile Country Code

LAC
Location Area Code

Position of Sectors The *Position of Sectors* panel defines a circle of variable size and position to limit the number of BTS symbols displayed in the *Route Track* view. BTSs outside the circle are not displayed. A small number of BTS symbols improves the system performance.

The size of the circle is defined by the *Radius [km]*. Its position is defined by the longitude and latitude coordinates of the center *(Center Longitude, Center Latitude)*. The default *Center Longitude* and *Center Latitude* are the coordinates of the pointer on the *Route Track* view when the context menu and the *BTS Selection* dialog was called up. The default radius corresponds to the maximum GSM cell radius.

Reset Reset the current BTS data base; delete all BTSs in the *BTS Stations* list (see section *Show BTS List* on p. 5.5 ff.).

Apply Apply the current condition. A message box indicates how many valid BTSs were found.

Close Close the *BTS Selection* dialog.

Remove All BTSs from Map

The *Remove All BTSs from Map* command in the *Route Track* context menu (see section *Graphical C/I Analysis in the Route Track View* on p. 5.2 ff.) removes all base stations from the C/I layer in the *Route Track* view and from the current BTS database. The warning *Delete all BTSs from map?* must be confirmed before this command is executed. After removing the BTS from the map the *BTS Station* list (see section *Show BTS List* on p. 5.5 ff.) is empty, however, the measurement file remains unchanged.

K6 CI Main View

The *K6 CI Main View* provides an overview of the measured interferences and gives access to the evaluation tools for a particular interference situation. The interference analysis can be performed in three different ways:

- During a measurement, while the system operates in Transmitter Scan mode. The interference analysis is disabled while the system performs an interference measurement.
- After loading a measurement file generated before in the replay mode.
- After directly loading the interference situations stored in a measurement (*.cmd) or stack (*.stk) file using the *Load* button in the *K6 Main View*.

The *K6 CI Main View* shows an overview of all interference situations in a particular measurement or measurement file. Various tools to analyze a particular interference in detail are directly accessible from this view:

- The *Open Power Analyser* button opens the *K6 CI Power Analysis View* to analyze the statistical distribution of the power from the current serving cell and up to 4 interferers and calculate the Carrier-to-Interference ratio; see section *K6 CI Power Analysis View* on p. 5.29 ff.
- The *Interference Analysis* button opens the *K6 CI Measurement View* to perform a graphical evaluation of the selected interference; see section *K6 CI Measurement View* on p. 5.18 ff.
- The *Remarks* button opens the *K6 CI Remark Editor View* to display detailed information on the BTS sector currently analyzed and add user comments; see section *K6 Remark Editor View* on p. 5.33 ff.

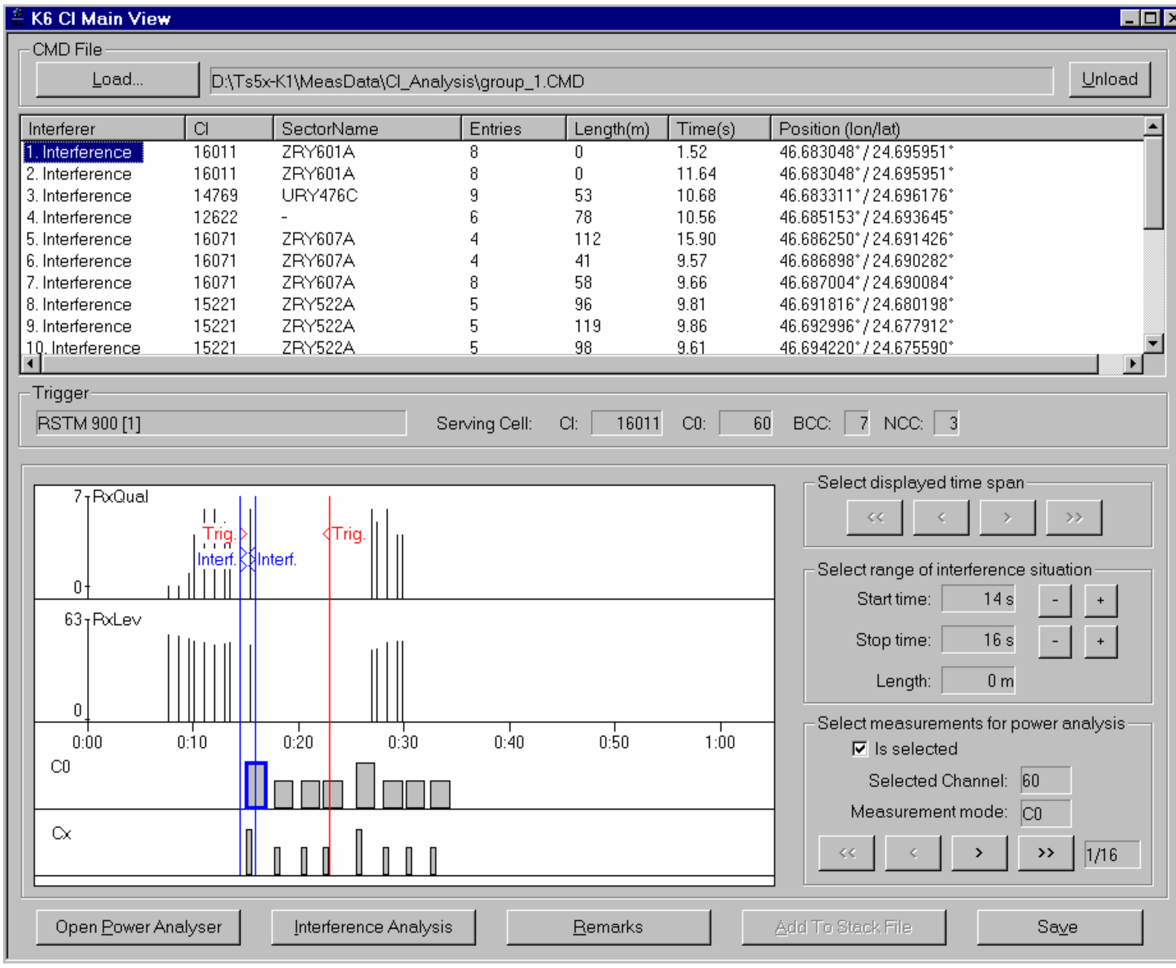


Fig. 5-10 K6 CI Main View

Load

Calls up an *Open* file dialog to select a measurement (*.cmd) or stack file (*.stk; see *Add to Stack File* on p. 5.6) to be loaded. The interference information from the file is displayed in the *Interferer List;* moreover, the diagram in the lower part of the *K6 CI Main View* shows various measurement results of a selected interference as a function of time.

Loading the interferences directly is faster than the evaluation in replay mode. The name and directory of the current measurement or stack file is displayed to the right of the *Load* button.

Unload

Closes the current measurement (*.cmd) or stack file (*.stk) and clears all entries from the *K6 CI Main View*.

Interferer List

The *Interferer* List displays all interference points stored in the measurement or stack file. In the *Route Track view*, an interference point is indicated by an asterisk with selectable color and shape; see section *C/I Layer Configuration* on p. 5.4 ff. Additionally, the interferer number, the interference route, the serving cell and interfering base station can be displayed.

Interferer

The interferences are numbered 1. Interference, 2. Interference, etc.

CI

Cell identity of the interfered SC

Sector Name

Sector name of the serving cell

Entries

Total number of measurements/interference diagrams in the K6 CI Measurement View for the sector

Length

Length of the route where the interference measurement was taken

Time (s)

Duration of the interference measurement

Position

Start position of the interference measurement

The *Trigger* panel below the list indicates the model of the test mobile used to acquire the interference data and the characteristics of the serving cell associated to the interference selected in the list (Cell Identity (CI), C0 channel number, BTS Color Code (BCC) and National Color Code (NCC)). More information on the serving cell ca be retrieved during the interference analysis; see description of *Select Station for C/I* option on p. 5.22.

RxQual/RxLev/ Channel diagram

The diagram in the lower half part of the *K6 CI Main View* shows the *RxQual* and *RxLev* results reported by the mobile phone for one channel as a function of time. The channel is the one that is currently selected in the *Channel List* of the *K6 CI Measurement View* (see p. 5.18 ff.). The abscissa corresponds to a measurement time of 1 minute (see also *Select displayed time span* below). One pair of red lines shows the duration of the trigger and one pair of blue lines shows the measured duration of the interference.

The pair of blue lines can be shifted by the user (see *Select range of interference situation* below) to express more accurately the actual duration of the interference.

Measurement bars

Below the RxQual and RxLev diagrams all different interference measurements that are available for the interference analyzed in the *K6 CI Measurement View* are shown as bars. The bars are characterized by their channels and measurement mode (C0, Cx), however, several measurements can be available for the same channel and mode. The bars for C0 and Cx interferers are drawn in two separate lines. Those for Cx interferers are narrower, indicating that the Cx interference measurement is shorter than the C0 measurement (it extends over one T_{51} frame compared to almost eight T_{51} frames for the C0 measurement). The bars can have different color, size and frame:

- A wide blue frame and an enlarged bar indicates that the measurement is currently selected for an interference analysis and displayed in the interference diagram of the *K6 CI Measurement View.* Otherwise the bar has a narrow black frame. A measurement can be selected for the analysis by clicking into a square or using the <</</>/>> buttons. The display in the *K6 CI Main View* and in the *K6 CI Measurement View* are synchronized: The interference diagram changes when another bar is clicked and vice versa.

- A gray color indicates that the measurement is currently selected for the power analysis and the results are taken into account for the calculation of the Carrier-to-Interference ratio. See *Select measurements for power analysis* below and section *K6 CI Power Analysis View* on p. 5.29 ff. Otherwise the bar is transparent (white).

Select displayed time span

If the duration of a complete interference is larger than one minute, only a part of the time domain is shown. The buttons in the *Select displayed time span* panel are enabled and can be used to scroll in the time domain.

Select range of interference situation

The */– buttons in the *Select range...* panel adjust the duration of the current interference and shift the blue lines in the diagram. By default, the interference duration is given by the trigger conditions displayed in the *K6 Trigger View* (see p. 5.34 ff.), the corresponding trigger time is displayed as a pair of red lines.

However the actual interference duration (visualized by the two blue lines) can be slightly different from the trigger time. It can therefore be adjusted by means of the information given by the *RxQual* and *RxLev* values, which are also displayed in the time range before and after the interference was triggered. In order to adjust the beginning of the interference, the displayed *RxQual* and *RxLev* values may be used. However, an interruption of those values does not necessarily indicate the end of the interference; it is usually caused by an interruption of the connection or a handover. It is better to determine the end of the interference with the help of the interference diagram in the *K6 CI Measurement View* (see p. 5.18 ff.).

The *Interference Route* in the *Route Track view* (see section *C/I Layer Configuration* on p. 5.4 ff.) corresponds to the interference interval between the blue lines, so it changes when the blue lines are adjusted.

Note that the shift of the time duration does not affect the default values in the selected measurement for power analysis below.

Select measurements for power analysis

By default, all interference measurements, represented by the shaded squares in the diagram, are used for the analysis in the *K6 CI Power Analysis View* (see p. 5.29 ff.). However, it may be desired to omit some of them, e.g. because the interference duration changed or because the interference pattern in some of the interference diagrams on a given channel is questionable or missing.

The squares in the diagram selected for the power analysis are filled with a gray color, otherwise they are white.

Open Power Analyzer

The *Open Power Analyser* button opens the *K6 CI Power Analysis View* to analyze the statistical distribution of the power from the current serving cell and up to 4 interferers and calculate the Carrier-to-Interference ratio; see section *K6 CI Power Analysis View* on p. 5.29 ff.

Interference Analysis

The *Interference Analysis* button opens the *K6 CI Measurement View* to perform a graphical evaluation of the interference; see p. 5.18 ff.

Remarks

The *Remarks* button opens the *K6 CI Remark Editor View* to display detailed information on the BTS sector currently analyzed and add user comments; see section *K6 Remark Editor View* on p. 5.33 ff.

Add to Stack File

The *Add to Stack File* button stores the data of the current interference in a stack file which can be used for future measurements or interference analyses. See *Add to Stack File* on p. 5.6.

This feature is particularly useful when the analysis of the interference situation shows that some BTSs involved in the interference have to be measured (again).

The new TS results will be assigned to the interference. It is possible to store several interference situations into the same stack file.

Save

The *Save* button saves the results of the current analysis and the changes made to the interference data to the current measurement or stack file. In particular the changes made in the three views depending on the *K6 CI Main View:*

- The interferers identified in the *K6 CI Measurement View*
- The results obtained in the *K6 CI Power Analysis View*
- User comments entered in the *K6 Remark Editor View*

The system also asks whether to save the current analysis results when an attempt is made to close the current measurement file and open another one (see *Load* button above).

K6 CI Measurement View

The *K6 CI Measurement View:...* represents the central tool for evaluating an interference situation, i.e. determining the kind of interference at a particular point and locating the interferers. It contains a rectangular diagram to visualize the relative position in time of all measured correlation results in the channel selected from the *Channel List* on the left side of the dialog. These are the FCCHs (frequency correction channels) for C0 interference analysis and the TSCs (training sequence codes) for traffic channel interference analysis, respectively.

The header indicates the number of the channel measured, the cell identity of the SC, and the type of interference (channel no. 28 and C0C0 interference in the example of *Fig. 5-11*). In the interference type, the first two characters denote the channel type of the serving cell (useful signal), the last two letters denote the channel type of the interfering signal.

The *K6 CI Measurement View* dialog can be opened like any other view from the *View* menu. Alternatively it can be accessed by pressing the *Interference Analysis* button in the *K6 CI Main View* (see *Fig. 5-10* on p. 5.14).

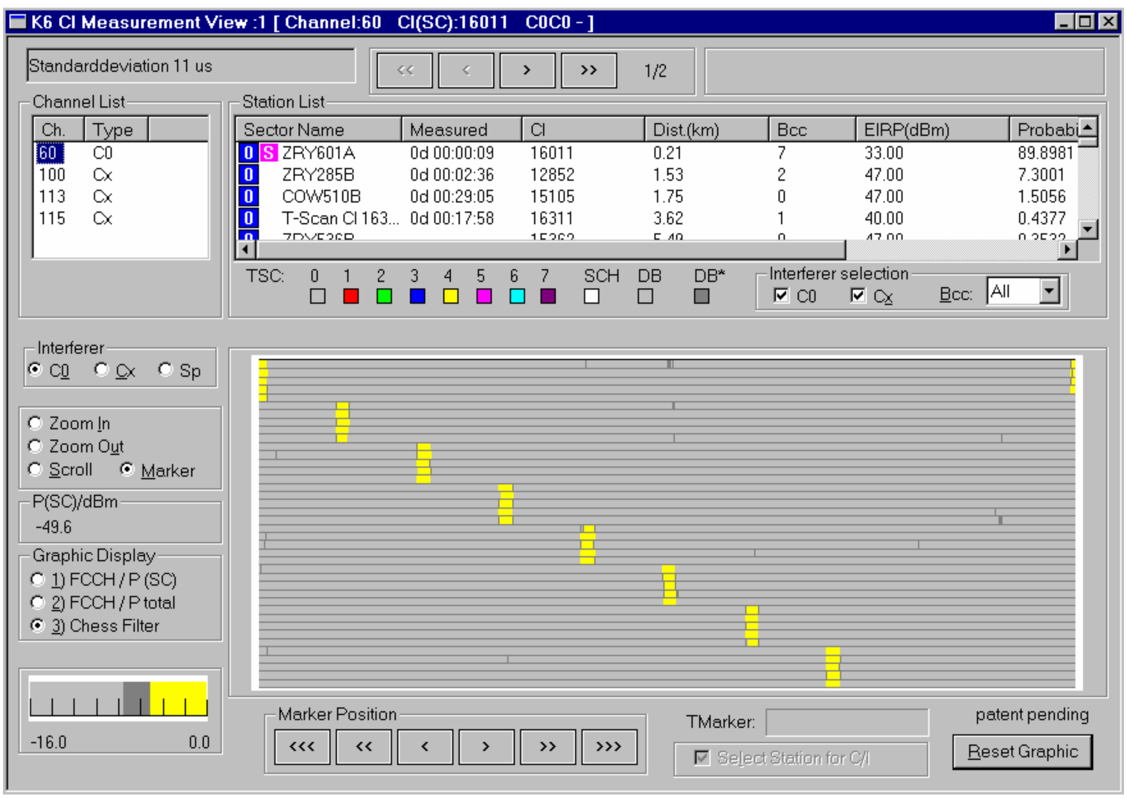


Fig. 5-11 K6 CI Measurement View

Interferer Selects the type of interference analysis, depending on the channel causing the interference, and the appropriate interference diagram:

C0

C0 interferers (C0C0 and CxC0 interferences), see section *Interference Diagram for C0 Interferers* on p. 5.22 ff.

Cx

Cx interferers (C0Cx and CxCx interferences), see section Interference Diagram for Cx Interferers on p. 5.25 ff.

Sp

Spectrum analysis, see section Spectrum Analysis on p. 5.27 ff.

Aside from the *Interferer* panel and the interference diagram the *K6 CI Measurement View* contains the following controls:

<< / < / > / >> n/m The buttons << / << / >> / > above the *Station List* select the first, the previous, the next or the last measurement that is available for the current channel and sector. To the right of the buttons, the number n indicates the number of the current measurement, m denotes the total number of measurements available for the current channel and sector.

Channel List The table lists all channels of the Serving Cell (SC) measured at the current interference point. For each channel in the list, the channel type (0 or 1 C0 channels plus 0, 1, or several Cx channels) is shown, too. The list can be scrolled with the *Page Up/Down* keys.

Station list The *Station List* and the interference diagram describe the channel selected in this list. (E.g. in *Fig. 5-16* channel 113 is selected. All signals measured on channel 113 are listed on the right side and shown in the diagram.)

The table on the right side lists the following information:

Sector Name

Name of the transmitting sector. The blue icon with a “0” indicates that this sector has a C0 channel in the selected entry of the *Channel List*, a green icon with an “X” is used for the sectors which have a traffic channel in the selected entry of the *Channel List.* On the right side of this icon is another one if the sector has been selected for the *Power Analysis* (see below).

The *Station list* contains both C0 and Cx interferers for a given channel because a secondary *K6 CI Measurement View* can be opened to view the two interferer types simultaneously (see below).

Measured.

Time difference between the TS (measurement of the sector’s time delay) and the interference measurement in the format `<days>d <hours>:<minutes>:<seconds>`.

CI

Cell identity of the sector

Distance(km)

Distance between the transmitting base station and the interference point.

Bcc

The BCC of the sector.

Power(dBm)

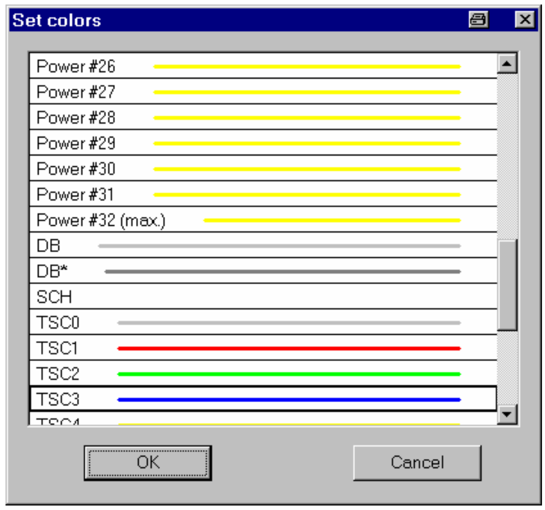
Transmission power (EIRP) of the sector

Probability(%)

Probability of the sector to have the highest signal level at the measurement location; the number is derived from a propagation model.

TSC

Legend of the signals shown in the interference diagram. This legend is particularly relevant if *Cx* is selected in the *Interferer* panel. Clicking on the colored rectangle opens a dialog to change the display colors for all powers in the C0 interference diagram and the TSCs, SCHs, and DBs indicated in the Cx diagram:



Any changes made are immediately applied in the interference diagram. The rectangles in the TSC legend denote the following:

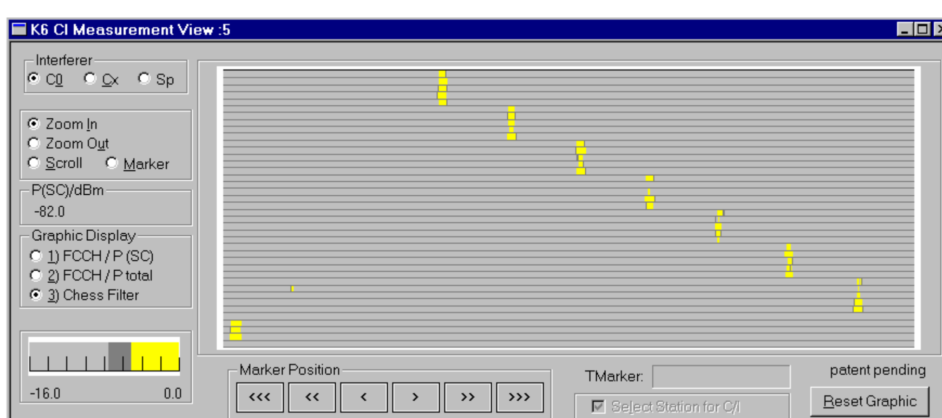
0 ... 7
Training sequence code

SCH
Synchronization channel

DB
Dummy burst

*DB**
If this signal appears, the dummy burst of the base station is not correctly coded

Right-clicking one of the rectangles calls up a context menu with the entry *New View*. This menu calls up a copy of the current interference diagram including the controls on the right side and below:



The secondary *K6 CI Measurement View* is useful, e.g., to take a closer look on an interference by zooming in the diagram or to view the interference diagrams for C0 and Cx Interferers simultaneously. Manipulating the secondary view does not affect the original view.

Interferer selection Restricts the sectors in the *station list.* Checking *C0* and *Cx* shows all sectors which have a C0 (or additionally a traffic channel in the Cx interference analysis) in the selected channel of the *Channel List*, respectively. The BCC list restricts the base station selection to a particular BCC.

Zoom In Magnifies a selected portion of the interference diagram. The cursor takes the shape of a zoom-in icon (a magnifying glass with a '+' inside) when placed on the diagram.

The zoom-in icon must be placed to the center of the area to be viewed. On clicking a point, the diagram will be magnified by a (linear) factor of 2, the position of the icon becoming the center of the magnified diagram. Two magnification steps (i.e. magnification factors of 2 and 4) are allowed, zooming in again will only re-center the diagram.

Zoom Out Scales down the magnified interference diagram if it was magnified before. The cursor takes the shape of a zoom-out icon (a magnifying glass with a '-' inside) when placed on the diagram.

On clicking a point, the diagram will be scaled down by a (linear) factor of 1/2, the position of the icon becoming the center of the magnified diagram. Two steps (i.e. scaling factors of ½ and 1/4) are allowed, zooming out again will only re-center the diagram.

Scroll Shifts the contents of the interference diagram within the window without changing the scale. The cursor takes the shape of a hand (grabber) when placed on the diagram. To shift the map left-click an arbitrary point, drag and drop the diagram to the desired position.

Marker Sets the markers of the power analyzer for the sector selected (see section *K6 CI Power Analysis View* on p. 5.29 ff.). In order to use this feature, *Select Station for C/I* must be selected. The cursor takes the shape of a cross and the markers are set on the interference diagram with a left mouse click. The time offset at the marker position is indicated in the *TMarker* output field below the diagram. Only measurement results located between the marker lines are used for the power analysis.

Note:
If a C0 and a Cx interference diagram is opened at the same time (secondary K6 CI Measurement View, see above), the markers in both diagram are coupled: The marker in the Cx diagram can be used for fine-tuning because the time resolution of this diagram is larger.

Caution:
Shifting the markers by very large steps may cause them to disappear from the diagrams. If a marker has disappeared the sector must be selected again.

P(SC)/dBm Power of the serving cell in dBm.

Graphic Display Changes the color assignment and representation of the signals in the interference diagram. Switchover between the three display modes can be used to optimize the visibility and contrast in the diagram. These entries are different depending on the analysis mode selected in the *Interferer* panel.

For C0 interference analysis (selection of *C0* in the *Interferer* panel), the entries are:

- FCCH / P(SC): The power of the measured FCCHs are referred to the power of the FCCH of the serving cell shown in *P(SC)/dBm* above.
- FCCH / P total: The power of the measured FCCHs are referred to the total power in the respective time slot.

- Chess Filter: The correlation of the FCCH from the signal may produce some artificial signals, which do not correspond to a FCCH. The chess filter suppresses this random correlation.

For Cx interference analysis (selection of *Cx* in the *Interferer* panel), the entries are:

- TSC / P(SC): The power of the measured TSCs are referred to the power of the serving cell shown in P(SC)/dBm above.
- TSC / P total: The power of the measured TSCs are referred to the total power in the respective time slot.
- Filter: The power values are also referred to the total power in the respective time slot. However, the sensitivity is higher than in the TSC / P total display, but accidental correlations will be suppressed by statistical evaluations.

For the spectrum analysis (selection of *Sp* in the *Interferer* panel), the entries are:

- dBm / 100 kHz: Display of the received signal power over a plane representing the current channel width times 220 ms.
- Distribution: Bar graph showing the received signal power over the current channel width.

Color Scale

This scale shows the level of the FCCHs or TSCs compared to the signal level of the selection in *Graphic Display*. There are 32 colors for the displayed power. By clicking on the color scale, these colors can be changed arbitrarily.

Marker Position

<<</ << / <
> / >> / >>>

Shifts the current marker position to the left (<<< / << / <) or to the right (>>> / >> / >). <<< and >>> have the largest, < and > the smallest effect.

Select Station for C/I

The *Select Station for C/I* checkbox activates the mode where the sector selected in the *Station List* is selected for the power analysis (see section *K6 CI Power Analysis View* on p. 5.29 ff.). In this mode, the *Marker* display option is active; see above. The marker can be used to select a time offset and the *K6 CI Remark Editor View* shows a comprehensive overview of the characteristics of the current sector (see section *K6 Remark Editor View* on p. 5.33 ff.).

Reset Graphic

The *Reset Graphic* button resets the scaling factor and position of the interference diagram to the default values.

Interference Diagram for C0 Interferers

The interference diagram for C0 interferers is obtained by choosing *C0* in the *Interferer* panel. It is used to analyze C0C0 and CxC0 interferences.

Interference diagram

The diagram consists of 40 lines scaled such that the left upper corner corresponds to the beginning of a T_{51} frame of the C0 channel of the serving cell and the length of a line to the transmission time for 10 TDMA frames. (If the serving cell is not measured when the interference measurement is started, the beginning of the T_{51} frame of the serving cell is not adjusted to the upper left corner of the diagram.) The right end point of a line is identical with the left starting point of the subsequent line so that the whole diagram can be interpreted as a single line and covers a period corresponding to the transmission of 400 TDMA frames (8

T_{51} frames minus 8 frames).

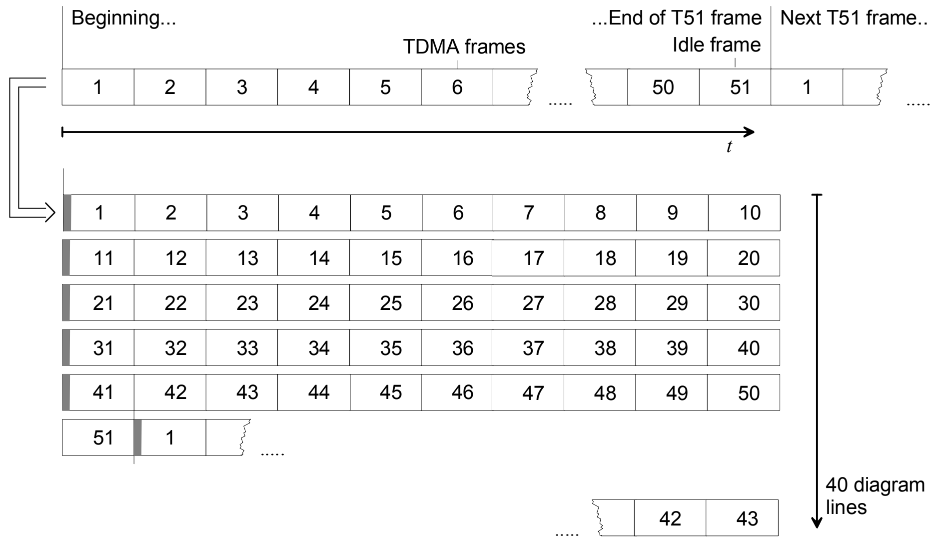


Fig. 5-12 Structure and representation of the FCCH signal

Representation of C0 signals

For every FCCH measured, a colored bar is drawn at the beginning of a T_{51} frame and after 10, 20, 30, and 40 TDMA frames. This means that within a T_{51} cycle fife bars are generated, one lying above the other. The color and width of the bars is a function of the signal level.

After the 5^{th} bar (beginning of TDMA frame no. 41), due to the idle frame, 11 TDMA frames are transmitted before the next T_{51} frame begins. Consequently the next T_{51} frame will be marked by another series of 5 bars, one lying above the other, but all of them shifted to the right by 1/10 of the diagram width with respect to the previous frame. Thus 8 subsequent T_{51} frames form the typical staircase pattern shown in *Fig. 5-11*.

Multiple signals

C0 signals from different base stations have the same TDMA frame structure, however, the beginning of the T_{51} frames are randomly distributed. The time offset between the signals from different base stations means that the stairs representing the signals are shifted relative to each other. An additional element differentiating between the signals is their transmission level visualized by the color and width of the bars.

Identification of signals

On their C0 channel all base stations of a network transmit signals divided in T_{51} frames of equal length. This periodical transmission provides a simple and easy-to-measure parameter characterizing the base station: The time offset, i.e. the difference between the starting time of a base station's T_{51} frames and the T_{51} frames of the serving cell signal.

The time offsets for all base stations in an area around the interference point are generally determined in a Transmitter Scan (TS) and stored in the measurement file (see chapter 2). Inaccuracies in the TS and other effects are accounted for in a model predicting a 1-σ confidence interval for the time offset. This interval increases with the time elapsed between the TS and the interference measurement due to possible small differences in the transmission characteristics of the base stations; see section *Matching Entries: Range* on p. 5.48 ff.

On clicking a particular Sector in the *Station List* above the diagram its confidence interval for the time offset is indicated by means of 2x5 red symbols. In addition, the selected sector is shown in the headline of the dialog, as shown in *Fig. 5-13*. A short time is needed for data processing. Once a sector is selected, the other ones can be accessed by the cursor up/down keys.

The identification of the interferer is shown in the following diagram (*Fig. 5-13*). The red symbols enclose the FCCH of the selected sector. If this enclosure matches to one of the staircase interference signals, the enclosed signal can be identified with a high probability with this sector. In case that a sector does not match with a T_{51} frame there are two possible reasons:

- The sector does not cause any C0 interference on the measured channel (and is not the serving cell).
- The sector has been reset since the last TS. Such a situation might especially occur when the TS is already quite old. In case of doubt the sector must be measured again.

Examples for interpreting the interference diagram are given in chapter 2.

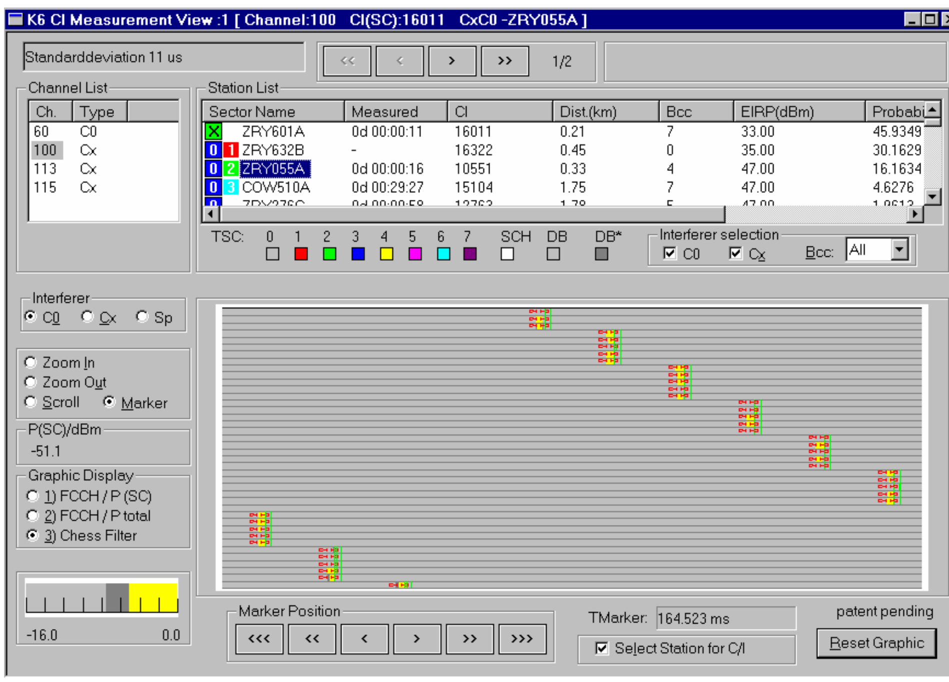


Fig. 5-13 Interference diagram: channel identification

Interference diagram for AdjC0 Interferences

The interference diagram for *AdjC0* interferences and the determination of the interfering sectors is analogous to the diagram and analysis above, however, only one T_{51} frame is measured. The display consists nevertheless of eight T_{51} frames which are obtained by repetition of the one frame measured. This can be observed in case of a incomplete frame structure e.g. due to fading effects.

Interference Diagram for Cx Interferers

The interference diagram for C0 interferers is obtained by choosing *Cx* in the *Interferer* panel. It is used to analyze C0Cx and CxCx interferences.

Interference diagram

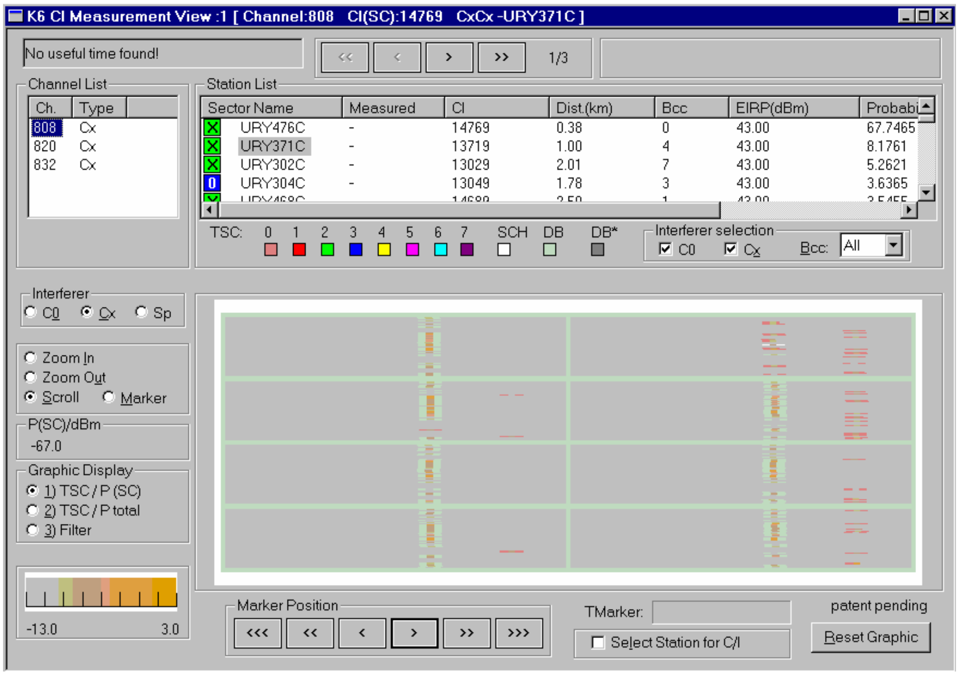


Fig. 5-14 Interference diagram: CoCx and CxCx interferences

The diagram for the traffic channel interference analysis can be interpreted in a way similar to the diagram for the C0 interferer analysis. It consists of 8 windows representing the 8 time slots of a TDMA frame, respectively, and each window contains up to 51 lines. So, the width of each window is about 577 µs. The right point of the first line in the first time slot window is continued at the left point of the first line in the second time slot window, and so on. The right point of the first line in the eighth time slot window is continued at the left point of the second line in the first time slot window. All remaining lines are to be interpreted in this way. The origin of the complete window, i.e. the upper left point of the first time slot window, corresponds to the beginning of a T_{51} frame of the SC, if the latter was measured during the last scan of the receiver.

A complete line therefore corresponds to the length of one TDMA frame and the complete window has the length on one T_{51} frame at maximum.

Representation of the signals

For every measured training sequence (MTS), a colored dot is drawn. Additionally, there are narrow lines on both sides of the colored dot specifying the underlying time slot, see the entries on the right hand side of the *TSC:* field above the diagram. So, in this diagram both the C0 signal and the traffic channel signal in the received channels are visible. In addition to the time offset and the signal strength, the information about the Training Sequence Code (TSC) of the signal is also available. The TSC may help to identify a C0 interferer in case that not all possible interfering base stations have been measured by a Transmitter Scan.

As the MTS is repeated with the same offsets in all time slots, a received signal consists of several signals aligned vertically within one time slot:

Fig. 5-15 Interference diagram: Example of a traffic channel signal

Here we have a traffic channel signal on the 5th, 7th and 8th time slot. The interrupted signal indicates that there is frequency hopping on this sector, because there is no signal in regular time intervals. A traffic channel signal can be easily distinguished from a C0 signal, as there are only SCH signals and dummy bursts in the C0 channel.

Identification of signals

The identification of the measured signals is performed in a way analogous to the identification of the signal in the C0 interference analysis. The time offset obtained by the Transmitter Scan is represented as a dashed vertical line, two bars on each side show the confidence interval:

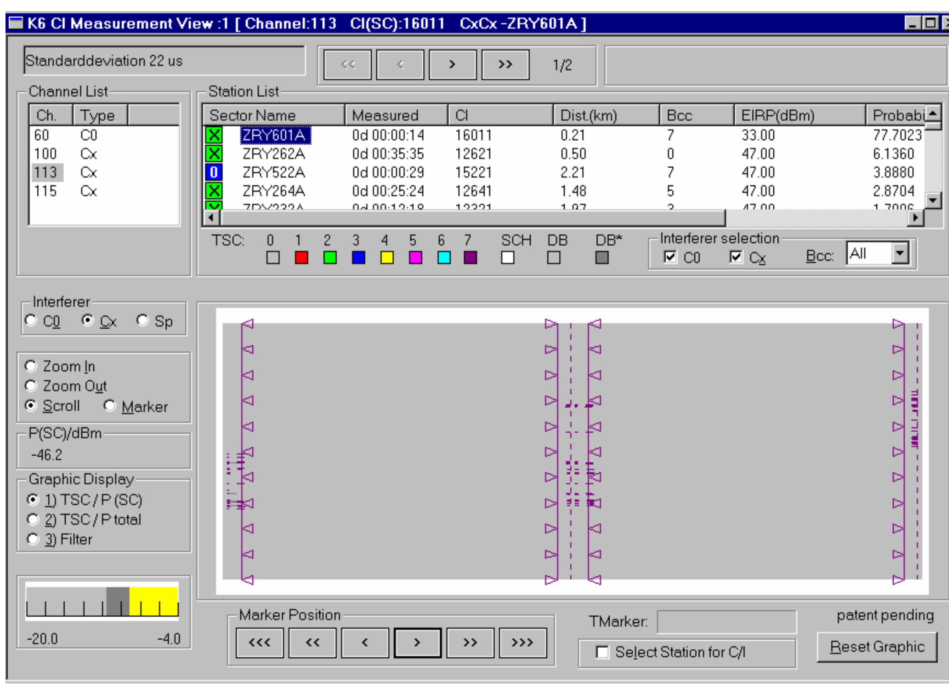


Fig. 5-16 Interference diagram: Identification of signals

The time offset and the lines for the confidence interval are shown in the same color as the narrow lines of the TSC. As the width of the time slots is 577 µs, these lines are only drawn when the standard deviation characterizing the confidence interval is 200 µs at maximum. If the standard deviation, shown in the upper left field of the dialog, is in the range between 200 µs and 1000 µs only the vertical line for the time offset is drawn, for larger standard deviations no lines are displayed.

Interference diagram for AdjCx Interferences

The interference analysis for AdjCx interferences is identical to the analysis of the C0Cx and the CxCx interference analysis.

Spectrum Analysis

Two alternative spectral views of the selected channel are obtained by choosing *Sp* in the *Interferer* panel.

Power density (dBm / 100 kHz)

Selecting *dBm / 100 kHz* in the *Graphic Display* panel calls up a diagram showing the spectral power density of the current channel in the time/frequency plane. The diagram width corresponds to 1 GSM channel width, ranging from the nominal channel frequency minus 100 kHz to the nominal channel frequency plus 100 kHz. The diagram height corresponds to the duration of a T_{51} frame, ranging from 0 ms to 51 x 8 x 577 μs $\approx$ 235 ms. The colors in the diagram express the measured power density dp/df at each time and frequency. The power density is scaled in units of dBm/100 kHz and explained in the color legend in the left lower corner of the diagram. The dynamic range of the color scale is 20 dB.

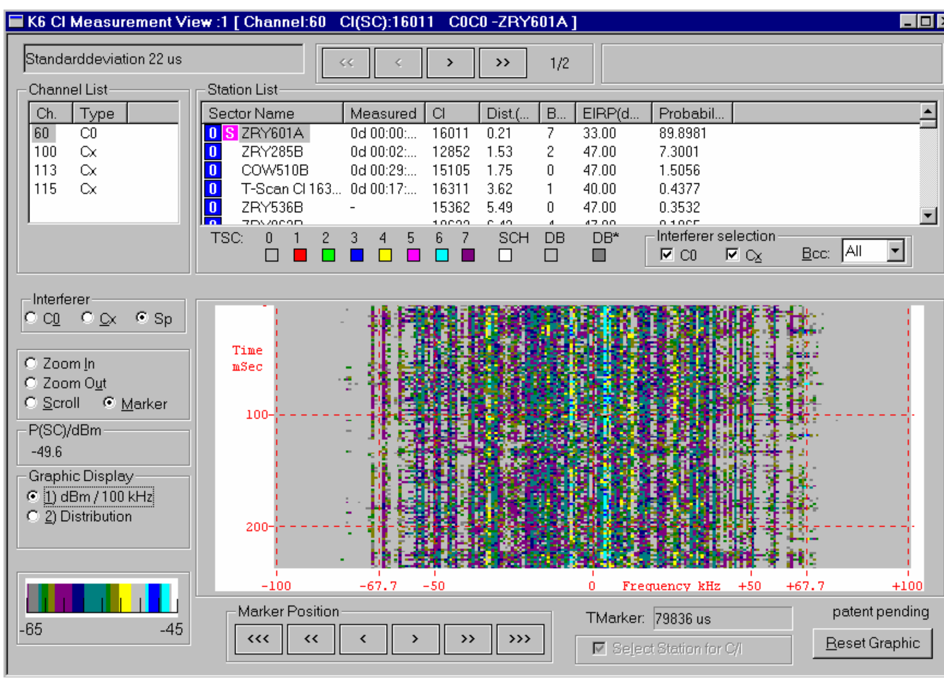
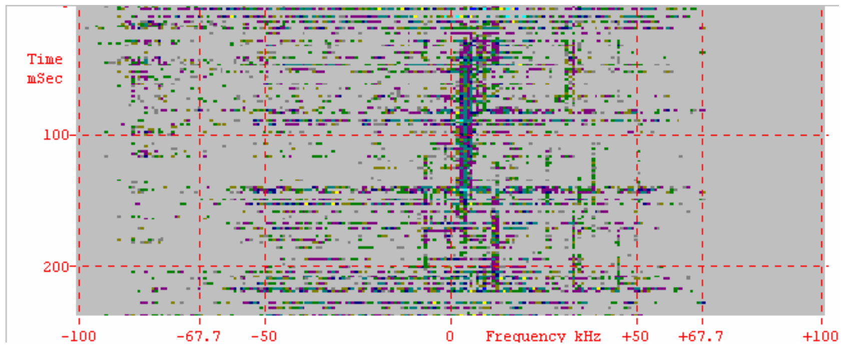


Fig. 5-17 Interference diagram: Spectrum (plane)

The measured power density and the width of the power distribution depends on the filter settings of the test receiver. For narrow filter bandwidths, the power is focussed around the center axis (nominal channel frequency = 0-kHz line) of the diagram; a signal in the vicinity of the channel borders indicate the presence of adjacent channel interferences.

The spectral view is a particularly valuable tool to detect interfering signals which do not originate from GSM networks, e.g. signals from analog transmitters. These signals can not be analyzed in the *C0* or *Cx* interference diagrams but they are visible in the spectral view because of their untypical spectral distribution. The figure below shows several vertical lines off the nominal channel frequency indicating non-GSM-specific interfering signals.



Power distribution

Selecting *Distribution* in the *Graphic Display* panel calls up a diagram showing the distribution of spectral power density values of the current channel as a function of the frequency. The diagram is a bar graph with a width of 1 GSM channel width, which is identical to the diagram width of the power density diagram (see *Fig. 5-17 above*). The bars are divided into sectors with different colors. The upper limit of each sector indicates the power density in dBm/100 kHz below which n percent of the measured values are located. The percentage n is expressed by the color of the sector and explained in the legend in the left lower corner of the diagram. The total height of each bar corresponds to the power density reached by at least 1% of the measurement results at the frequency of the bar.

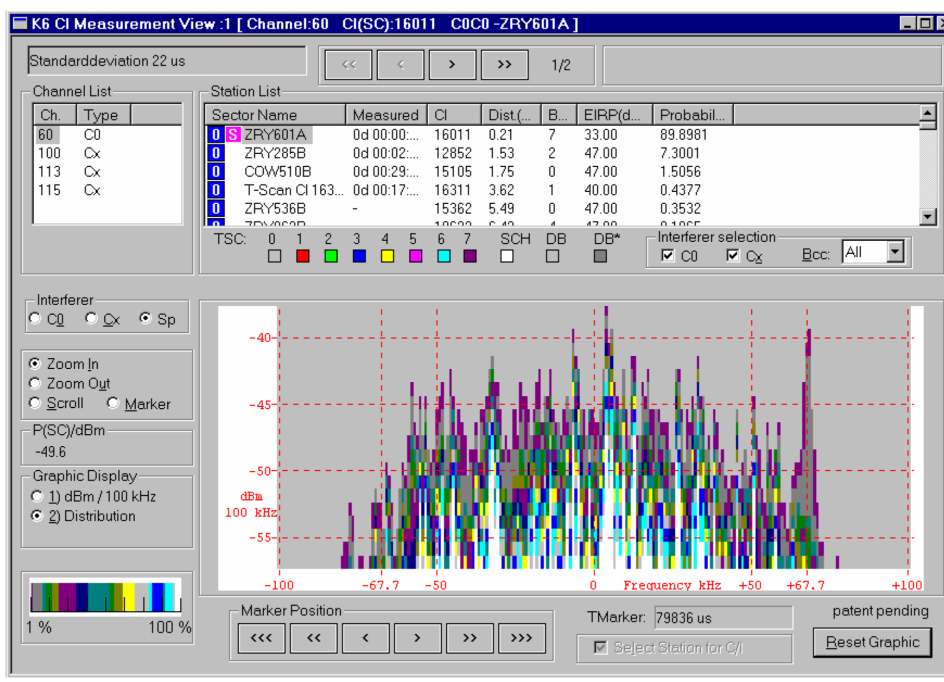


Fig. 5-18 Interference diagram: Spectrum (distribution)

K6 CI Power Analysis View

The *K6 CI Power Analysis View* shows the statistical distribution of the measured signal powers for the serving cell and up to four interferers and extracts the Carrier-to-Interference ratio.

The main purpose of the power analysis is to calculate and possibly correct the Carrier-to-Interference ratio obtained from the measured serving cell signal and a selection of interferers. This can be done primarily by varying the following parameters:

- The measurements that contribute to the C/I ratio (–> Select measurement for power analysis in the *K6 CI Main View*)
- The power measurement results within a single measurement that contribute to the C/I ratio (–> markers in the *K6 CI Measurement View*)
- The weighting rules for the calculation of average powers and C/I ratio (–> Weighted power average below)

If no power analysis is performed or nothing is modified, the default settings are applied. In particular, the default weighting rules and marker positions are used for the calculation of average powers and the C/I ratio.

- The *K6 CI Power Analysis View* dialog can be opened from the *View* menu like any other view. Alternatively it can be accessed by pressing the *Open Power Analyzer* button in the *K6 CI Main View* (see *Fig. 5-10* on p. 5.14).

Note:
The power analyzer is disabled for measurement files recorded with a ROMES version < 3.11.

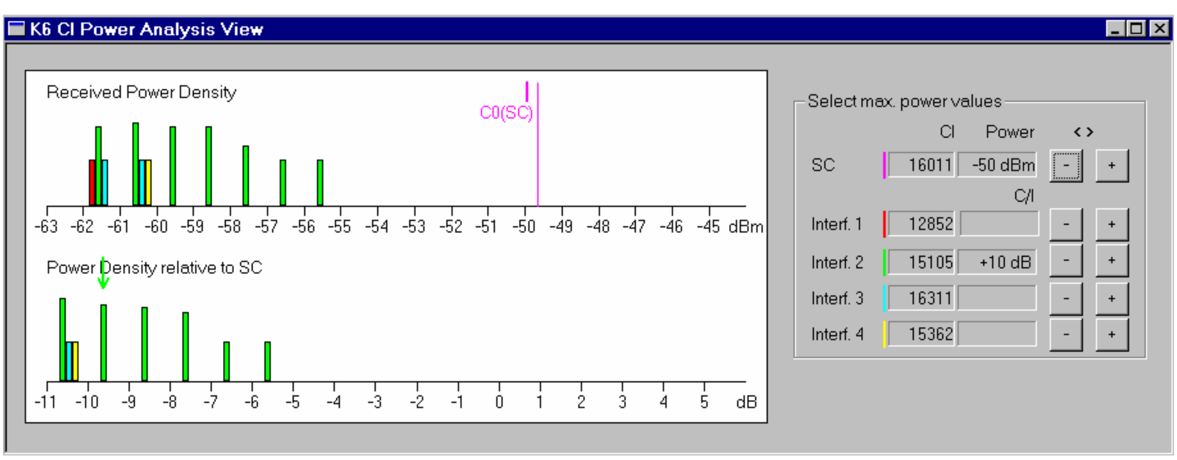


Fig. 5-19 K6 CI Power Analysis View

Power Analysis: Procedure

The *K6 CI Power Analysis View* complements the C/I analysis performed in the *K6 CI Measurement View* (see p. 5.18 ff.), providing a detailed analysis of the C/I ratio of different interfering signals.

To perform a power analysis of an interference stored in a file proceed as follows:

1. Open the *K6 CI Main View* (see p. 5.13 ff.) and load a measurement

or stack file.

2. Select the interference to be analyzed from the *Interference* list in the *K6 CI Main View*.

3. Click the *Open Power Analyzer* and *Remarks* buttons to open the *K6 CI Measurement View* and the *K6 CI Power Analysis View.*

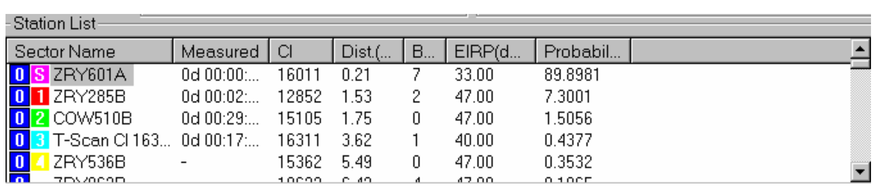
4. If desired click *Windows – Tile* to observe the three views simultaneously.

5. In the *Channel List* and the *Station List* of the *K6 CI Measurement View,* select a channel and a BTS sector to be analyzed. Use the << / < / > / >> buttons above the *Station List* to select a particular measurement for the selected channel and BTS sector.

6. Perform an interference analysis as described in sections *Interference Diagram for C0 Interferers* (p. 5.22 ff.) or *Interference Diagram for Cx Interferers*E. Preferably, open a second *K6 CI Measurement View* to view the C0 and Cx interferers simultaneously.

7. Once a sector is identified with a signal in the interference diagram check the *Select Station for C/I* box.

A colored icon on the right hand side of the channel type icon in the *Sector Name* appears, showing either the letter *S* if the selected sector is the SC, or the number of the identified interferer.


Station List

Sector Name	Measured	CI	Dist.(...	B...	EIRP(d...	Probabil...
0 S ZRY601A	0d 00:00:...	16011	0.21	7	33.00	89.8981
0 1 ZRY285B	0d 00:02:...	12852	1.53	2	47.00	7.3001
0 2 COW510B	0d 00:29:...	15105	1.75	0	47.00	1.5056
0 3 T-Scan CI 163...	0d 00:17:...	16311	3.62	1	40.00	0.4377
0 4 ZRY536B	-	15362	5.49	0	47.00	0.3532

Additionally, a set of vertical bars (markers) in the same color as the icon is drawn on the interference diagram. For the power analysis, the measured power values between those bars are taken into account, so they should match as closely as possible with the middle of the signal under consideration. If they do not match they can be (fine-)tuned with the buttons in the *Marker Position* panel. Alternatively they can also be set by choosing the *Marker* option in the panel containing the interference diagram display functions (*Zoom in* etc.) via a left mouse click on the interference diagram. The exact position of the markers is monitored in the *TMarker* field.

The SC plus up to 4 interferers can be analyzed this way. If the interferer could not be identified due to missing Transmitter Scan measurements its power can nevertheless be analyzed by taking an *Unknown Sector* at the end of the *Station List*. Note that you can only mark a sector as a C0 interferer **or** as a Cx interferer.

Power Diagrams

The diagram area contains two graphs, the *Received Power Density* (RPD) graph representing the signals of the current interference and the *Power Density relative to SC* (PDSC) graph representing the complete signal of all interference measurements selected for the power analysis (gray bars in the *K6 CI Main View* diagram).

Received Power Density

The *Received Power Density* (RPD) bar graph in the upper half of the diagram shows the distribution of the received signal power results in the current measurement, i.e. the measurement symbolized in the *K6 CI Main View* diagram by an enlarged bar with a blue frame.

If the RPD graph is missing if the BTS sector of the current measurement is not explicitly selected for the Carrier-to-Interference analysis, i.e. if the *Select Station for C/I* box in the *K6 CI Measurement View* is unchecked.

To draw the bars in the RPD graph, all power values are first rounded to integer dBm values. The height of each bar expresses the number of rounded power values obtained in the current measurement and marked in the interference diagram. This height increases logarithmically with the number of power results available at the corresponding power. The color of the bars corresponds to the color of the icons in the *Station List,* see above.

If the SC was selected for power analysis, a small arrow (in the same color as the SC) pointing to the mean value of the SC power of the current interference is displayed. This mean value, however, is not the arithmetic mean value but a weighted average (see below), where the emphasis is on the smaller power values. The reason of this choice is the following: In an interference region the smaller power values of the SC are the most sensitive, as the weak signals are most easily disturbed. The mean value can be adjusted in the *Select max. power values* panel (see below), which amounts to implicitly modifying the weighting rule.

Additionally there is a vertical line showing the mean value (arithmetic mean) of the SC displayed in the *K6 CI Measurement View*, measured directly before and after the current interference. The power at this line replaces the calculated mean value of the SC power if the latter is not available (e.g. because the SC was not involved in the power analysis).

Power Density Relative to SC

The *Power Density relative to SC* (PDSC) graph in the lower half of the diagram shows the distribution of the received signal power results in all interference measurements selected for the power analysis (gray bars in the *K6 CI Main View* diagram) referred to the power of the SC. If no measurement is selected for the power analysis (only white bars) the PDSC graph is omitted.

The PDSC graph is constructed as follows: For all RPD graphs involved the power values are shifted so that on each graph the mean value of the SC is 0. Then, all graphs are added, resulting in the PDSC graph. So, by construction, this graph contains all power values relative to the SC. Colored arrows show the weighted average of all interferers. Here, the weight is on the larger power values (see below), because these values correspond to the most disturbing signals. Again, the mean value can be adjusted in the *Select max. power values* panel (see below), which amounts to implicitly modifying the weighting rule.

Example:

If only a single measurement is selected for the power analysis, the RPD and PDSC graphs are identical, except for their scale[1]*. This is a trivial result which shows that the PDSC graph was introduced in order to combine the contributions from different measurements and interferers.*

Weighted power average

The weighted average is calculated differently for SC and interfering signals:

- For each interferer, at least 5 power measurement values are required, otherwise the result is set invalid, implying that no C/I ratio can be calculated for the corresponding interferer. If this condition is fulfilled, the upper half of the

[1] Small differences between the two graphs are due to rounding effects: The PDSC graph is calculated from the exact mean value of the SC power, not from the integer dBm value indicated in the RPD graph.

power values enter into the calculation of the average power, however, at least 10 values are used (exception: if the number of power measurement values is between 5 and 9, all values are used). So, if the measurement contains 12 power values, the 10 largest values are used, if it contains 50 values, the 25 largest values are used. The arithmetic mean value of all used values is calculated and the result is expressed as a value relative to the SC power (in dB).

- The calculation of the weighted average for the SC is done in an equivalent way, however at least 10 power measurement values are required and the lower half of the power values enter into the calculation. If less than 10 measurement values are available, the average value P(SC) from the *K6 CI Measurement View* is used.

The weighting algorithms for the power can be modified implicitly by adapting the average power result or C/I in the *Select max. power values* panel; see below.

Combining C0 and Cx measurements

The weight of a single measurement in the PDSC graph is proportional to the number of power measurement results available in this measurement (provided that they are marked in the interference diagram, see below).

- In a C0 measurement a maximum of 40 values is obtained (the interference diagram contains 40 lines).
- In a Cx measurement a maximum of 408 values is obtained (1 value per measured slot).

This implies that the relative influence of the Cx measurements on the C/I value can exceed the influence of the C0 measurements by a factor of almost 10.

Influence of the marker position

The power analysis only takes into account the measurements that are located between the marker lines in the interference diagram. Shifting the markers to the right and left in the diagram generally changes the selection of measurements and the power analysis.

Important note on marker positions and power analysis:
The positioning of the markers is at the discretion of the user. The automatic marker positions may not necessarily correspond to the desired selection of measurement results.

Select max. power values

The +/- buttons in the *Select max. power values* panels can be used to change the mean SC power and C/I ratio calculated according to the weighting rules described above in steps of ±1 dB. This effectively modifies the default weighting rules:

- A larger mean value for the SC power implies that more importance is attributed to larger SC powers and vice versa.
- A larger C/I ratio implies that more importance is attributed to larger interferer powers and vice versa.

K6 Remark Editor View

The *K6 CI Remark Editor View* shows the absolute signal power and the Carrier-to-Interference ratio of up to four interferers in a common diagram.

The *K6 CI Remark Editor View* dialog can be opened like any other view from the *View* menu. Alternatively it can be accessed by pressing the *Remarks* button in the *K6 CI Main View* (see *Fig. 5-10* on p. 5.14).

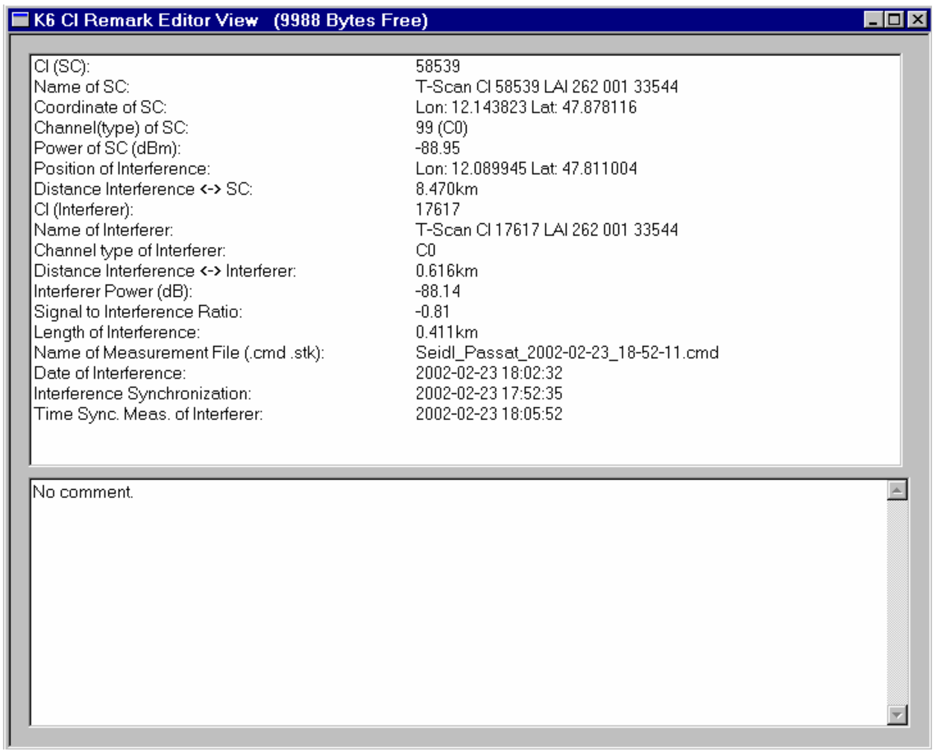


Fig. 5-20 K6 CI Remark Editor View

The *K6 CI Remark Editor View* is split into two areas:

- The upper area the *K6 CI Remark Editor View* displays detailed information on the BTS sector currently analyzed in the *K6 CI Measurement View* (see p. 5.18 ff.). To obtain a result, a sector must be selected and the *Select Station for C/I* box in the *K6 CI Measurement View* must be checked.
- In the lower area it is possible to enter and edit a comment to the current BTS sector. A context menu is opened on right-clicking a point in the lower area, allowing copy and paste text or undo changes. The user comment is saved to the measurement file together with the results of the interference and power analysis; see *Save* button in the *K6 CI Main View* (p. 5.13 ff.).

K6 Trigger View

The *K6 Trigger View* shows the current trigger status of all connected test mobiles including the trigger conditions set in the *C/I Driver Configuration* menu.

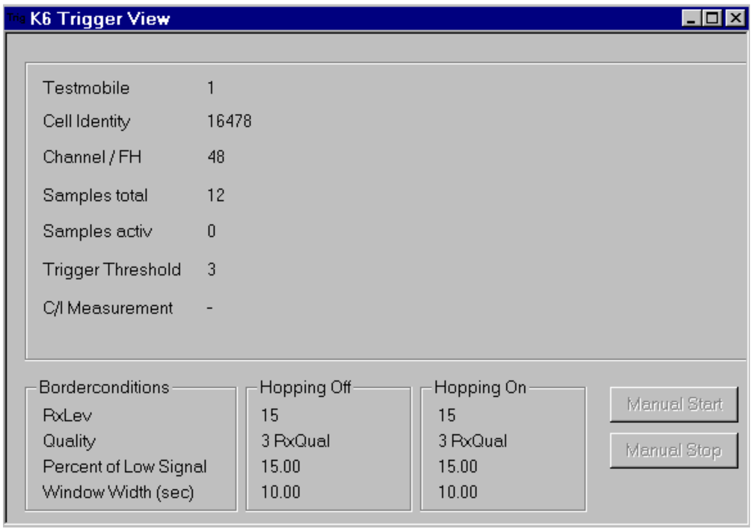


Fig. 5-21 K6 Trigger View

The view is divided into the main panel to show the current trigger state, three panels below to indicate the trigger conditions and two buttons to initiate and stop manual tracking mode (see sections *Manual Start* on p. 5.35 ff. and

Manual Stop on p. 5.36 ff.).

Main Panel

Each column in the main panel shows the trigger state of one test mobile connected to one sector. The signals are stored and displayed for the duration of the *Monitoring Interval* set in the *C/I Driver Configuration* menu (see chapter 6). This implies that, immediately after a successful handover, one mobile can appear in several columns for the duration of the *Monitoring Interval*.

Test Mobile

Current number of the test mobiles.

Channel/FH

Channel of the serving cell if there is no frequency hopping or *FH* if frequency hopping occurs.

Samples total

Total number of trigger evaluations made. The trigger criteria are checked continuously in the Transmitter Scan mode; each trigger evaluation yields the RxLev and RxQual values (see chapter 6).

Samples Active

Number of trigger evaluations fulfilling the trigger conditions (i.e. evaluations where both RxLev and RxQual exceed the limits shown in the *Border Conditions* panel).

Trigger Threshold

Number of trigger evaluations used to check the trigger conditions (this number is given by the *Monitoring Interval (sec.)* set times the number of trigger evaluations per second).

C/I Measurement

Result of the trigger evaluation. The values are:
- No interference measurement detected.
! Interference measurement detected.
* Interference measurement started.

Border Conditions The three panels below the main panel show the trigger conditions set in the *Setup C/I Driver* tab of the *C/I Driver Configuration* menu (see chapter 6). The conditions can be set independently for serving cells that operate at constant frequency *(Hopping Off* column) or in frequency hopping mode *(Hopping On* column).

Manual Start

As an alternative to constantly monitoring the trigger conditions, it is possible to initiate or stop an interference measurement any time irrespective of the coverage situation. *The Manual* Start button is available while a Transmitter Scan is running provided the drivers necessary for an interference measurement are loaded. This button opens the *Trigger Simulation* window.

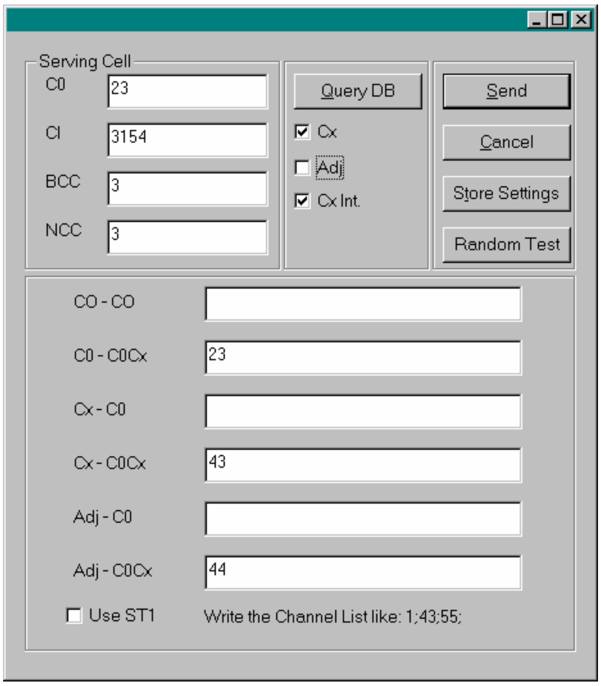


Fig. 5-22 Trigger Simulation

Serving Cell Panel to specify the parameters identifying the serving cell: Channel number of the C0 channel, Cell Identity, BTS Color Code, National Color Code.

Query DB Based on the given (incomplete) data from the *Serving Cell* panel, the *Query DB* button reads the remaining data and the C0 channel from the BTS data base. In case that the *Cx* and the *Adj* boxes are checked, the traffic channels and the adjacent channels are determined, too. If the *Cx Int.* box is checked, the channels are additionally written into the dialog fields where the Cx interferences are measured. If the given data is not unique in the network, the nearest serving cell with matching data is taken.

Send Triggers an interference measurement.

Random Test On pressing this button instead of the *Send* button, the interference is triggered randomly with time intervals of random duration. The *Random Test* is stopped by sending the *Manual Stop* command. This feature is for test purposes only.

Cancel Discards all settings made and closes the *Trigger Simulation* window without triggering an interference measurement.

Store Settings Store the serving cell and channel settings in the windows registry. These settings are also stored when the *Send* button was used.

Channel selection panel The input fields in the panel in the lower half of the dialog select the channels for the different interference types to be measured. If an input field is empty, the corresponding interference type is not measured:

C0 – C0
Measures C0 interferences on the C0 channel of the SC.

C0 – C0Cx
Measures C0 and Cx interferences on the C0 channel of the SC.

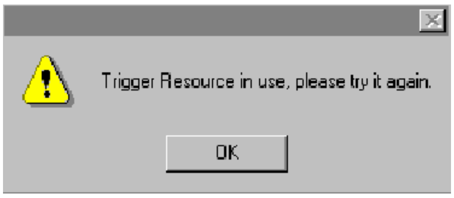
Cx – C0
Measures C0 interferences on the given traffic channels of the SC.

Cx – C0Cx
Measures C0 and Cx interferences on the given traffic channels of the SC.

Adj. – C0
Measures C0 interferences on the given adjacent channels of the SC.

Adj. – C0Cx
Measures C0 and Cx interferences on the given adjacent channels of the SC.

The message



is displayed if the trigger is busy evaluating data from the mobile. In this case, try to trigger again; if this trial fails again wait until the test mobile has disconnected.

Use ST1 If *Use ST1* is selected the channels of the serving cell listed in system information type 1 (ST1) are measured.

Note:
This feature is available with if the R&S GSM Demodulator driver of option ROMES-GS is loaded and configured for demodulation of ST1 messages (see chapter 6). In addition a Transmitter Scan of the serving cell including demodulation of the ST1 messages must be available.

Manual Stop

The *Manual Stop* command stops a manually triggered interference measurement and switches back to the Transmitter Scan mode.

K6 TS View

The *K6 TS View* command opens the view window to monitor the level of the signals recorded during the Transmitter Scan (TS) and the color codes (BCC) of the corresponding base stations. During the TS the test receiver performs a cyclic scan of all channels selected in the driver configuration menu; the *K6 TS View* window shows a subset of these channels where a signal was received.

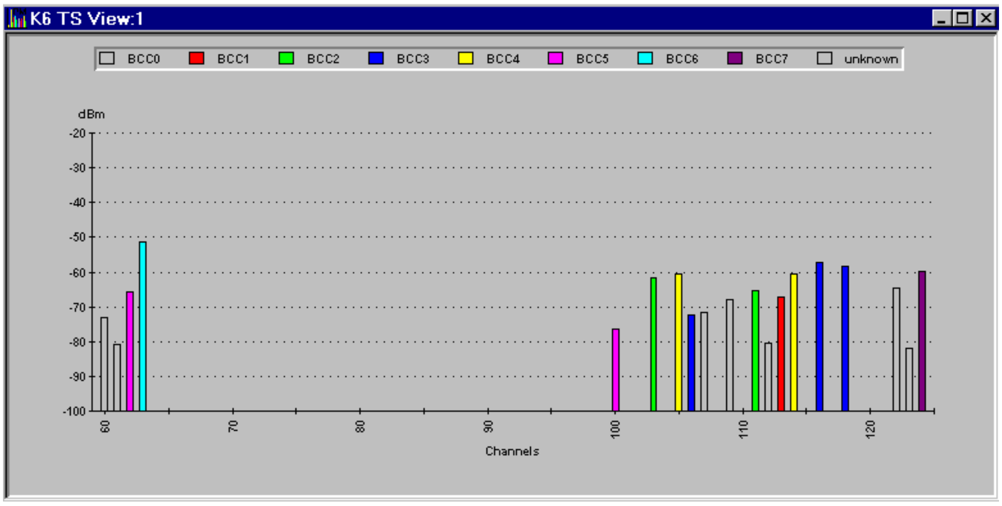


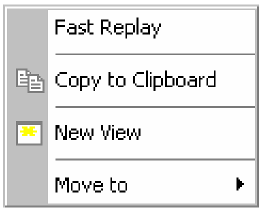
Fig. 5-23 K6 TS View

Channel diagram The channel diagram is a bar graph representing the measured signal power (in dBm) as a function of the channel numbers.

Thus the abscissa scale is given by the channel numbers selected for the TS. The ordinate scale is fixed, with signal powers ranging from –100 dBm to –20 dBm.

Legend The colors of the bars in the channel diagram denote the BCC of the measured signal in this channel. If no color code could be measured an empty bar is drawn.

Context menu A right mouse click on any point in the view opens the context menu to (de-)select the view for fast replay, copy the current view to the clipboard, create or delete views, or move to another worksheet; see context menu description at the beginning of chapter 4. Note that up to two *K6 TS* views can be opened at the same time.



K6 TS Notification

The *TS Notification* module indicates successful Transmitter Scans (TS) of selected BTSs.

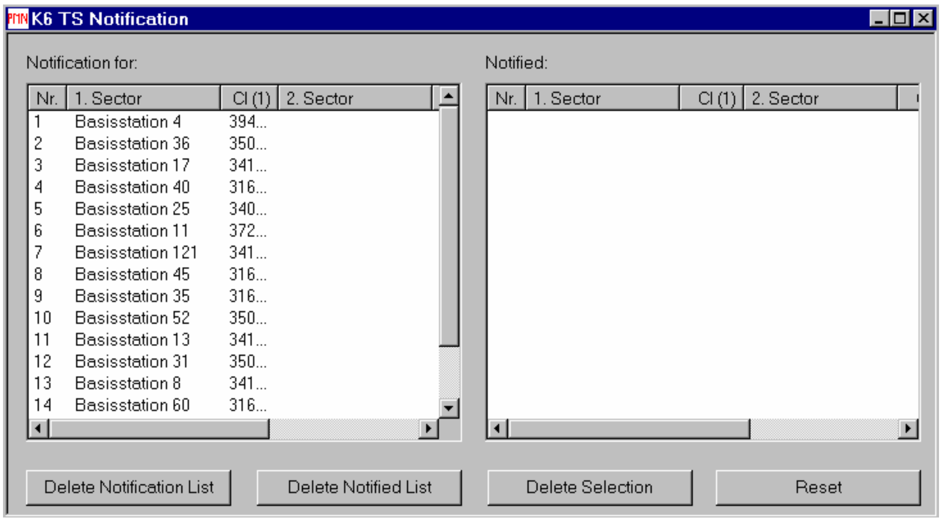


Fig. 5-24 TS Notification

Lists

The *Notification for:* list on the left side contains all BTS for which a notification will be given in case of a successful TS. Usually every two minutes, the view is updated and all BTS from the *Notification for:* list which could be measured in a TS since the last update are shifted to the *Notified:* list on the right hand side. The entries in the list are:

Nr.

Enumerates the BTS in the list. This number is unique for a BTS as long as it is in the *TS Notification* window, so this number is also used in the *Notified* list.

n. Sector

Sector name

CI(n)

Cell Identity

Selecting BTSs to be notified

There are three alternative ways to fill the *Notification for* list:

- Selection of a particular BTS to be notified in the *BTS Information* dialog *(TS Notification* button, see *Fig. 5-5* on p. 5.7).

- Selection of several BTSs to be notified in the *BTS Station* dialog (see *Fig. 5-4* on p. 5.5). To select all BTSs in a given area and with specified properties for notification proceed as follows:

  1. Open the *Route Track* view and right-click on a point inside the view to open the context menu.

  2. In the context menu, click *C/I Layer – DB Query...* to open the *BTS selection (Search Sector)* dialog, set the conditions for BTS selection (see section

  3.

  4.

5. DB Query on p. 5.11 ff.) and click *Apply*.

6. In the context menu, click *C/I Layer – Show BTS List* to open the *BTS Station* dialog with the list of selected BTSs and click *TS Notification (All)*.

The selected BTSs are now displayed in the *Notification for* list of the *TS Notification* dialog.

- In both of the above-mentioned dialogs there are also buttons *Add to stack* and *Add to stack (All)*. With these buttons, the corresponding BTS can be stored in a stack file, which can be loaded on every start of a measurement. Note that an arbitrary number of BTS can be stored in one stack file together with interference to be reassigned. Each BTS data record contains a timestamp indicating its storage time in the stack file. On loading the stack file, the program first checks whether a measurement for the BTS **newer** than this time stamp exists. If this is the case, the BTS is immediately written to the *Notified* list. So, one stack file can be used for several measurement tours to complement the desired TS information.

Notification Lists The *Notification for:* list on the left side contains all BTS for which a notification will be given in case of a successful TS. Usually every two minutes, the view is updated and all BTS from the *Notification for:* list which could be measured in a TS since the last update are shifted to the *Notified:* list on the right hand side. The entries in the list are:

Nr.
Enumerates the BTS in the list. This number is unique for a BTS as long as it is in the *TS Notification* window, so this number is also used in the *Notified* list.

n. Sector
Sector name

CI(n)
Cell Identity

Delete Notification List Deletes all base stations from the *Notification for* list.

Delete Notified List Deletes all base stations from the *Notified* list.

Delete Selection Deletes all selected base stations from both lists (to select a base station click on its number using the left mouse button; to select several BTSs use the Ctrl key in addition).

Reset Resets both lists, i.e. both lists are deleted and the enumerator gets a reset, too.

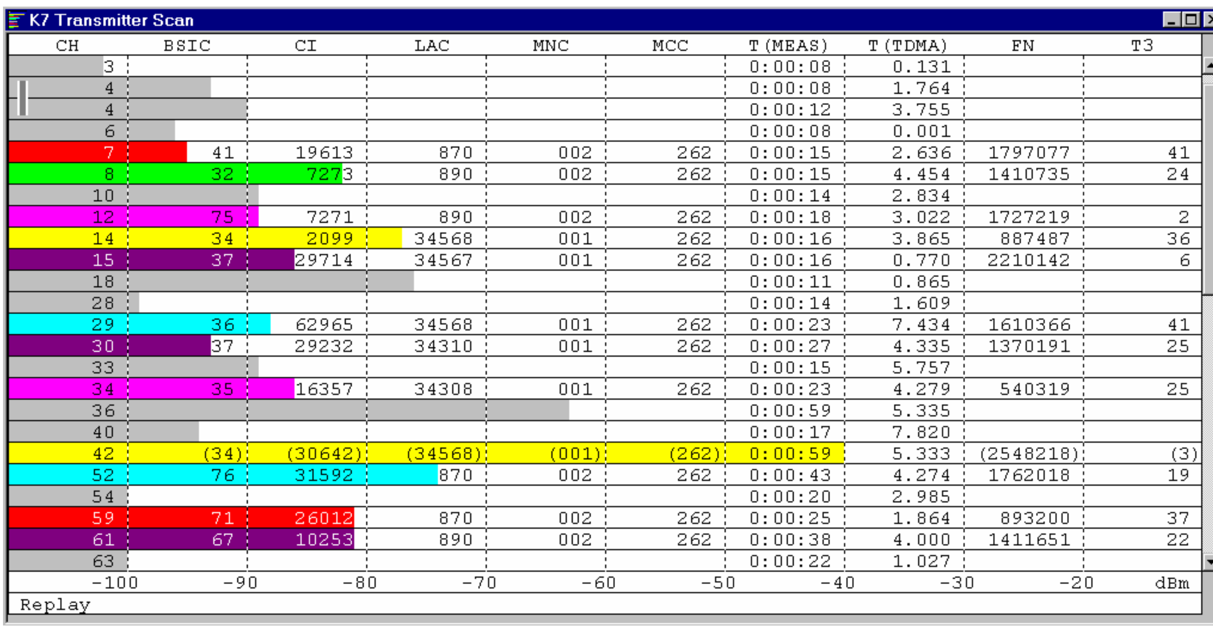
The *TS Notification View* has no context menu for configurations assigned. The *Info* tab can be accessed via the *Configuration – Settings* command.

K7 Transmitter Scan View

The *K7 Transmitter Scan View* displays the data measured by the test receiver during the Transmitter Scan and demodulated by the *R&S GSM Demodulator*. The data also contains information transmitted on the Synchronization Channel (BSIC and TDMA frame number) and the *System information Type 3* of the BCCH.

Note:
The R&S GSM Demodulator driver of option ROMES-GS must be installed to view data in the K7 Transmitter Scan View.

The results are arranged in different rows:



K7 Transmitter Scan

CH	BSIC	CI	LAC	MNC	MCC	T(MEAS)	T(TDMA)	FN	T3
3						0:00:08	0.131		
4						0:00:08	1.764		
4						0:00:12	3.755		
6						0:00:08	0.001		
7	41	19613	870	002	262	0:00:15	2.636	1797077	41
8	32	7273	890	002	262	0:00:15	4.454	1410735	24
10						0:00:14	2.834		
12	75	7271	890	002	262	0:00:18	3.022	1727219	2
14	34	2099	34568	001	262	0:00:16	3.865	887487	36
15	37	29714	34567	001	262	0:00:16	0.770	2210142	6
18						0:00:11	0.865		
28						0:00:14	1.609		
29	36	62965	34568	001	262	0:00:23	7.434	1610366	41
30	37	29232	34310	001	262	0:00:27	4.335	1370191	25
33						0:00:15	5.757		
34	35	16357	34308	001	262	0:00:23	4.279	540319	25
36						0:00:59	5.335		
40						0:00:17	7.820		
42	(34)	(30642)	(34568)	(001)	(262)	0:00:59	5.333	(2548218)	(3)
52	76	31592	870	002	262	0:00:43	4.274	1762018	19
54						0:00:20	2.985		
59	71	26012	870	002	262	0:00:25	1.864	893200	37
61	67	10253	890	002	262	0:00:38	4.000	1411651	22
63						0:00:22	1.027		
-100	-90	-80	-70	-60	-50	-40	-30	-20	dBm

Replay

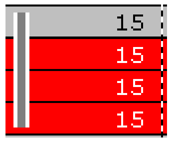
Fig. 5-25 K7 Transmitter Scan View

Each table row corresponds to a GSM downlink signal received from one BTS. It is underlined with a gray or colored bar, where the color denotes the measured BCC (the second digit of the octal BSIC), with the same color legend as in the *K6 TS View* (see p. 5.38 ff.). Gray bars and brackets in the table row characterize how complete or how recent the displayed results are; see section *Info Levels* on p. 5.44 ff. The length of this bar corresponds to the received SCH power, according to the dBm scale displayed across the bottom of the view.

The power bars in the K7 Transmitter Scan *view indicate the power on the Synchronization Channel (SCH). This power generally differs from the GSM downlink signal power obtained in a CW measurement.*

The columns contain the following information:

CH The number of the measured channel. If two or more consecutive lines are measurements on the same channel, they are marked with a vertical bar:



BSIC BSIC in octal representation. The first digit denotes the NCC, the second the BCC.

CI Cell Identity.

LAC Location Are Code (decimal).

MNC Mobile Network Code (in BCD code format).

MCC Mobile Country Code (in BCD code format).

The four preceding elements uniquely identify a BTS worldwide. So this set of information is especially useful in border regions where two network operators may share the same frequency range, to identify a BTS of a network when there is no base station list available.

T(MEAS) Time (hh:mm:ss) indicating the last measurement update of the displayed line. The time is counted from the start of the measurement. Although *T(MEAS)* is displayed in seconds it is internally stored in µs. This is important when *T(MEAS)* is used for sorting, see *Sort Sequence* on page 5.46.

T(TDMA) Time offset of the correlated burst. This time is given by *T(MEAS)* modulo one TDMA frame. The unit is the length of one time slot, so the range is $0 \leq \mathrm{T(TDMA)} < 8$.

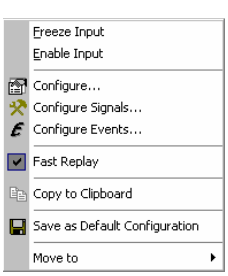
FN TDMA frame number of the correlated burst in the range 0 to FN_MAX where FN_MAX = (26 x 51 x 2048) -1 = 2715647 (one hyperframe length) as specified in GSM 05.02. The FN is obtained from the measured Synchronization Channel (SCH). The *FN* column shows the FN at T(TDMA) which is calculated from the FN at the SCH time T(SCH) and the time offset between T(SCH) and T(TDMA)*;* see Fig. 5-26 *below*.

T3 Frame number FN modulo 51 (one multiframe length).

Notes:

In case that two sectors are synchronized, both values T3 and T(TDMA), are identical up to a measurement error. Synchronization can be checked this way. For the interference analysis identical values of T3 and T(TDMA) imply that the signals in the interference diagram are on identical positions and cannot be distinguished.

Context menu A right mouse click on any point in the view opens the context menu to access the configuration menus, (de-)select the view for fast replay, copy the current view to the clipboard, or move to another worksheet; see context menu description at the beginning of chapter 4. The context menu contains the following additional commands:



Freeze Input

Additional input from the measurement or replay is not displayed. Meanwhile, the data is still stored during measurement. Sorting of the data and changes in the parameter settings are possible during input freezing.

Enable Input

Terminates the input freezing.

Config...

Opens the K7 Transmitter Scan View configuration menu, see K7 Transmitter Scan View Configuration on p. 5.45 ff.

Frame Timing

The values *T(MEAS), T(TDMA)* and *FN* are visualized in the following figure:

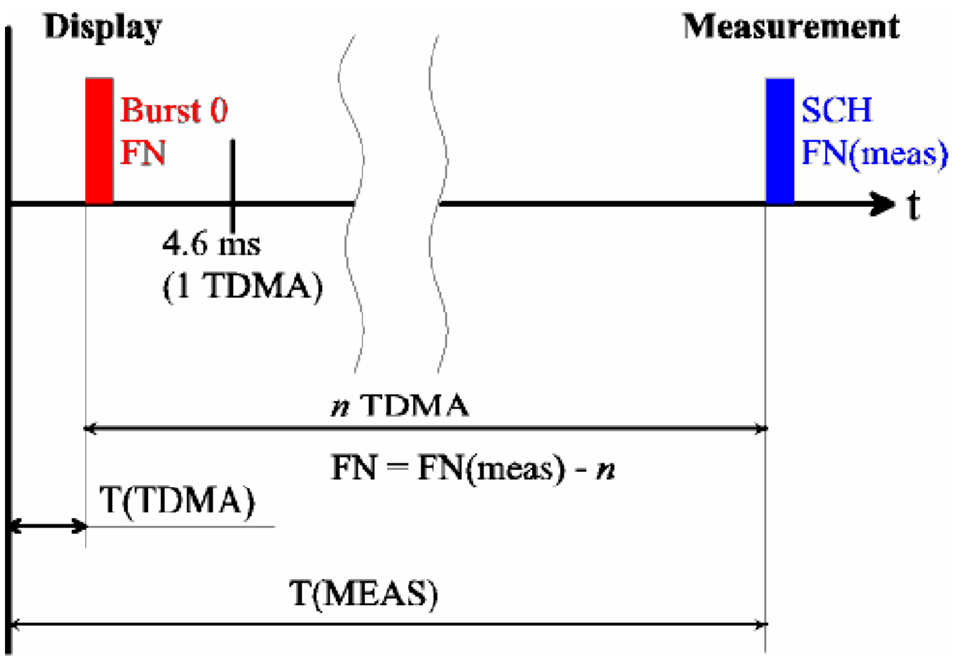


Fig. 5-26 Display of the K7 Transmitter Scan View time measurements

The start of the measurement is shown as a vertical bar on the left side of the diagram. At *T(MEAS)* a SCH is detected and demodulated, giving the information about the BSIC and the TDMA frame number *FN(MEAS)*. *T(MEAS)* is shifted back to the time period of the first TDMA frame after the start of the measurement by subtracting the duration of *n* TDMA frames. This yields the value *T(TDMA)*. In the same way, the demodulated frame number is reduced by *n* (modulo 2715648). So, both values, *T(TDMA)* and *FN* denote the measurement time and frame number of a BTS if it would have been measured within the first TDMA frame period after the start of the measurement assuming no drift of both the BTS and the test receiver and assuming no timing advance due to different measurement locations.

The advantage of this definition of frame numbers and measurement times is that the values for one BTS are approximately constant with only small changes produced by:

- Drift of the BTS
- Drift of the test receiver
- Time shift on different measurement locations due to the finite speed of light
- Different offset times when repeater signals are received
- Additional time delay produced by reflections

Info Levels

The Transmitter Scan distinguishes three different info levels, depending on the amount of information that could be extracted from the received signal. At level 3 the most complete information is available.

Info level 1 A C0 channel of a BTS could be identified by correlating the FCCH and the extended training sequence of a SCH burst. As a result, the C0 channel number, the measured power of the BCCH signal and the frame synchronization time are known.

Info level 2 This info level is reached when the SCH could be reliably demodulated. The validity of the demodulated data is checked with the 10 parity bits available, so the probability that an error is not detected is about 1/1000. However, as the values have restricted ranges, this probability can be improved to an estimated 1/3000.

Because this probability is still too high, the data is only considered to be reliable if there are at least two independent SCH demodulations of one BTS reducing the error rate to a negligible value. The probability that an error is not detected is reduced to less than the factor (1/3000)^2, because the comparison of the SCH content of both signals provides an additional constraint.

The additional information obtained at this info level is the BCC, NCC and frame number. As soon as this info level is reached, the bars showing the measured power become colored.

Info level 3 The info level 3 is reached when the system information type 3 on the BCCH channel could be demodulated. The additional information obtained is the Cell Identity (CI), Location Area Code (LAC), Mobile Network Code (MNC) and Mobile Country Code (MCC).

By default, every new measurement result is compared with those already shown in the list. The values of a measurement in the list matching with the new one are updated. If the older measurement had a higher info level, the old values missing in the new measurement are kept in the display, indicated by values in brackets. This behavior can be changed in the configuration menu; see description of *Matching Entries: Action* panel on p. 5.47*.* The decision algorithm for two measurements belonging to the same BTS is described on p. 5.48.

K7 Transmitter Scan View Configuration

The *K7 Transmitter Scan* configuration menu defines criteria for the Transmitter Scan, sets conditions to decide whether two measurements belong to the same BTS and shows information on the current view version. It can be accessed via right mouse click at a point inside *K7 Transmitter Scan* or via the *Configuration – Settings* command (see chapter 3).

The *Transmitter Scan View Configuration* tab defines criteria for the Transmitter Scan, complementing the settings in the C/I driver configuration menu (see chapter 6).

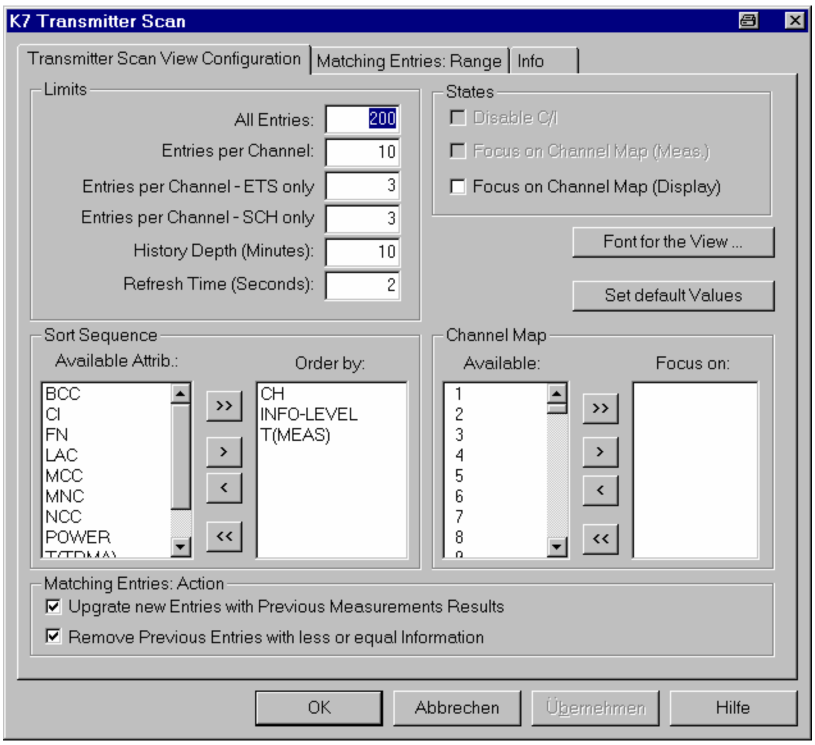


Fig. 5-27 Transmitter Scan View Configuration

This configuration dialog contains the following panels:

Limits

Limits the displayed data. The entries denote the following limitations:

- All Entries: The maximum number of signals displayed.
- Entries per Channel: The maximum number of signals displayed for each channel.
- Entries per Channel – ETS only: The maximum number of entries per channel which only have reached info level 1 (ETS: Extended Training Sequence).
- Entries per Channel – SCH only: The maximum number of entries per channel which only have reached info level 2.
- History depth (Minutes): Entries which have not been updated during the given amount of time are discarded from the display.
- Refresh Time (Seconds): The display is refreshed every time the Refresh Time has passed. Using higher values avoids the flickering of the diagram.

When the number of measurement data exceeds the above limitations, the oldest entries are discarded in the view.

Sort Sequence

Specifies the criteria how the lines in the display are sorted.

Available Attrib.
List of available criteria (attributes). Any attribute can be selected to be appended to the end of *Order by:* list; see description of buttons below.

Order by
Specifies how the lines are sorted. In the example of *Fig. 5-27 above* the list is sorted according to channel numbers, all lines with the same channel number are sorted according to their info level, and so on. Sorting is always in ascending order.

The buttons between the two lists move a selected entry from one list to the other:

>>	Removes the elements from the *Order by:* list and loads the default values.
>	A selected element in the Available Attributes list is moved to the end of the *Order by:* list. Alternatively, the element can be double clicked.
<	A selected element in the *Order by:* list is moved to the *Available Attrib*. list. Alternatively, the element can be double clicked.
<<	Empties the *Order by:* list.

Note:
The measurement time T(MEAS) is stored internally in microseconds, although it is displayed in seconds. So it is recommended to use T(MEAS) only as a last sorting criteria in the Order by: list.

States

The *States* panel can be used to restrict the measurement (and display) range, overriding the corresponding values in the C/I driver configuration menu. Note that these restrictions can be changed even during a running measurement.

Disable C/I

Selecting this option disables the interference measurement, regardless of the trigger conditions. The Transmitter Scan is performed without any interruption. Unlike with the *Transmitter Scan only* option in the C/I driver configuration menu (see chapter 6), the database is still automatically updated.

Focus on Channel Map (Meas)

Restricts the Transmitter Scan to the channels selected in the *Channel Map* panel (see below). This feature is especially useful in the situation where a stationary Transmitter Scan is carried out using a directed antenna turned around manually in order to obtain information about particular interferences of interest. Here, only the data of some channels need to be acquired. Restricting the channel range reduces the measurement time because it is not necessary to wait for a complete channel cycle of the test receiver for each direction.

Focus on Channel Map (Display)

Restricts the displayed channels to those on which the focus is set in the *Channel Map* panel (see below).

Channel Map

The *Channel Map* is used to select the channels on which a focus can be set in the *States* panel (see above). It consists are two lists: The list with the available channels according to the settings in the C/I driver configuration menu (see chapter 6), and a list of channels specifying the focus when a corresponding item in the *States* field is selected.

The buttons between the two lists move a selected entry from one list to the other; see *Sort Sequence* above.

Matching Entries: Action

The *Matching Entries: Action* panel determines how a new entry to the *K7 Transmitter Scan* view is displayed if it matches with one that was recorded before.

Upgrade new Entries with Previous Measurement

Results

If this box is checked the entries in the old measurement are updated even if the new measurement has reached a lower info level. The missing entries in the new measurement result are taken over from the old entry and displayed in brackets. If the box is not checked, a new measurement with a lower info level is displayed in a separate line.

Remove Previous Entries with Less or Equal

Information^A new measurement only updates the old one if this item is selected, otherwise it is displayed in a separate line. Deselecting this item allows e.g. to investigate the drift behavior of a BTS.

Matching Entries: Range

For the decision whether two measurement results originate from the same BTS the following criteria apply:

- The decoded information available in both signals (info level 2 or 3) must correspond.
- The offset times of both bursts must match to some measurement error.

The *Matching Entries: Range* tab sets the criteria for the allowed measurement error in order to decide whether criterion 2 is fulfilled. In case of doubt it is recommended to keep the default values.

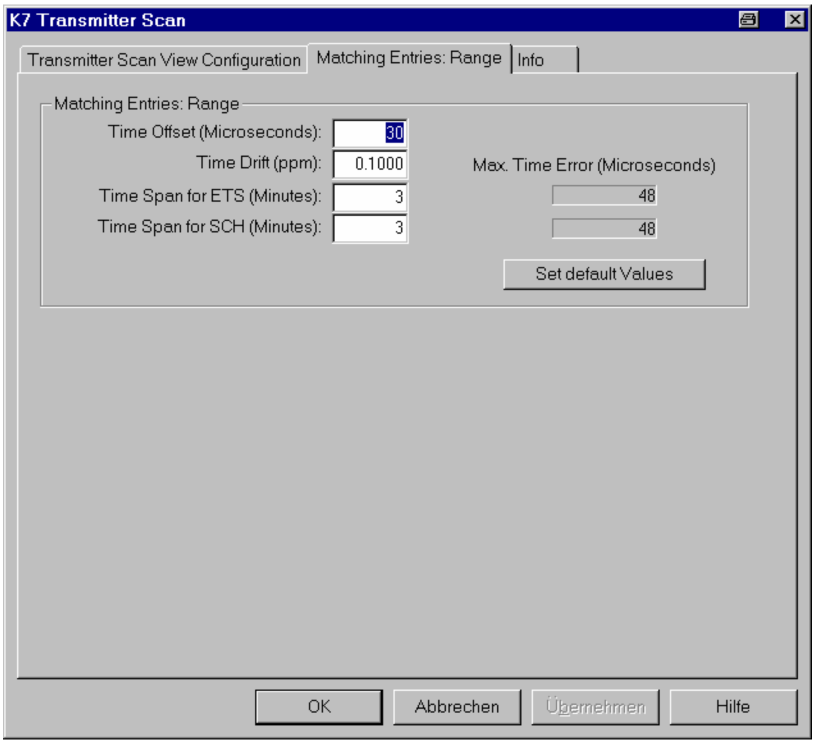


Fig. 5-28 K7 Scan View Configuration: Matching Entries: Range

The matching entries are illustrated in the following figure:

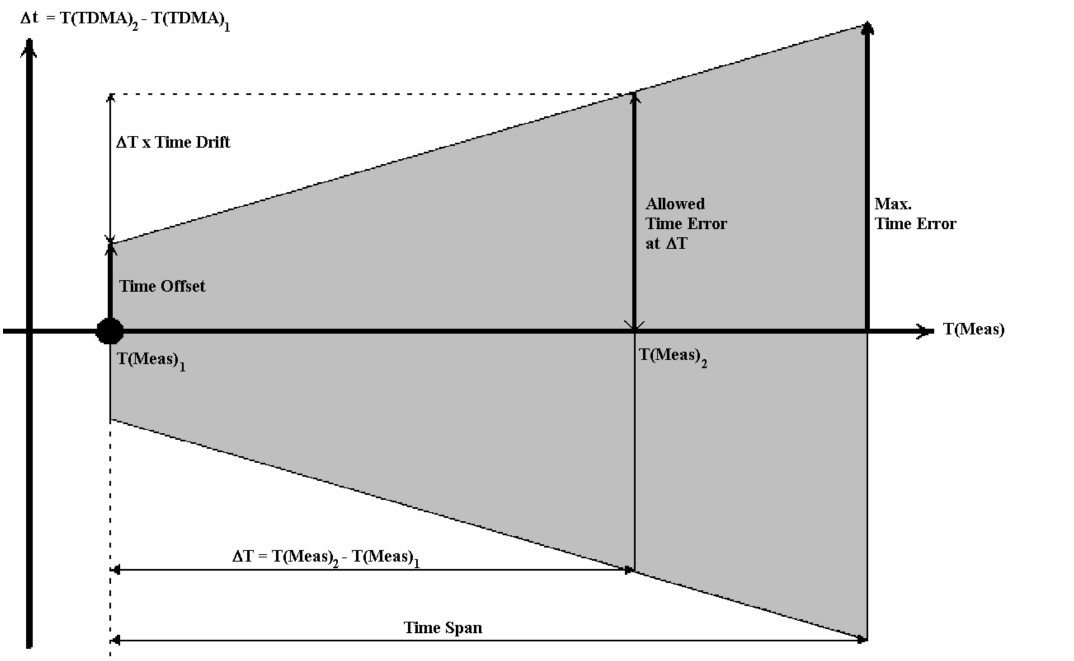


Fig. 5-29 Matching Entries: Range Parameter Explanation

The decision whether two detected signals originate from the same BTS is based on a comparison of the measurement times T(Meas) for both signals and of their measured time offsets T(TDMA). *Fig. 5-29 above* The figure shows the matching entries in the T(Meas)-T(TDMA)-plane: If the large dot at $T(Meas)_1$ corresponds to the measurement result for signal 1 and the result for signal 2 is within the shaded area, then the two signals are considered to originate from the same BTS. If both signals contain at least info level 2, then the TDMA frame number is compared in addition, which extremely enhances the accuracy.

Matching Area The shaded matching area in *Fig. 5-29* is bordered by the measurement time of the first signal detected $T(Meas)_1$, the measurement time $T(Meas)_1$ plus the *Time Span,* and the straight lines parametrized by the equations

$$\Delta t = \pm\,(<\textit{Time Offset}> + <\textit{Time Drift}> \times [T(Meas) - T(Meas)_1])\ .\ \text{(Equation 1)}$$

The *Time Offset, Time Drift,* and *Time Span* can be entered in the input fields in the *Matching Entries: Range* tab. They provide estimates for possible errors from different sources that might cause the measured time offsets T(TDMA) for two signals from the same BTS to be different.

Time Offset Difference of the measured time offsets T(TDMA) for two signals due to measurement inaccuracies, e.g. caused by reflections.

Time Drift Drift of T(TDMA) in time, caused by the BTS, the receiver, or a time delay due to a location update.

Time Span for... Maximum difference of the measurement time beyond which two signals are generally considered to be different. The *Time Span* can be set independently for the case that at least one signal has only reached info level 1 (*Time Span for ETS)* and for the case that both signals have reached at least info level 2 (*Time Span for SCH)*. In the latter case, higher values for the *Time Span* are reasonable, because the inclusion of the TDMA frame number minimizes the accidental time offset coincidences considerably.

Max. Time Error Maximum time error allowed calculated according to Equation 1 above, where T(Meas) = Time Span; for information only.

Contents

6 Hardware Components 6.1

Driver Installation 6.1
Connection via COM Port 6.1
Connection via USB Interface 6.5
Test Receiver Drivers 6.7
IP Addresses 6.9
External Trigger Device 6.11
TSMx Firewire Driver and Firmware Installation 6.11
Configuration of Installed Drivers 6.21
System Monitor and Performance Counters 6.23

Test Devices 6.25
GSM Mobile Drivers 6.25
Driver Configuration Menu 6.27
Driver Configuration – Setup 6.27
Driver Configuration – Nokia Settings 6.31
Driver Configuration – GSM/GPRS Forcing 6.33
Driver Configuration – Measurement Mode / General Settings / RAT Settings 6.34
Driver Configuration – Remote Receiver 6.40
Remarks about the Tracking Mode 6.43
Driver Configuration – Autodialing 6.43
Driver Configuration – NQA 6.47
Driver Configuration – Mobile Options 6.50
Driver Configuration – Antenna 6.50
Driver Configuration – Slaves 6.51
Driver Configuration – SMS Tester 6.52
Driver Configuration – Layer 3 Uplink frames 6.53
Driver Configuration – QoS Tests 6.53
Driver Configuration – QoS Statistics 6.56
Driver Configuration – Templates 6.56
Driver Configuration – Handover Analyzer 6.58
Driver Configuration – Speech Quality 6.58
SQA Settings 6.60
SQA – Principle and Test Setup 6.62
Driver Configuration – Serial Port Driver Info 6.63
Settings Check and Loading of a Symbol File 6.64
Action Menu 6.66
UMTS Mobile Drivers 6.69
Driver Configuration Menu 6.71
Qualcomm – Configuration 6.72
Qualcomm – Expert Mode 6.73
Driver Configuration – Nokia Settings 6.78
Driver Configuration – RAT Settings 6.80
Qualcomm / Nokia – NQA Settings 6.81

Qualcomm / Nokia – Autodialing 6.82
Qualcomm / Nokia – Handover Analyzer 6.83
Qualcomm / Nokia – Remote Receiver 6.84
Qualcomm / Nokia – Speech Quality....6.84
Qualcomm / Nokia – Mobile Options 6.85
Qualcomm / Nokia – Antenna....6.85
Qualcomm / Nokia – Templates 6.86
Qualcomm / Nokia – Serial Port Driver Info....6.87
Action Menu 6.87
Motorola – Configuration 6.89
Motorola – NQA Settings 6.90
Motorola – Autodialing 6.91
Motorola – Handover Analyzer 6.92
Motorola – Remote Receiver 6.92
Motorola – Speech Quality Analyser 6.93
Motorola – Mobile Options 6.93
Motorola – Antenna 6.94
Motorola – Templates 6.94
Motorola – Serial Port Driver Info 6.95
CDMA2000 and 1xEV-DO Mobile Drivers 6.96
Driver Configuration Menu 6.97
Configuration 6.98
Expert Mode....6.99
Autodialing 6.100
Speech Quality Analyzer 6.101
Mobile Options 6.101
Antenna....6.102
Templates 6.102
Serial Port Driver Info 6.103
CDMA IS-95 Mobile Drivers....6.104
Configuration Menu 6.104
Define Measurement 6.105
Autodialing 6.107
Antenna....6.108
Serial Port Driver Info 6.109
ETACS Mobile Driver....6.110
Configuration Menu 6.110
FIZZ Configuration....6.110
Antenna....6.112
Serial Port Driver Info 6.113
Action Menu 6.113
DAB752 Driver 6.115
Configuration Menu 6.115
Philips752 Configuration....6.116
Antenna....6.117
Serial Port Driver Info 6.117
Action Menu 6.118
DVB Drivers 6.119

Configuration Menu 6.119
Barco Atlas Configuration 6.119
Atlas Measurements 6.120
Atlas Settings 6.121
Atlas: Antenna 6.123
CAS3173 Configuration 6.124
Serial Port Driver Info 6.126
DVMD Configuration 6.127
EFA-T Configuration 6.131
TSM-DVB Configuration 6.139

Test Receiver Drivers 6.147

Supported Devices 6.147
Resources Configuration 6.148
Configuration Menus 6.149

Test Receiver Configuration 6.149

ESVx/Seegull/ESPI/EB200/TSMx 6.150
Receiver settings 6.151
Measurement settings 6.155
Antenna 6.164
Templates (TSMx) 6.164
Info 6.166

Trigger Box Configuration 6.168

Triggerbox (external) 6.168
Serial Port Driver Info 6.170
Trigger Box (TSMx, internal) 6.171
Action Menu 6.172

R&S Test Receiver Calibration 6.174

CW Level Calibration 6.174
IF and Level Calibration for C/I Measurements 6.175

UMTS PN Scanner Driver 6.178

Resources Configuration 6.178
Configuration Menus 6.180
Receiver settings 6.181
Add Frequency / BCH Demodulation 6.183
Measurements 6.184
Top N 6.189
Pilot Pollution 6.193
Ultra High Speed (TSMU) 6.195
TSMU / TSML-W 6.196
Templates (TSMU / TSML-W) 6.196
Antenna 6.197

GSM Network Scanner Driver 6.199

Resources Configuration 6.199
Configuration Menus 6.200
Setup GSM NWS Driver 6.201
TSMU / TSML-G 6.203
Templates 6.203

CDMA2000 PN Scanner (PNS) Driver 6.205

Resources Configuration 6.205
Configuration Menus....6.206
Receiver settings 6.207
Add Frequency 6.208
Measurements 6.210
Antenna....6.213
TSMU / TSML-C 6.214
Templates 6.215
ESPI (Spectrum) Driver 6.216
Resources Configuration 6.216
Configuration Menus....6.216
Receiver settings 6.217
Antenna....6.219
WLAN (NDIS) Driver 6.220
Resources Configuration 6.220
Configuration Menus....6.220
Device Setup 6.221
Device Info 6.222

Device-Independent Drivers....6.223
Data Quality Tester Driver (DQA) 6.223
Resources Configuration 6.223
Configuration Menus....6.223
DQA Settings 6.224
Configuration menus for the DQA jobs 6.227
Net Statistic....6.238
Patch File....6.239
Templates 6.241
Action Menu 6.241

Navigation 6.243
GPS Drivers 6.243
Driver Types and Supported Devices....6.243
Configuration Menus....6.244
Indoor Navigation Driver INDOOR....6.253
Driver Configuration Menu....6.254
Mast Controller GB127M Driver....6.267
GB127M Configuration Menu 6.267
Manual Mode Action Dialog....6.268

Carrier-to-Interference Analysis 6.269
C/I Driver 6.269
Configuration Menus....6.269
C/I Driver Measurement Selection....6.270
C/I Driver Measurement Specification 6.272
R&S GSM Demodulator....6.275
Configuration Menus....6.275
Settings....6.276

6 Hardware Components

In the following, the hardware devices necessary for interference measurements and their installation and configuration is described. Note that, before any measurement is started, drivers for the mobile phone (see section *Test Devices* on page 6.23 ff.) and for the positioning system (see section *Navigation* on page 6.171 ff.) must be loaded.

Driver Installation

The hardware device drivers can be installed either by via the *Configuration – Hardware...* menu, or simply by loading the desired configuration file. They are not necessary if the measurement data is simply replayed from a measurement file.

The following examples show how to install and remove hardware drivers and to assign them to a physical or virtual COM port. These actions are analogous for all drivers with a few exceptions:

- Loading the R&S Indoor driver and QoS Tester does not require any hardware or port assignments.
- The Rohde & Schwarz test receivers ESVx, EB200/ESMB, and ESPI can be connected via IEC/IEEE bus interface, LAN interface or a dial-up connection; see section *Test Receiver Drivers* on p. 6.7 ff.
- The IEEE1394 Firewire interface is required for the Rohde & Schwarz TSMx.
- A PCMCIA slot is used i.e. for WLAN cards or for the Merlin U530 UMTS data card.

Configuration of the drivers is explained in the following sections (see page 6.23 ff.).

Connection via COM Port

Loading the drivers is initiated by the *Hardware…* command in the *Configuration* menu. This command opens the *ROMES Hardware Configuration* menu.

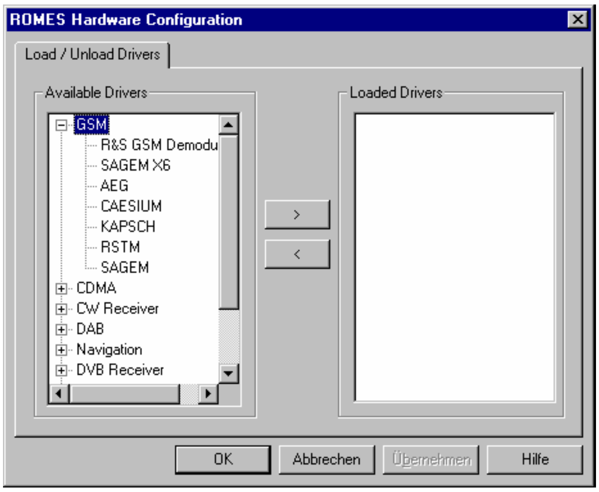


Fig. 6-1 ROMES Hardware Configuration

Multiple drivers

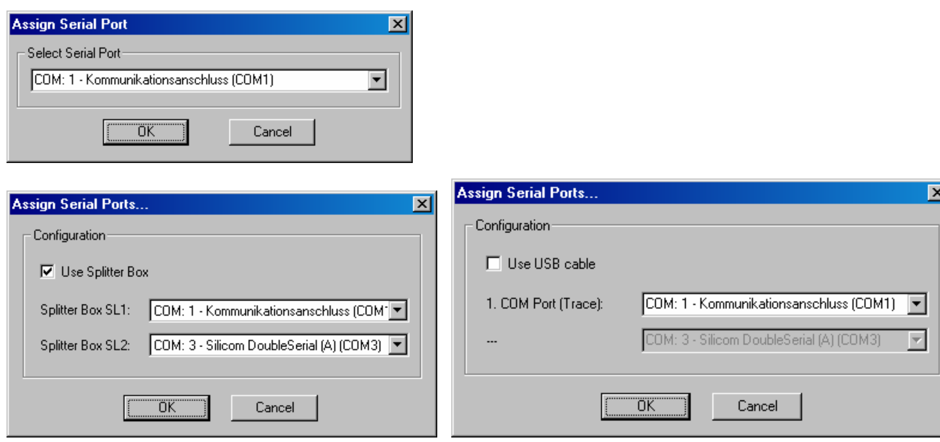
It may be necessary to add one driver type several times, e.g. if several mobiles of the same type are used. The number in square brackets displayed behind the device node denotes the number of drivers allowed. In the example of Fig. 6-1, it is possible to use up to 4 GSM mobiles (the number can be increased on request). The same GSM mobile driver can be assigned to several different ports.

Available drivers

The left-hand field shows a list of all available devices and installed drivers.

> button

The > button opens the *Assign Serial Port* window. For AEG drivers, the used device type must be selected from a *Mobile* list, for SAGEM and RS TM, the mobile type is automatically recognized. The entry SAGEM is for models SAGEM OT 35, OT 55, OT 75 and OT 95; the remaining SAGEM mobile drivers are installed via SAGEM X6. The *Assign Serial Port* windows for non-GSM drivers are analogous (see also section *Test Receiver Drivers* on p. 6.7 ff.).



The *Driver resources* window assigns a COM port to the selected driver. It provides three buttons:

Serial Port	Assigns a port to the driver to be loaded. Select a port from the pull-down list if the current assignment is to be changed.
OK	Confirms the port assignment and closes the window. The driver previously selected (clicked) in the *Available drivers* list is initialized (loaded) and finally entered in the *Loaded drivers* list of the *ROMES Hardware Configuration* window. The progress of the procedure is monitored in a popup window.
Cancel	Discards the changes made and closes the window

There is an automatic verification if the COM port is still available; only free ports are offered in the pull-down list. Drivers can be assigned to different ports by repeating the process.

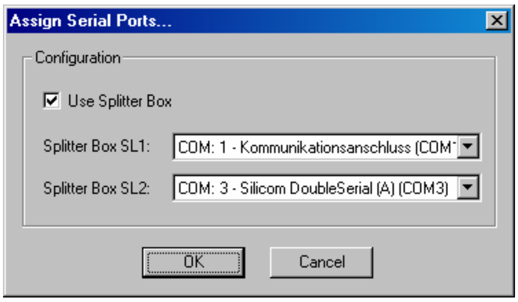
Splitter box (Sagem mobiles supporting GPRS)

Instead of being directly connected to one of the COM ports, the Sagem mobile supporting GPRS may be used in combination with a splitter box. This additional device is connected to the mobile and to the power supply as shown below.

The splitter box separates the trace and data interface of the mobile. The trace interface corresponds to the normal GSM test mobile mode except GPRS, the data interface represents an extension that is used for GPRS data transfer. Three different modes can be set at the mobile:

Trace	Route the trace interface to SL1
Data	Route the data interface to SL1
Trace/Data	Route the data interface to SL1, the trace interface to SL2

The two outputs *SL 1* and *SL 2* of the splitter box can then be connected to two separate COM ports. The COM ports can be assigned in the *Assign Serial Port* after the *Use splitter box ...* option is checked:



Note:

To measure, record and view GPRS data, the mobile must be used in Trace/Data mode and the trace and data interfaces must be routed to different COM ports. Therefore, the splitter box is a prerequisite for GPRS measurements using Sagem test mobiles.

GPRS test mobiles from Nokia and Qualcomm can be connected via USB interface; see section Connection via USB Interface on p. 6.5 ff.

Failed Initialization

If the initialization of the mobile driver fails (e.g. because no mobile of appropriate type is available at the serial port), ROMES displays the following messages:

(AEG only)

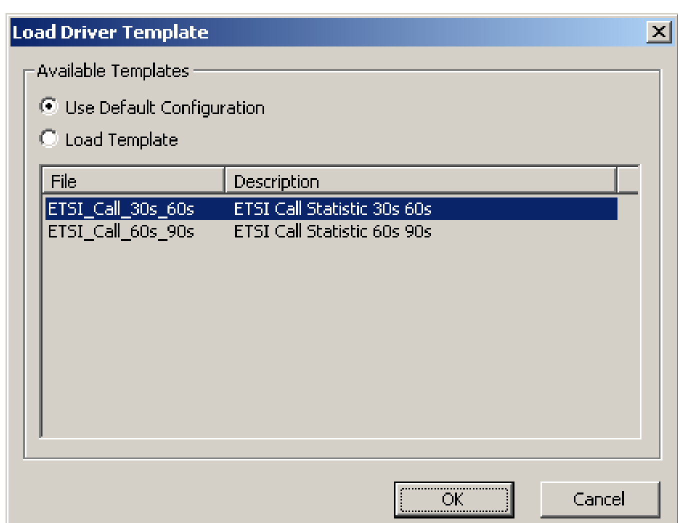
➢ In this case, check the connection and click *Repeat* to return to the *Assign Serial Port* window.

< button

The < button removes a selected driver from the *Loaded drivers* list.

Driver Templates

When a driver is loaded ROMES checks whether a driver template is stored in the *Driver Templates* subdirectory of ROMES program directory (see *Templates* on p. 6.56 ff.) and displays a list of the templates found.



The driver can be loaded with default settings or with the settings stored in any of the templates found.

OK

Confirms the port assignments made, loads the drivers with the configuration settings suitable for the connected mobile type, and closes the *Hardware drivers* window.

Cancel

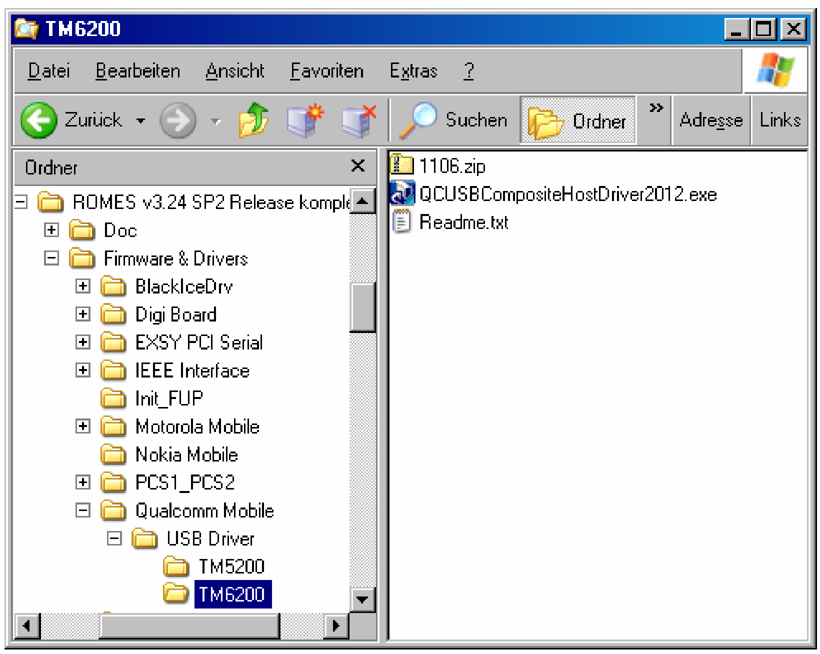
Cancels the installations made and closes the *Hardware drivers* window.

Connection via USB Interface

Some newer test mobiles (e.g. the Motorola, Nokia and Qualcomm models) can be connected via USB cable using an appropriate driver. Physical COM ports are not needed. The USB drivers are already pre-installed on controllers from Rohde & Schwarz. They can also be installed from the ROMES CD-ROM.

Installing the drivers

The USB drivers are mobile-specific and located in the *Firmware & Drivers* sub-directory on the ROMES CD-ROM, see the following example for the Qualcomm TM6200 test mobile.



To install the driver(s) for your test mobile(s):

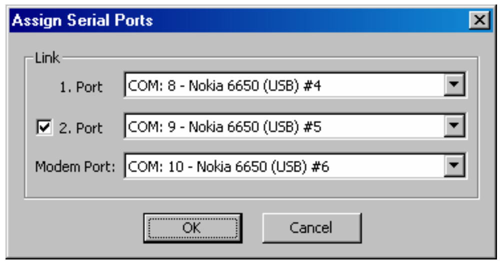
➢ Go to the relevant subdirectory for your test mobile type.

➢ Follow the instructions in the *Readme.txt* files or in the *.pdf installation instructions.

During the installation, Windows creates the necessary number of virtual COM ports and attaches them to the mobiles. Therefore, test mobiles connected via USB interface do not need a splitter box to separate the trace and data interface.

Loading the drivers (Nokia)

Once the USB drivers are installed on the system, they can be loaded following the procedure outlined in section *Connection via COM Port* (see p. 6.1 ff.). When one of the Nokia drivers is loaded *(Nokia 6230, Nokia 6630, Nokia 6650, Nokia 6680, Nokia 7600),* ROMES opens the following dialog box:



One of the virtual COM ports created during USB driver installation can be assigned to the 1st port (data interface), the 2nd port (AT interface) and the *Modem Port* (data interface). The three virtual COM port numbers must be different.

The second port is optional but is required for autodialing. Besides it is recommended to always assign all three ports.

The operating system does not reliably delete unused virtual COM ports if USB devices are connected and disconnected repeatedly. It is recommended to delete redundant USB ports using the Special Device Manager (see chapter 8) if the assigned port numbers exceed values around 30.

Connecting several Qualcomm mobiles

The supported Qualcomm mobiles (e.g. TM6200 etc.) are composite devices which require two virtual COM ports. To install the driver, the test mobile must be connected to the USB port of the PC (see the installation information supplied with the driver). During installation, Windows will enumerate the mobile in order to add it to the USB device list.

Under Windows XP several mobiles can be connected to the host PC without any modifications as long as they all use the same USB hub. The number of devices is limited by the number of ports on the hub. To connect more devices, use the method described below.

Connecting different USB hubs

Several Qualcomm test mobiles (e.g. TM6200) can only be enumerated when each one has a different product ID. It is recommended to use only 4-port hubs and to limit the number of devices connected simultaneously to 32. Moreover, a firmware release 5.0 or higher of the TM6200 is required.

To set the appropriate product ID,

1. Connect one device to the host PC at a time.
2. Load the TMx200 driver following the procedure described above.
3. In the *Configuration* tab of the TMx200 driver configuration menu (accessible via *Configuration – TMx200)*, click the *Advanced* button to open the *Advanced Options* dialog (see Fig. 6-31 on p. 6.72).
4. Click *Advance USB ID.*
5. Open the Windows *Device Manager* (e.g. from the *Hardware* tab of the *Control Panel – System Properties* dialog) to check whether the device is enumerated and installed correctly with the new USB ID.

6. Disconnect the device from the host PC.

To connect several test mobiles,

7. Repeat steps 1 to 6 for all test mobiles, assigning each one a different USB ID offset. Reload the driver each time before you advance the USB ID.

8. Connect the devices all together to the USB hubs (4-port hubs).

9. Check the Windows *Device Manager* to make sure that all devices are enumerated correctly.

Caution:
The Samsung Z105/Z107/Z130/Z500/Z560/... mobiles rely on the USB interface for its power supply. A supply current of up to 0.5 A is required. Check the specification of your USB interface, especially when connecting several Z... mobiles or other power-consuming devices in parallel. If necessary, use a self-powered USB hub.

Test Receiver Drivers

When a test receiver driver is loaded *(EB200, ESPI, ESVx, SBR, dti SeeGull, TS55-R2, TSMx),* ROMES checks whether the driver configuration settings comply with the connected receiver. If they do not, the *Receiver settings* tab of the test receiver configuration menu is opened to adjust the driver settings. Test receivers must be switched on to be identified by the drivers.

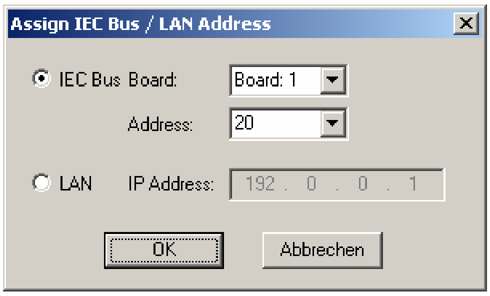
Interfaces

The Rohde & Schwarz test receivers *EB200/ESMB, ESPI* and *ESVx* are not simply connected to a serial COM port but controlled via either an IEC/IEEE bus interface, a LAN interface, or a serial RS232 interface:

- The ESVx is always controlled via IEC/IEEE interface.
- The ESPI can be controlled either via IEC/IEEE interface or via LAN interface.
- The EB200 can be controlled either via LAN interface or via serial RS232 interface with 9-pole sub-D connector on the rear panel of the instrument, to be used preferably in the mode RS232 PPP (dial-up Point-to-Point Protocol connection). Both interfaces are optional; at least one of them is provided on each unit.
- The TSMx is always controlled via IEEE 1394 Firewire interface.

ESPI Driver

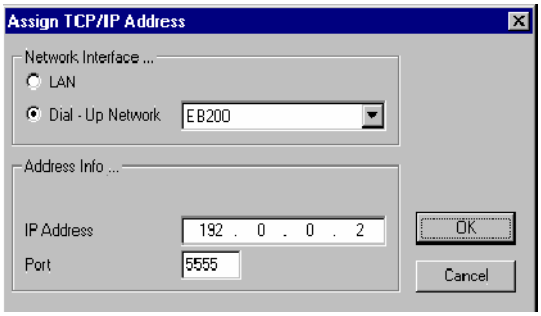
The LAN interface is provided as an option for the ESPI receiver (option FSP-B16, LAN Interface). Loading the ESPI driver opens the *Assign IEC Bus/LAN Address* window:



The window chooses between the IEC/IEEE bus interface and the LAN interface and defines the IEC bus or IP address of the test receiver. See paragraph *Allocating a valid IP Address* below.

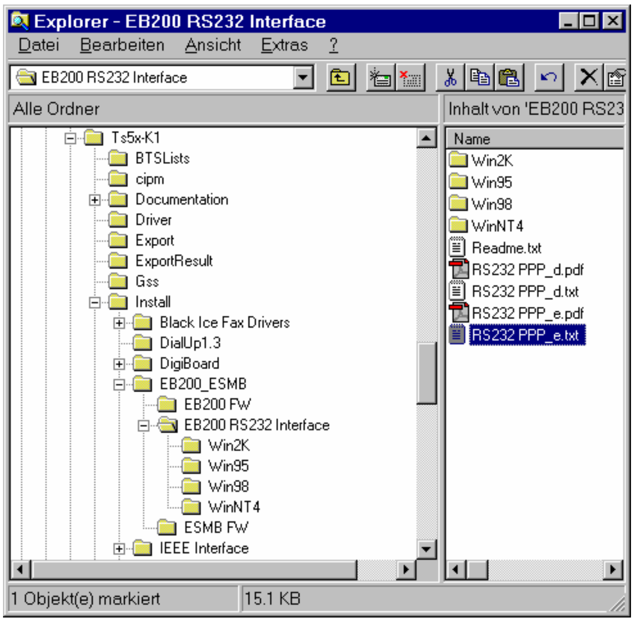
EB200 Driver

Loading the EB200 driver opens the *Assign TCP/IP Address* window.



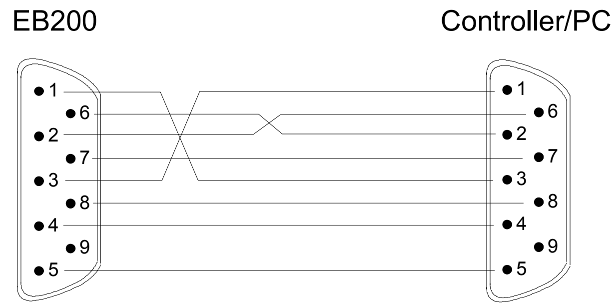
This window chooses between the LAN interface and a dial-up network connection via RS232 (PPP connection) for data exchange by means of a terminal program. It also sets the *IP Address* (see paragraph *Allocating a valid IP Address* below) of the test receiver and the *Port* number for the connection. The default port number of 5555 needs to be adjusted only in case of problems, e.g. due to a firewall with port filters.

Establishing a dial-up PPP connection to the EB200 via serial interface and by means of the TCP/IP network protocol and a virtual modem is described in the EB200 operating manual and in the instructions supplied with the ROMES installation:



Note:

To establish the physical connection between the EB200 RS232 interface and the controller, a special null modem cable must be used. The cabling is as shown below; in particular, the two pin pairs 1, 3 and 2, 6 must be cross-connected. This specification differs from the ordinary cabling for a connection of a test instrument with a controller via RS232 interface (see e.g. PPP installation instructions).



IP Addresses

Allocating a valid IP address

To establish a LAN connection, the IP address of the test instrument and the controller must be compatible. In practice, the IP address of the test instrument is adapted to the IP address of the controller. Determining the addresses that can be potentially used for the test instrument (if they are not yet assigned to another host in the LAN) involves the following steps:

Determine the IP configuration of your controller.

Use the IP address and the subnet mask to determine the available network IDs.

***Note**:*
The following procedure is appropriate for a standalone, dedicated connection between a controller and a test device. If you intend to connect through an established network (e.g. a company intranet), contact your network administrator to obtain the required IP addresses.

Determining the IP configuration

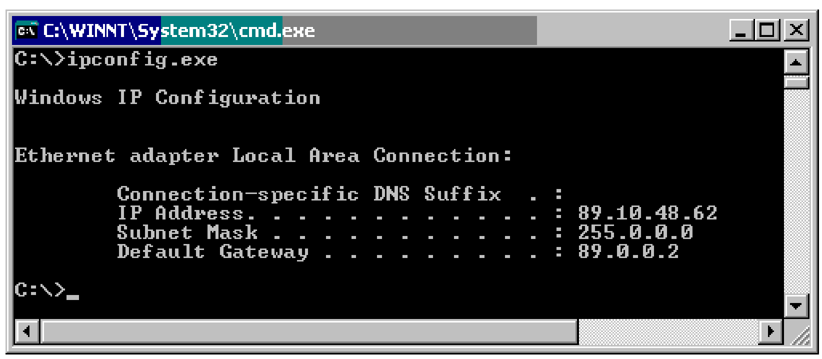
To determine the IP configuration of your controller,

1. Open the *Start* menu of your Windows operating system and select *Run…*

In the *Run* dialog opened, enter *CMD* and click *OK.*

In the DOS box opened, type *ipconfig.exe* and press *Enter.*

The IP address information of your controller is displayed:



IP address and subnet mask

The IP address (IPv4) consists of four 8-bit values, called octets, that are written as decimal numbers (0 to 255) and separated by dots. The IP address consists of the network ID and the host ID:

- The *network ID* identifies the LAN and must be common to the controller and the test instrument.
- The *host ID* identifies a controller, test instrument or other TCP/IP host within the LAN. The address for each host must be unique to the network ID.

The subnet mask is a 32-bit value that is used to distinguish the two parts of an arbitrary IP address:

- A 1 in the subnet mask (written in binary notation) means that the corresponding bit in the IP address belongs to the network ID.
- A 0 in the subnet mask (written in binary notation) means that the corresponding bit in the IP address belongs to the host ID.

The 1s in the subnet mask are always chosen in a contiguous fashion from the high order bits.

The IP Address numbers 10.a.b.c, 172.d.b.c, 192.168.b.c (where a = 0 to 255, b = 0 to 255, c = 1 to 254, d = 16 to 31) are reserved for private addresses; they are not reachable on the Internet.

Special subnet mask values

In decimal notation, a subnet mask octet value of 255 (= 11111111 binary) means that the entire octet belongs to the network ID, so the corresponding octets of the controller and the connected test device must be equal. A subnet mask octet value 0 means that they must be different.

Example:

IP address of the controller: 192.168.48.62
Subnet mask of the controller: 255.255.255.0
The first three octet values in the IP addresses must be equal. An example for a valid IP address for the test device is 192.168.48.52.

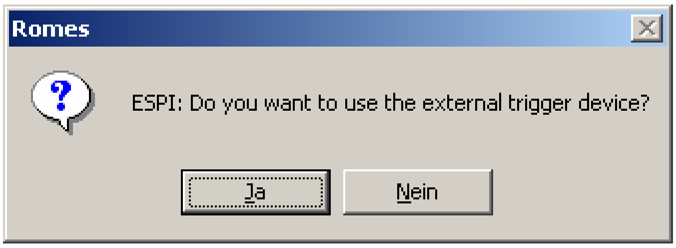
Note:

Host IDs must not consist of all zeros or all ones (in binary notation) because these values are reserved. For subnet mask values other than 0 or 255, a conversion into binary notation is helpful.

External Trigger Device

Trigger Box

The Rohde & Schwarz test receivers can be operated with the Trigger Box, an external trigger device to be connected to a serial port. The Trigger Box is mandatory for the ESVx receivers, optional for the EB200/ESMB and ESPI receivers. Clicking *OK* in the *Assign IEC Bus/LAN Address* window opens the following message box:



After clicking *Yes,* ROMES asks for a serial COM port to be assigned to the Trigger Box and terminates the installation. Both the test receiver and the Trigger Box configuration menus can be accessed from the *Configuration* menu; see Fig. 6-97 on p. 6.149. *???*

TSMx Firewire Driver and Firmware Installation

Firewire Driver (TSMx) - Information

The R&S TSMU and TSML-x options are controlled via IEEE 1394 Firewire interface. Due to measurement requirements, a special driver from Rohde & Schwarz is required for the operation.

When the TSMU was introduced for ROMES, the original Microsoft driver file **ohci1394.sys** was replaced by a modified R&S file with the same name. Two major disadvantages were observed:

- The R&S driver file was not digitally signed, as opposed to the original MS files. And since MS Windows always prefers its own signed files – if not fooled by some smart tricks, performed by the R&S installer tool *R&S_OHCI1394_InstallationTool.exe*. However, on some PCs this did not work, and sometimes MS Windows re-installed the original file later, as it is not possible to remove it from the system completely.

- The modified R&S driver did not work with all IEEE1394 interface hardware. Some devices were successfully tested and therefore recommended, but it can happen that a manufacturer e.g. changes the chipset without announcement – and without notification on the label.

So the idea to use the original driver file again and install an additional R&S driver instead was pursued, providing the required TSMx functions.

To keep it simple, we call the first one (replacement of the original ohci1394.sys by a R&S file) the **Old FireWire driver**, and the installation of an additional driver the **New FireWire driver**.

However, there are two important conditions for both Old and New driver: The TSMx firmware version and the ROMES version. This diagram shows the relationships between ROMES version, FireWire driver and TSMx firmware:

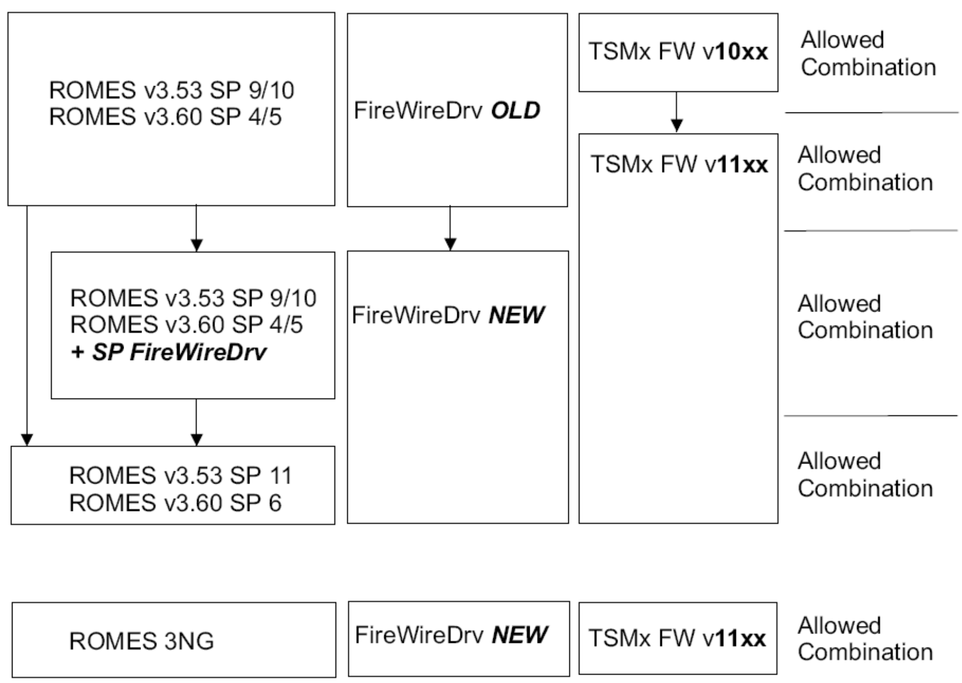
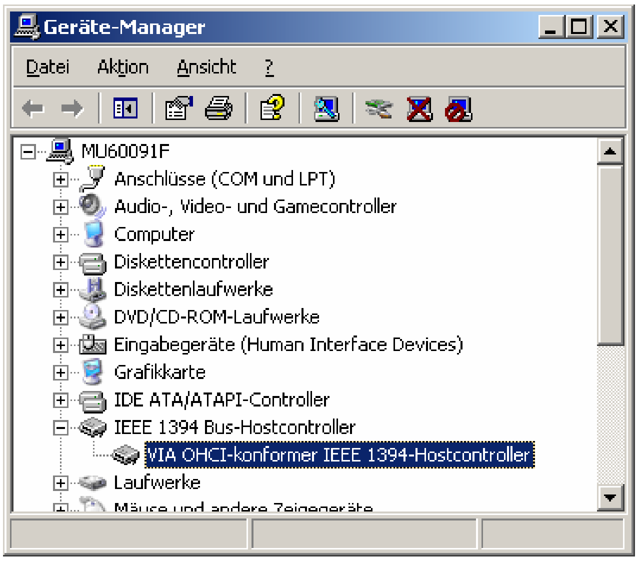


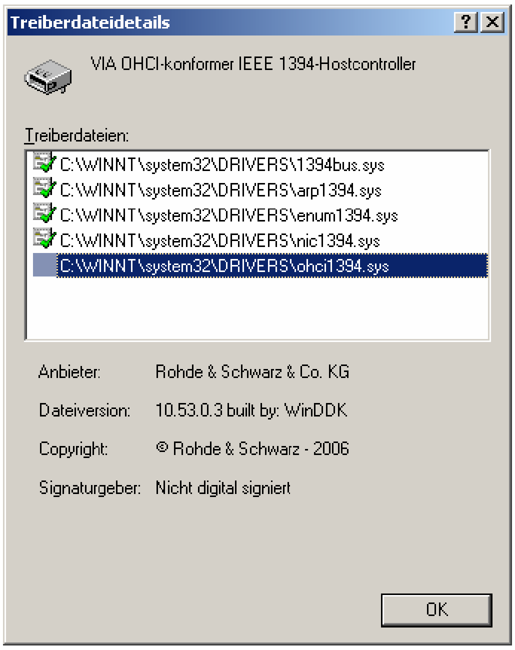
Fig. 6-2 ROMES version, FireWire driver and TSMx firmware dependencies

For the firewire driver support in ROMES Service Packs 6 and 11 please read their release notes carefully.

To determine the currently installed FireWire driver version, go to the MS Windows Device Manager and select the IEEE1394 controller:

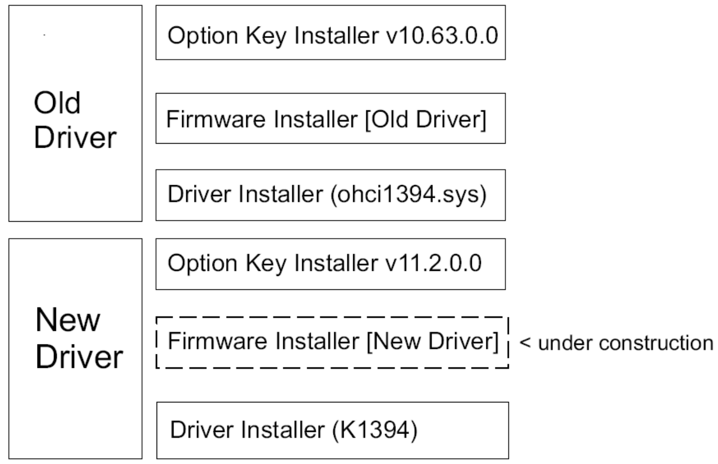


Right-click the controller, select *Driver*, then *Driver Details*:



Select the **ohci1394.sys** file list entry to view its properties. If the fileoriginates from MS and has a digital signature, then the old driver devices will not work properly.

To resolve the installation difficulties, another set of TSMx tools is included on the ROMES 3.60 and 3NG CDs). Here is an overview of the available old and new TSMx tools:



Note that the firmware version numbers are subject to change, but but v**10**.xxxx always refers to the **Old** and v**11**.xxxx to the **New** Firewire driver.

The Option Key and *Firmware Installer* tools only work with the related driver.

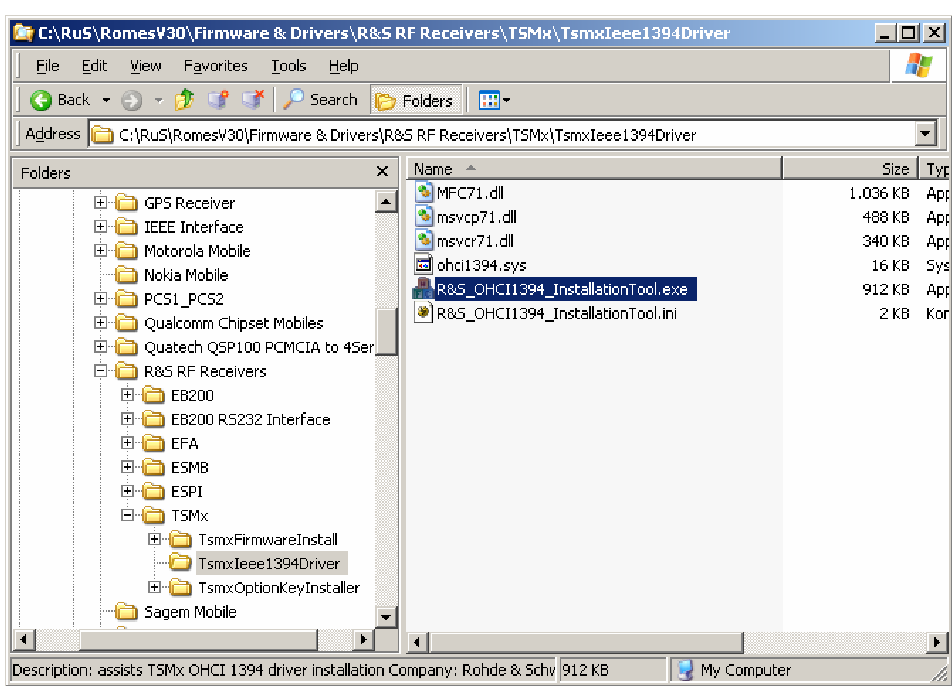
As long as the *Firmware Installer* for the *New* driver is not available, all firmware updates have to be done with the old tool and the old driver, also e.g.an update from FW 11.04 to 11.05.

For this reason, the ROMES 3NG CD contains the old driver as well, as a possible fallback position.

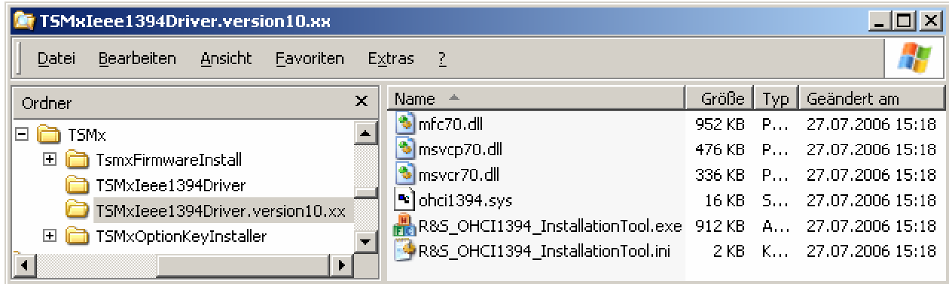
Old Firewire Driver (TSMx) - Installation

Please consult *Fig. 6-2 ROMES version, FireWire driver and TSMx firmware dependencies* first to confirm that the old Firewire driver is to be installed.

The old TSMx IEEE 2394 Firewire driver is located in the *Firmware and Drivers\R&S RF Receivers\TSMx\TSMxIEEE1394Driver* subdirectory of the ROMES CD-ROM:



If a new TSMx IEEE 2394 Firewire driver is available, the directory structure shown above is slightly different:



In case of the presence of a new driver, the directory of the old driver is named "*TSMxIEEE1394Driver.version10.xxx* ".

➢ To install the old driver, double-click *R&S_OHCI1394_InstallationTool.exe* and follow the directions in the installation wizard.

The old TSMx IEEE 1394 Firewire driver replaces the Microsoft driver delivered with the IEEE 1394 hardware and reserves the IEEE 1394 functionality for TSMx operation. The original Microsoft driver is restored by deleting the system file C:\WINNT\system32\drivers\ohci1394.sys.

To prevent Windows from accessing its own installation sources while the driver is installed, it is necessary to disable network and dial-up connections and block the Windows file protection mechanism. Once the installation is complete, the driver can be enabled in the Windows Control Panel or by simply restarting the computer. For details refer to the information in the installation wizard.

New Firewire Driver (TSMx) - Installation

Please consult *Fig. 6-2 ROMES version, FireWire driver and TSMx firmware dependencies* first to confirm that the new Firewire driver is to be installed.

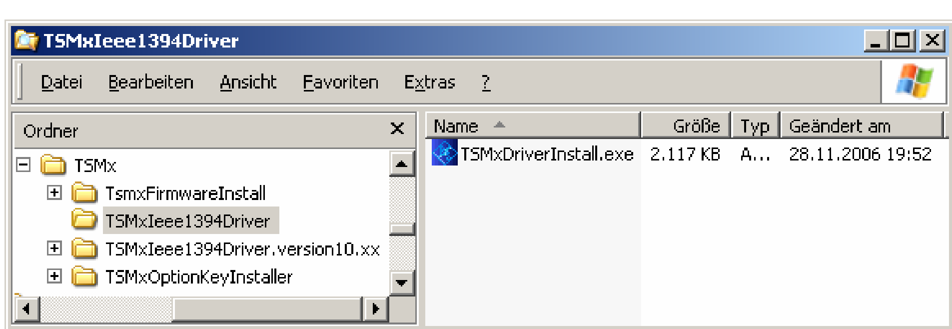
The installation of the new Firewire driver can either be done from scratch (new installation) or as a migration from old to new version (if a ROMES update is performed).

The TSMx Firmware Installer for the new driver is still under development, so for all firmware updates the old tool has to be used, which makes it necessary to switch back to the old driver temporarily, even if you go i.e. from FW 11.04 to 11.05. This is described in step 3.).

For this reason, the installation tool for the old driver is available as well.

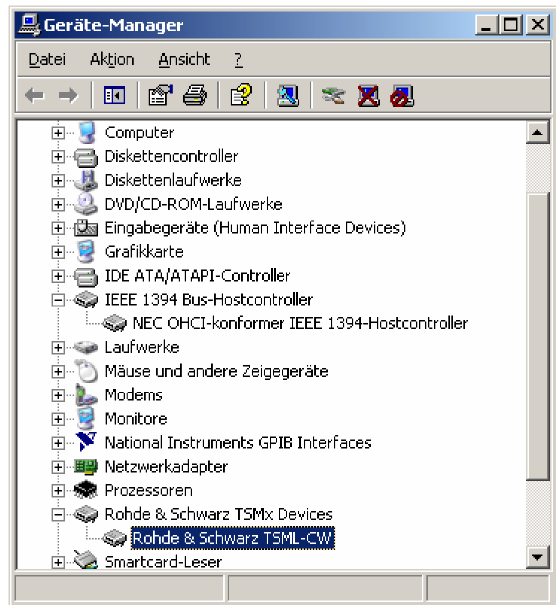
1.) Installation of the New Firewire Driver from Scratch

The new TSMx IEEE 2394 Firewire driver is located in the *Firmware and Drivers / R&S RF Receivers / TSMx / TSMxIEEE1394Driver* subdirectory of the ROMES CD-ROM:

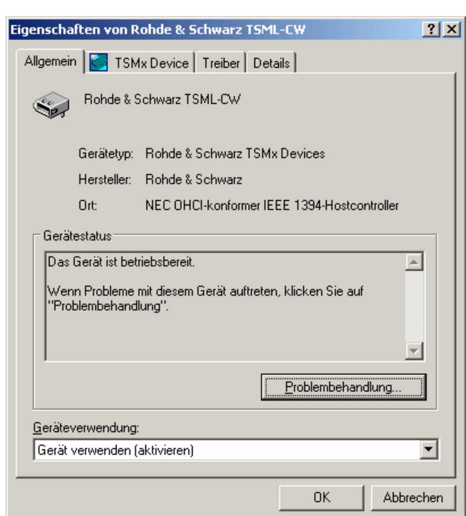


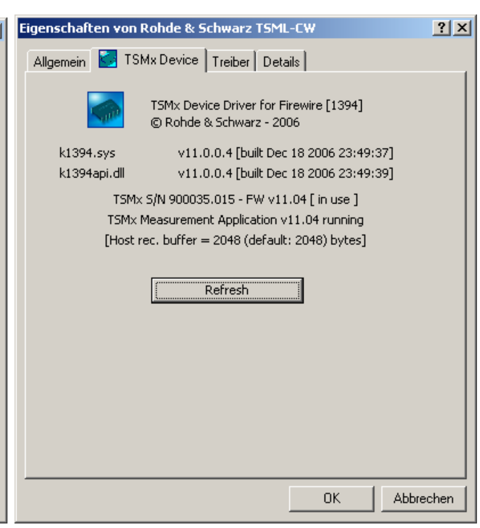
➢ To install the new driver, double-click *TSMxDriverInstall.exe* and follow the directions in the installation wizard.

The installation of the new Firewire driver verifies that the original ohci1394.sys from MS is restored and installs the new add-on driver. The add-on driver is activated as soon as the TSMx is connected to the ROMES computer. The MS Windows Device Manager shows the driver, e.g. for a TSML-CW:



The driver properties are available using the context menu of the Device Manager entry:





According to the driver file name, the new driver can be referred to as **K1394** driver.

Checking the driver details shows that the K1394.sys file is still not signed digitally, but now the file is ignored by the Windows file protection mechanism.

The new K1394 add-on driver is also available in the *Windows Software manager*:

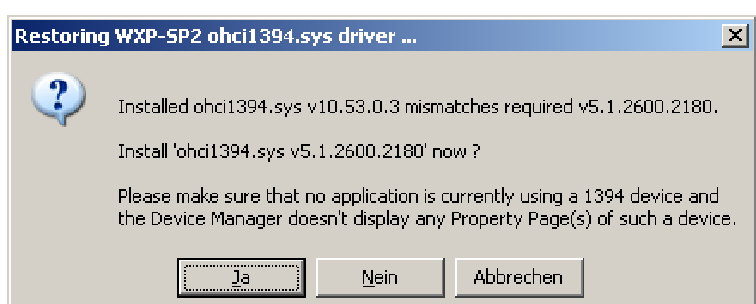
Every time the new driver detects a TSMx with a new serial number, it will initiate the “New hardware found” dialog and install itself in the device manager. If the serial number is already known this will be done silently.

2.) Migration from Old to New Firewire Driver

Since the new TSMx driver only complies with firmware v11.xx or above, it is advised that first all TSMx units are upgraded to the latest available firmware while the old firewire driver is in operation. This is done with the Firmware Installer as described below.

In case the New driver is already installed and a TSMx still running on Firmware v10.xx must be updated, you have to go back to the old driver, upgrade the TSMx to FW v11.xx, and then re-install the new driver. This will become obsolete as soon as the *Firmware Installer* for the *new* driver becomes available.

After all TSMx devices are updated to firmware v11.xx or above, the new driver is installed by double-clicking *TSMxDriverInstall.exe* as described in step 1.). No TSMx needs to be connected. When the old driver is detected, the following message is shown:



Click on *Yes* to restore the original ohci1394.sys from Microsoft.

After that, the K1394 driver is installed.

If ROMES 3NG is used, the driver migration is now finished.

With ROMES 3.53 SP10 or ROMES 3.60 SP5 the special Service Pack for the new FireWire driver has to be installed before ROMES is restarted.

3.) If needed: Return from New to Old Firewire Driver

If it is necessary to return to the old driver for firmware updates, just use the driver install tool *R&S_OHCI1394_InstallationTool.exe*. After that the necessary firmware update(s) can be performed.

Then the new K1394 driver can be reinstalled as described above.

This rollback is sufficient for the firmware updates from v10.xx to v11.xx, but NOT for ROMES measurements with the *Old* driver.

Certain DLLs in the ROMES path are changed with the update from *Old* to *New* driver, and these will not be re-stored by reinstalling the *Old* driver. If only the firmware installer is run, the old DLL versions are provided in its path – but ROMES is run, the ROMES program path DLLs are used.

If the old version of Romes is required, it is necessary to re-install ROMES .

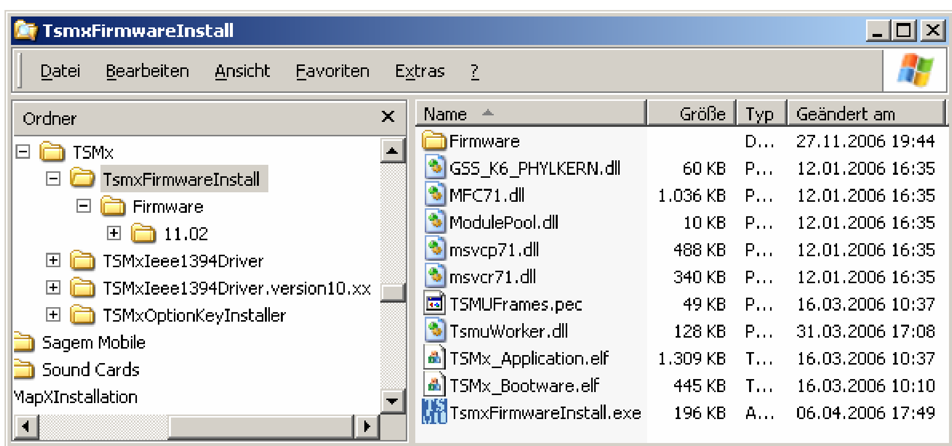
TSMx Tools - Firmware Installer

To install a different firmware on a TSMx. the following steps have to be conducted:

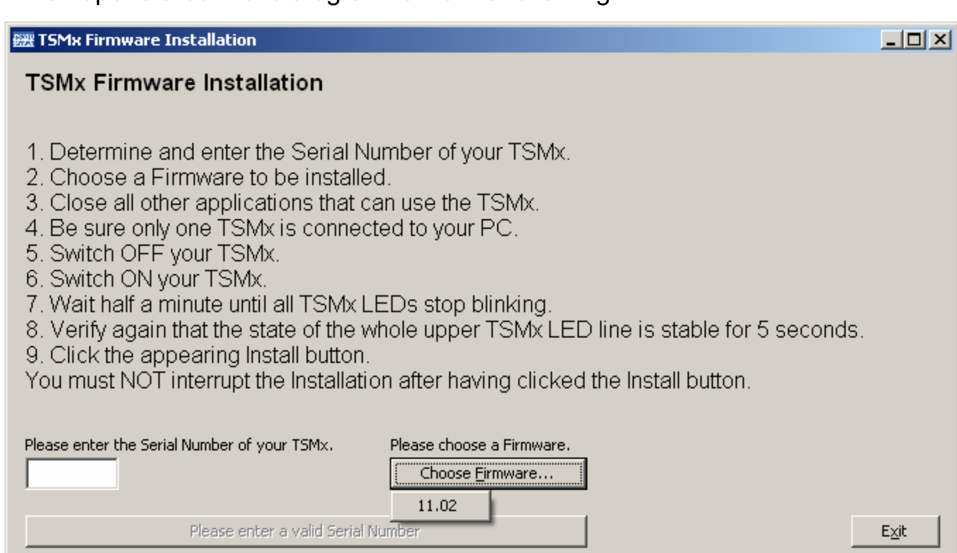
The ROMES program directory contains a subdirectory

...\Firmware & Drivers\R&S RF Receivers\TSMx

where the TSMx tools are available:



To install a new firmware version on a connected TSMx, change to the subdirectory "TsmxFirmwareInstall" and run the "TsmxFirmwareInstall.exe" executable, which opens a control dialog similar to the following:



Follow the given instructions closely to install the selected firmware version.

Note:
In case you are already running the New driver, and receive a TSMx still running on Firmware v10.xx, you have to go back to the Old driver, upgrade the TSMx to FW v11.xx, and then re-install the New driver.

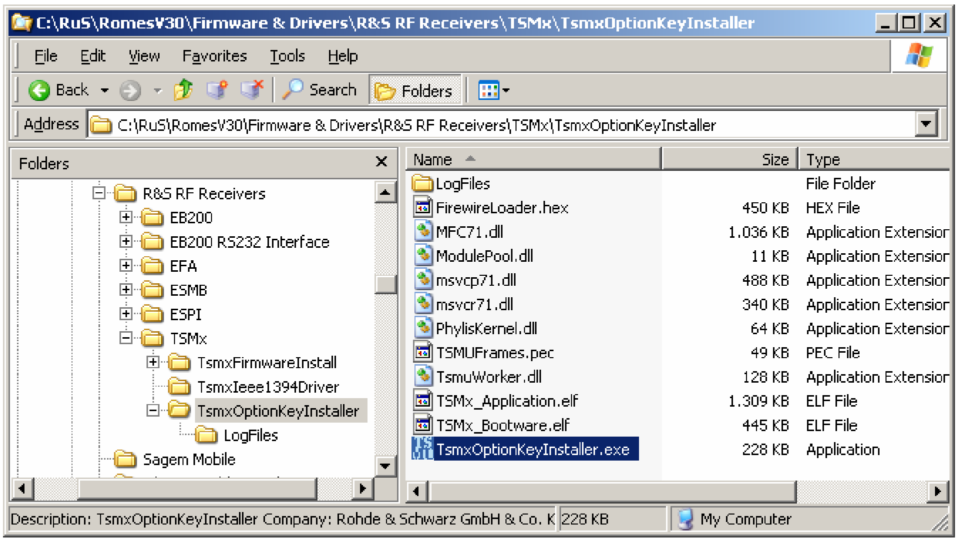
TSMx Tools - Option Key Installer

To activate an option key for a TSMx. the following steps have to be conducted:

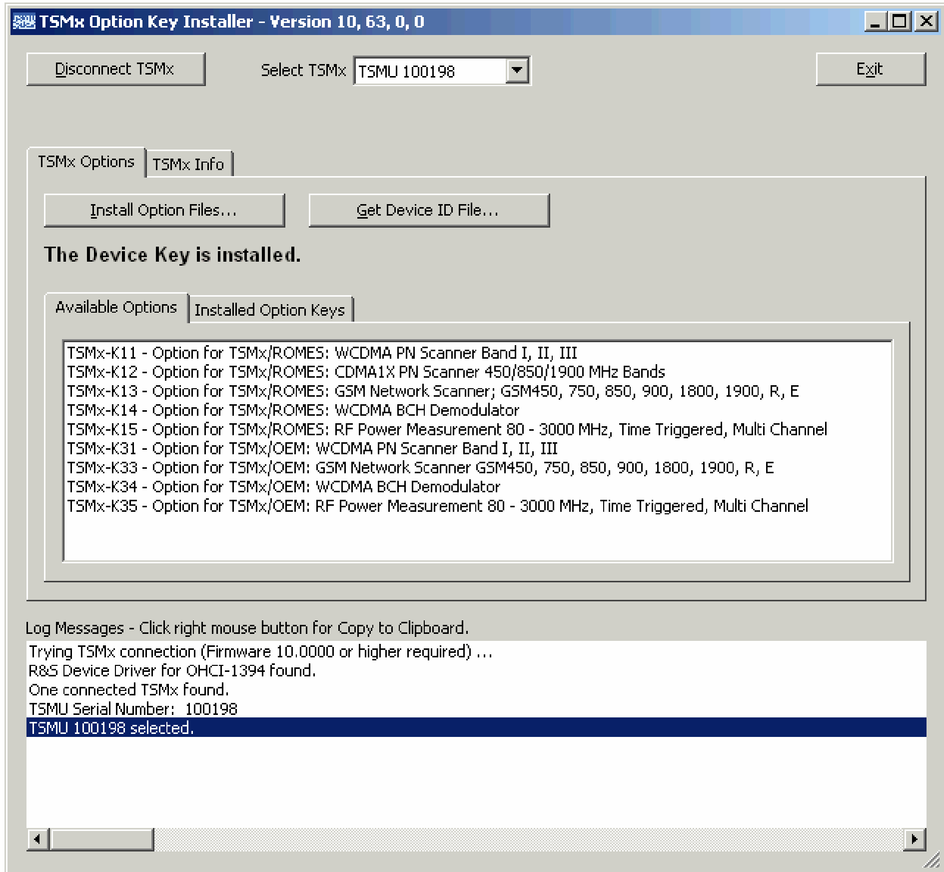
The ROMES program directory contains a subdirectory

...\Firmware & Drivers\R&S RF Receivers\TSMx

where the TSMx tools are available:



To activate an option key for a connected TSMx, change to the subdirectory "TSMxOptionKeyInstaller" and run the "TsmxOptionKeyInstaller.exe" executable, which opens a control dialog similar to the following:



Connect TSMx / Disconnect TSMx
After a connected TSMx from the *Select TSMx* list is marked, the *Connect TSMx* button queries the installed and available options for this TSMx. The results are displayed in the related fields of the option key installer dialog.

After a TSMx is selected, the button changes to *Disconnect TSMx.*

Select TSMx
A list can be opened which contains the available TSMx for selection.

Exit
Saves the modifications and closes the dialog.

TSMx Options
This panel contains information about the available and installed options and it allows the installation of the purchased option files.

Install Option Files...
Opens a *File Open...* dialog to load the option key files which were delivered after purchase of the desired option for the selected TSMx.

Get Device ID File...
Creates a file named DevID_TSMx_xxxxxx.hex, which is used for the identification of the device. In some cases, e.g. when additional options are ordered, the file has to be sent to R&S.

Available Options
Lists the options for the selected TSMx.

Installed Option Keys
Lists the installed and currently enabled options.

TSMx Info	This panel contains a list of information of the TSMx device (hardware, serial numbers, firmware version, calibration data).
Log Messages...	The message log of the activities related to the option key installation is shown.

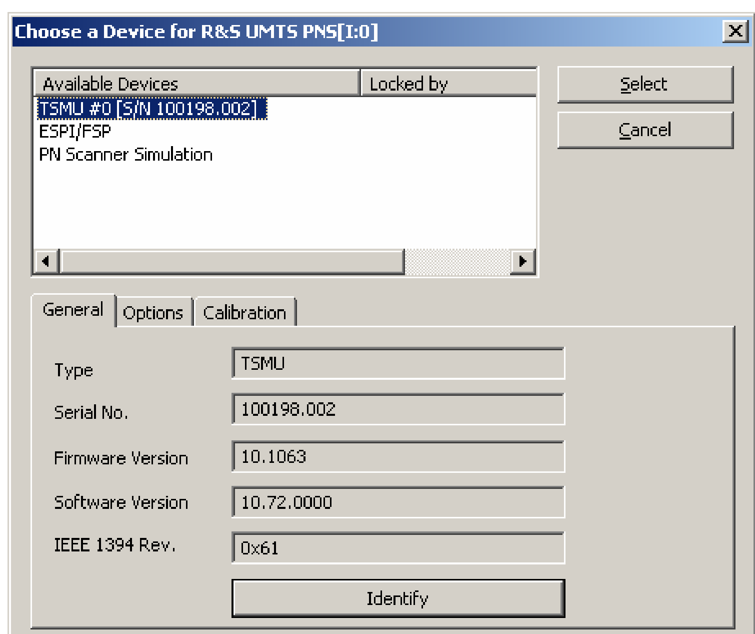
Device Chooser (TSMx)

The TSMx can be used as a *CW Receiver*, as a GSM Network Scanner *(GSM NWS),* or as a *UMTS PN Scanner.* Whenever one of the three drivers is loaded, ROMES displays the *Device Chooser* dialog with a list of available test devices, their general properties, and the enabled options.

Note:

The two IEEE 1394 (Firewire) connectors on the rear panel of the TSMx can be used to cascade several units together and perform different measurements in parallel. One unit can be used as a GSM network scanner, one as a PN scanner, and more as CW receivers. The position of a TSMx unit in the cascade is irrelevant for its use, just check whether the unit is equipped with the required options.

In the following *UMTS PN Scanner* example, one can choose between a TSMx test receiver, the simulation (which is always available), and an ESPI/FSP test receiver. The *Device Chooser* is closed after selecting the device; the installed driver is configured in an independent driver configuration menu.



Configuration of Installed Drivers

All added drivers are shown in the *Loaded Drivers* list of the *ROMES Hardware Configuration* menu. Additionally, they appear in the *Configuration* menu. To distinguish multiple drivers (i.e. drivers assigned to various COM ports) from each other, they are assigned a number in the command line (*Z500 [**1**] ..., Z500 [**2**]* ...).

If a *Custom Name* was assigned to the device (see section *Driver Configuration – Serial Port Driver Info*, p. 6.63), it is displayed in a column of the *Device Chooser* list above. The *Custom Name* can be used to assign a name to a mobile, e.g. to make a quick association of a test mobile to its designated test network provider. An example for a Sagem OT260 mobile with an assigned *Custom Name* of "This_is_my_mobile" is shown below:

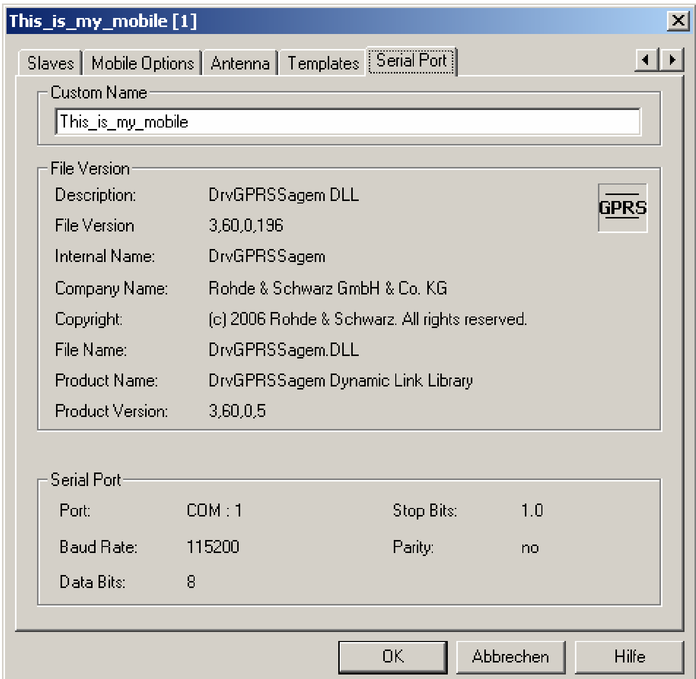


Fig. 6-3 Custom name

Please note that the *Custom Name* as defined above is used for test receiver driver labeling only. The field is also visible on the *Info* tab of other views, but in the context of other views the entry is ignored.

For many device drivers the *Action* menu is also added to the menu bar. It contains driver-specific functions for control during measurement and recording (see subsections *Action Menu* in the corresponding mobile driver sections).

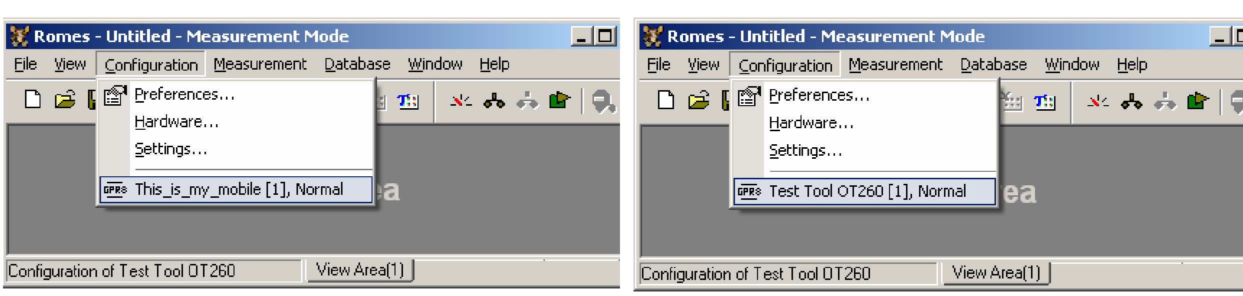


Fig. 6-4 Driver indication with Custom Name ...without Custom Name

The *Driver* commands in the *Configuration* menu open the driver-specific configuration menus described in section *Driver Configuration Menu* on page 6.27 ff.

System Monitor and Performance Counters

The *System* driver is a hardware-independent driver that stores Windows performance counters to the measurement file. Monitoring this information during the measurement can be helpful for assessing the validity of measurement results.

Example:

Suppose that a DQA job involving an FTP download from a remote server fails. Monitoring the local processor time together with the measurement data helps to decide whether the failure is due to local performance problems rather than to an unstable data connection.

The *System* driver is installed from the *ROMES Hardware Configuration* menu (see Fig. 6-1 on p. 6.1) like any other driver. The driver configuration menus are accessible from the *Configuration* menu.

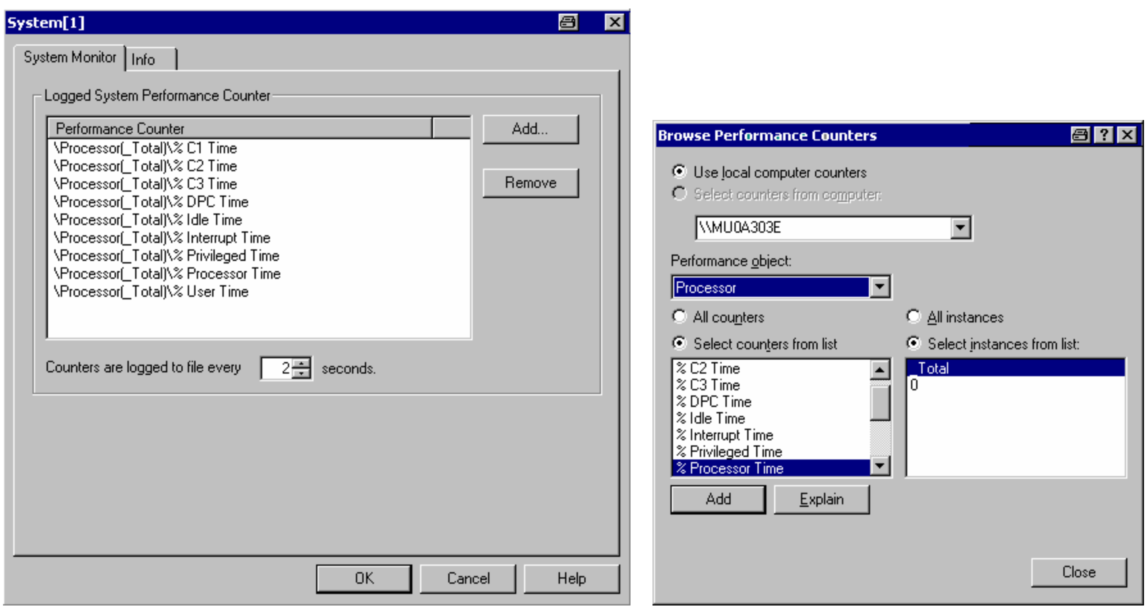


Fig. 6-5 System driver configuration

The *System Monitor* tab selects the performance counters to be stored to the measurement file and the time interval between two consecutive loggings. *Add* opens the *Browse Performance Counters* selection dialog. A selected local computer counter in directly written into the *Performance Counter* list in the *System* dialog.

ROMES generates a signal for each selected counter. The signals are displayed in the *Available Signals* tab of the *ROMES Configuration* menu. They can be viewed in correlation with other signals using an appropriate view (e.g. the *2D Chart View* or *Alphanumeric View* in the *General Views* section of the *View* menu).

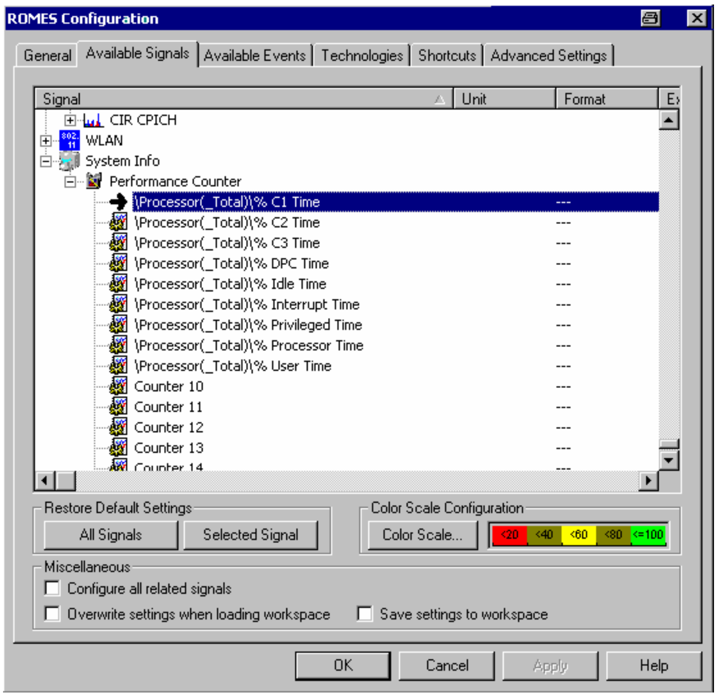


Fig. 6-6 Performance counter signals

Test Devices

The measurement system supports a wide range of devices that can be used to perform measurements and provide the desired results:

- Mobile phones for various networks and of various types
- A selection of test receivers and analyzers

The drivers needed for the test devices and their configuration is described in the following sections.

GSM Mobile Drivers

Several different GSM mobile drivers are provided with the measurement system: AEG, RS TM, Sagem, Chase, Kapsch, GSM/GPRS Motorola, Siemens. Each of the drivers supports a set of mobile types. Installation of all drivers is analogous (see section *Driver Installation* on page 6.1 ff.); differences concerning the configuration are pointed out in the following sections. The devices listed in the following tables are either hand-portable or vehicle-mounted mobile phones (AEG, Sagem) or modules for system integration.

The mobile drivers and mobiles are now grouped into the R&S support classes 1 and 2. The mobiles of R&S support class 1 are continuously tested with new ROMES versions and service packs, they are permanently available to our testing staff. The mobiles of R&S support class 2 are not always available for testing, but they have been tested successfully at least once with the current ROMES software release. The introduction of the R&S support classes is necessary due to the sheer number of supported mobiles. The mobile types with R&S support class 1 are listed with normal title typeface in the tables below, the mobiles with R&S support class 2 are marked with ***italic*** title typeface.

All GSM channels and frequencies are listed in chapter 8, section *GSM Channels and Power classes.*

Table 6-1 GSM mobile drivers and supported devices

Manufacturer: AEG	**Manufacturer: Rohde & Schwarz**[1]	**Manufacturer: Sagem**
HT901 GSM Mobile[2] Hand-portable GSM900 mobile Power classes: 4-5 Channel numbers: 1-124 ***D902 GSM Portable*** Vehicle-mounted GSM900 mobile Power classes: 2-5 Channel numbers: 1-124 ***HT1801 DCS Mobile*** Hand-portable GSM1800 mobile Power classes: 1-2 Channel numbers: 512-885	***RS TM GSM900*** GSM900 module for system integration Power classes: 4-5 Channel numbers: 1-124 ***RS TM GSM 1800*** GSM900/GSM1800 module for system integration Power classes: 1-2 Channel numbers: 512-885 ***RS TM GSM 1900*** GSM850/GSM1900 module for system integration	***SAGEM OT 35-G/OT 55-G*** Hand-portable GSM900 mobile Power classes: 4-5 Channel numbers: 1-124 ***SAGEM OT 35-D/OT 55-D*** Hand-portable GSM1800 mobiles Power classes: 1-2 Channel numbers: 512-885 ***SAGEM OT 35-P/OT 55-P*** Hand-portable GSM1900 mobiles Power classes: 1-2 Channel numbers: 512-735

[1] **Note:** ROMES V3.07 and higher supports RS TM devices with firmware V4.40 and higher only. Earlier ROMES versions (up to V3.06) support RS TM devices with older firmware versions (<V4.40) only.

[2] **Note:** Mobile Devices in italic typeface are R&S Support Class 2 (see above)

Manufacturer: AEG	Manufacturer: Rohde & Schwarz[1]	Manufacturer: Sagem
HT1901 PCS Mobile Hand-portable GSM1900 mobile Power classes: 1-2 Channel numbers: 512-735 ***911 GSM Mobile*** ***1811 DCS Mobile*** ***1911 PCS Mobile***	Power classes: 1-2 Channel numbers: 512-735 ***TS 95 MM7*** GSM900/E-GSM/GSM1800 module for system integration Channel numbers: 1-124, 975-1023, 512-885 The RS TM modules require the RSTM driver; the TS 95 MM7 module requires the Siemens driver.	***SAGEM OT 75-M[3]/OT 95-M*** ***SAGEM OT 76-M/OT 96-M GPRS[4]*** ***SAGEM OT 96-MW/OT 96-RBAND[5]*** Hand-portable GSM900/1800 dual-band mobiles Power classes: 4-5 | 1-2 Channel numbers: 512-885 **SAGEM OT 160/190[6]** Hand-portable GSM900/1800 dual-band mobiles Channel numbers: 1-124, 975-1023 | 512-885 ***SAGEM OT 169/199*** Hand-portable GSM900/1900 dual-band mobiles Channel numbers: 1-124, 975-1023 | 512-810 **SAGEM OT 260/290[6]** Hand-portable GSM900/1800/1900 triple-band mobiles Channel numbers: 1-124, 975-1023 | 512-885 Models OT 76, OT 96, OT 160/190, OT 169/199, and OT 260/290 require the SAGEM x6 driver, the other models require the SAGEM driver.
Manufacturer: Chase	**Manufacturer: Kapsch**	**Manufacturer: Motorola**
Chase Caesium GSM900/1800 dual-band module for system integration Power classes: 4-5 | 1-2 Channel numbers: 1-124 | 512-885	***Kapsch GSM R*** GSM900/GSM-R module for system integration Power classes: 2-5 Channel numbers: 1-124, 955-1023	***Motorola T280i/T720 (Europe)*** Hand-portable GSM900 / GSM1800 / GSM1900 triple-band mobile ***Motorola T720 (US)*** Hand-portable GSM 850 / GSM1900 dual-band mobile All models support GPRS and are equipped with a USB driver providing two COM ports (see section *Connection via USB Interface* on p. 6.5 ff.).

[3] The OT 75-M, OT 95-M and OT95-MW mobiles support the P-GSM band (channels 1 to 124) and Enhanced Full Rate (EFR) encoding for data channels.

[4] The OT 76 and OT 96-M GPRS mobiles support the P-GSM and the E-GSM band (channels 975 to 1023). The OT 96-M GPRS mobile supports GPRS and can be used to record GPRS data.

[5] The OT 96-RBAND mobile supports the P-GSM, the E-GSM and R-GSM band (channels 955 to 974) but no GPRS.

[6] The OT 190 and OT290 mobiles support GPRS and can be used to record GPRS data.

Manufacturer: Nokia	**Manufacturer: Siemens**
Nokia 6230 GSM900 / 1800 / 1900 or GSM 850 / 1800 / 1900 triple-band mobile supporting GPRS and EGPRS. The test mobile must be connected via USB port, see section *Connection via USB Interface* on p. 6.5 ff and does not support Scanning.	***Siemens S55***[7] GSM900 / 1800 / 1900 triple-band mobile supporting GPRS. **Siemens S55-R** GSM900 / 1800 dual-band mobile supporting R-GSM and GPRS. ***Siemens M65***[7] GSM900 / 1800 / 1900 triple-band mobile supporting GPRS. **Siemens S75** GSM900 / 1800 / 1900 triple-band mobile supporting R-GSM, GPRS and EDGE. **Siemens S75-R** GSM900 / 1800 dual-band mobile supporting R-GSM, GPRS and EDGE. All test mobiles require the SAGEM x6 driver.

Driver Configuration Menu

The *Driver Configuration* menu contains various tabs configuring the mobile type *(Setup)* and *Measurement Mode,* the autodialing and autoanswer call mode *(Autodialing)*, the network quality analysis *(NQA),* the characteristics of the antenna used *(Antenna),* a fax terminal driver connected *(Slaves),* and displays information on the driver and the serial port assigned *(Serial Port Driver Info).* It can be opened by clicking the *Driver* command line of the *Configuration* menu which is available as soon as a mobile driver is loaded or via the *Driver* tab in the *Configuration of Software Modules* menu opened via the *Configuration – Settings* command.

TIP *Many mobile drivers support template files. These files store a complete driver configuration which can be re-used independent of the workspace; see* *Templates on p. 6.56 ff.*

Driver Configuration – Setup

The *Setup* tab defines the device type used, its power class and the PIN number (not for all drivers). In addition it opens the menu configuring the Rx Level Calibration.

For mobiles supporting GPRS (e.g. SAGEM OT 96-M GPRS, OT190 GPRS, OT 290 GPRS and Siemens S55, S55-R)), the *Setup* tab is replaced by the *GPRS Forcing* tab; see section *GSM/GPRS Forcing* on page 6.33.

[7] The test mobile requires a splitter box even if the GPRS data interface is not used. *Use Splitter Box* must be enabled in the *Assign Serial Ports* dialog when the driver is loaded.

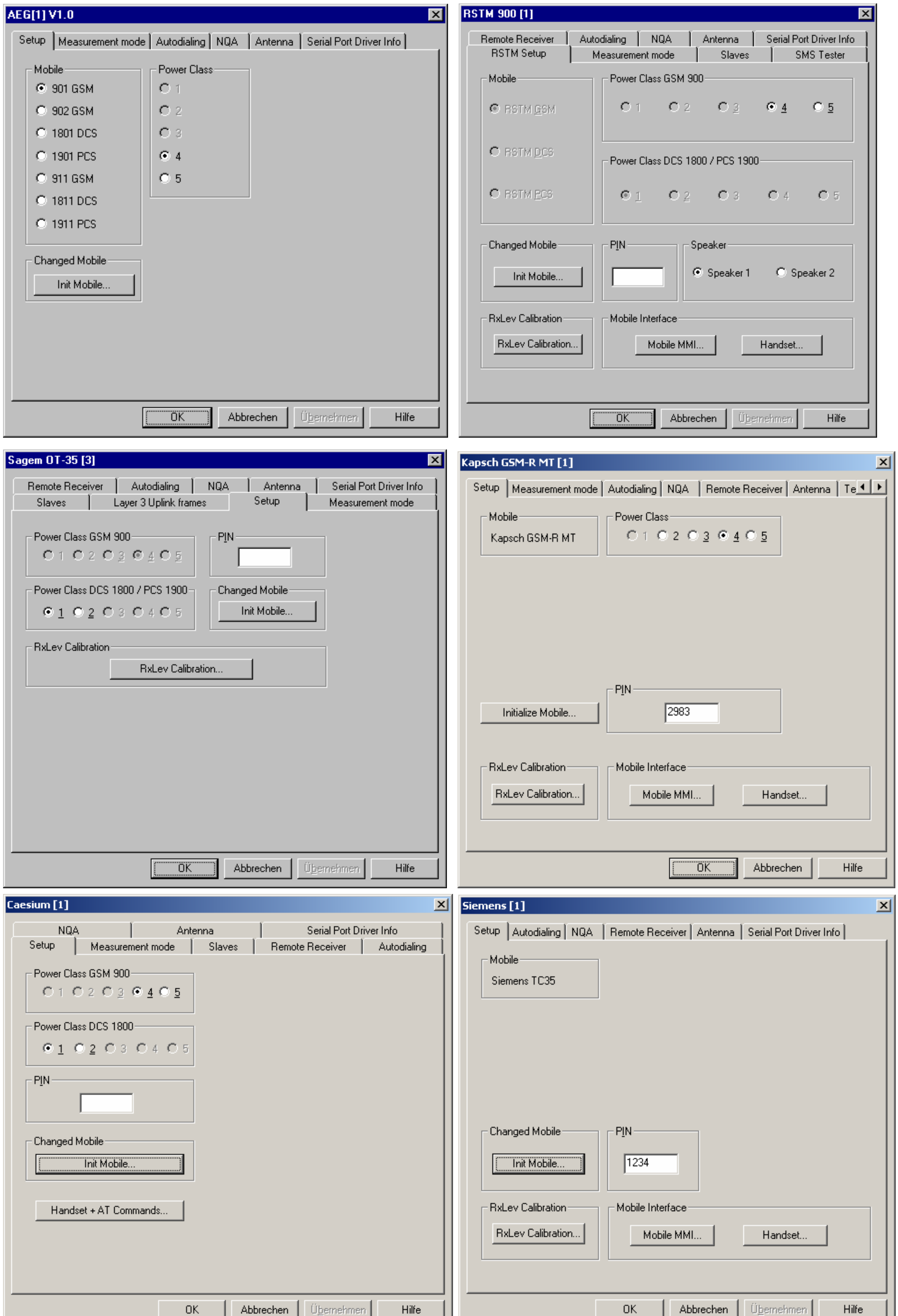


Fig. 6-7 Driver configuration – Setup (AEG, RS TM, Sagem, Kapsch, Caesium, Siemens)

Mobile List of the mobile types supported by the driver (see section *GSM Mobile Drivers* on page 6.25). To select a mobile type click the corresponding radio button. The COM port assigned to the driver is indicated below the *Mobile* list.

Power Class Power class of the mobile phone used. The GSM standard defines power classes 1 to 5:

Power class	GSM900	GSM/GSM1800	GSM/GSM1900
1	-	1 W / 30 dBm	1 W / 30 dBm
2	8 W / 39 dBm	0.25 W / 24 dBm	0.25 W / 24 dBm
3	5 W / 37 dBm	4 W / 36 dBm	2 W / 33 dBm
4	2 W / 33 dBm	-	-
5	0.8 W / 29 dBm	-	-

The power class may be decreased, however, it is not possible to go beyond the highest supported power class of the selected mobile type. See also overview of power classes and power control levels in chapter 8.

Changed Mobile The *Init Mobile...* button in the *Changed Mobile* panel starts the initialization if a mobile (even of the same type) was changed.

Speaker In the *Speaker* panel, one of the two speaker connections of the RS TM mobile can be selected.

PIN

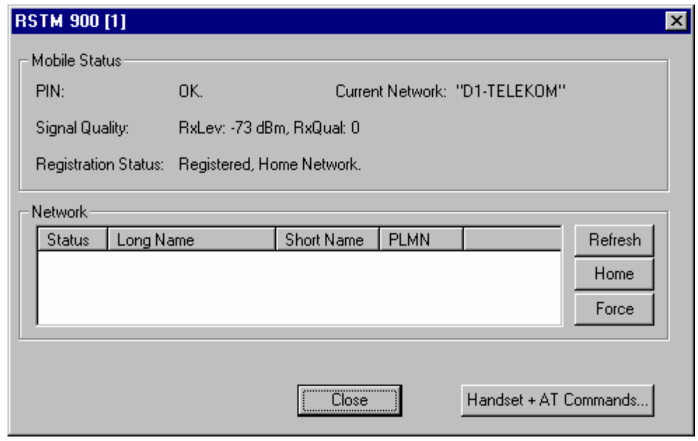
Some driver types allow to enter the PIN number in the configuration dialog:

- In the RS TM driver configuration menu the PIN number is entered via a dialog box which is opened by pressing the *PIN* button:

- In the Sagem driver configuration menu the PIN number is directly entered into the *PIN* input field. Alternatively, the PIN can be entered via the mobile phone.

Mobile MMI...

The *Mobile MMI...* button opens the user interface for the RS TM, Kapsch, or TS 95 MM7 mobile (Siemens driver):

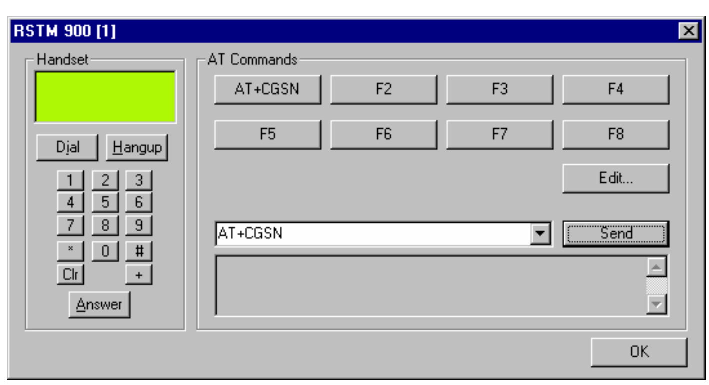


Mobile Status	Status information reported by the mobile
Network	List of all available networks with their status, name, and "PLMN" (consisting of the mobile country code MCC (first 3 digits) and the mobile network code MNC (last 2 digits)). Status *forbidden* means that the network is available for emergency calls only.
Refresh	Update the network list
Home	Switch from the current network to the home network (if a home network is registered on the SIM card)
Force	Switch from the current network to another accessible network
Handset + AT-Command	Open a dialog to set up a call and to edit an AT-command and send it to the mobile; see description of the *Handset* button below.

Handset /

Handset + AT Commands...

The *Handset... (Handset + AT Commands)* button, which is available for RS TM and TS 95 MM7 (Siemens) mobiles, opens a dialog to set up a call and to edit an AT-command and send it to the mobile:



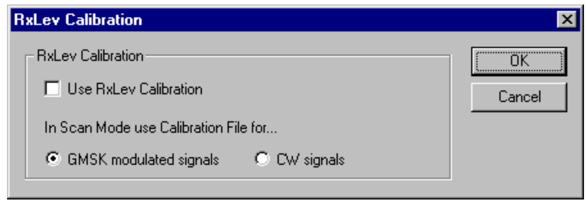
The *Handset* panel is identical with the handset dialog, see section *Action Menu* on page 6.66.

Warning!

The AT-Command feature is for service purposes and should be used by experts and the R&S service staff only. Inappropriate use may cause malfunctions of the RS TM or TS 95 MM7 mobile.

RxLev Calibration

The *RxLev Calibration* button, which is available for AEG, RSTM, Kapsch, Sagem, and Nokia mobiles, opens a dialog to activate the calibration of the received signal level reported by the mobile:



The RxLev Calibration is based on a comparison between the RX level values reported by the mobile and the actual RX levels applied to the mobile receiver. This comparison can be drawn with a CMD Digital Radio Communication Tester and the *MobCal* software tool from Rohde & Schwarz. The correction table is an ASCII calibration file that is stored in the *Driver* subdirectory of the ROMES program directory.

The calibration can be used for single-band as well as for GSM900/1800 dual-band mobiles. For dual-band mobiles two separate correction tables are generated for the two GSM hyperbands. In order to be recognized as two files belonging to the same mobile, the two correction tables must be named as follows: If the file name for the 900-MHz band reads [Part_of_the_IMEI].CM, then the file name for the 1800-MHz band must be [Part_of_the_IMEI]_d.CM. Both correction tables must be copied to the *Driver* subdirectory.

Driver Configuration – Nokia Settings

The *Nokia Settings* tab selects GSM and GPRS-related parameters to be measured and recorded by Nokia 6230 mobile phones. It replaces the *Setup* tab provided for mobiles that do not support GPRS; see section *Setup* on page 6.27.

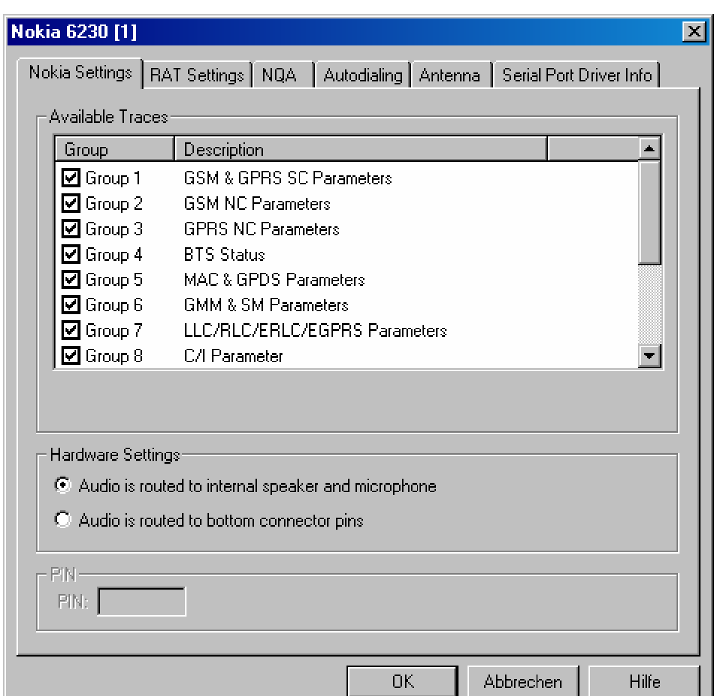


Fig. 6-8 Driver configuration – Nokia Settings

The available message types are arranged in the groups listed in the table Table 6-2 below, together with the names of the corresponding views and data structures/signals in the data tree. For an explanation of the recorded parameters refer to the description of the GSM and GSM/GPRS views in chapter 4. The table below indicates the most important views and signals which use the different message types.

All parameters are selected by default. Deselecting some of the groups reduces the size of the measurement file but does not speed up the measurement.

Hardware settings The input and output signals of the mobile audio circuit are usually routed to the speaker and microphone. As an alternative it is possible to route the signals to the bottom connector pins of the mobile to be tapped off and analyzed.

Table 6-2 GSM/GPRS message types, views and signals

Message type	**View**	**Data structure / signal**
Group 1: GSM & GPRS SC Parameters	GSM Measurement Report, GSM System Information, GSM GPRS/EGPRS, GSM Layer 1	Measurement Report, Server Report, Packet Server Report Layer 1 Ext
Group 2: GSM NC Parameters	GSM Measurement Report, GSM Layer 1	Measurement Report, Server Report
Group 3: GPRS NC Parameters	GSM GPRS/EGPRS	Packet Server Report
Group 4: BTS Status		
Group 5: MAC & GPDS Parameters	GSM GPRS PDP Info	GPRS LLC Info GPRS MAC Info
Group 6: GMM & SN Parameters		
Group 7: LLC/RLC/ERLC/EGPRS Parameters	GSM GPRS/EGPRS	Packet Server Report, EGPRS Info
Group 8: C/I Parameters		
Group 9: AMR Parameters		
Group 17: GSM System Information Messages	GSM System Information View GSM GPRS System Information View	
Group 18: GSM Layer 3 Messages	UMTS/GSM Layer 3 View	Layer 3
Group 19: GSM & GPRS Parameters		
Group 20: GSM & EGPRS Configuration Parameters	GSM GPRS/EGPRS View	
Group 21: GPRS Context & GMM/SM Messages		

Driver Configuration – GSM/GPRS Forcing

The *GSM/GPRS Forcing* tab selects GSM and especially GPRS-related parameters that can be set at the Sagem mobile phones supporting GPRS. It replaces the *Setup* tab provided for mobiles that do not support GPRS; see section *Setup* on page 6.27.

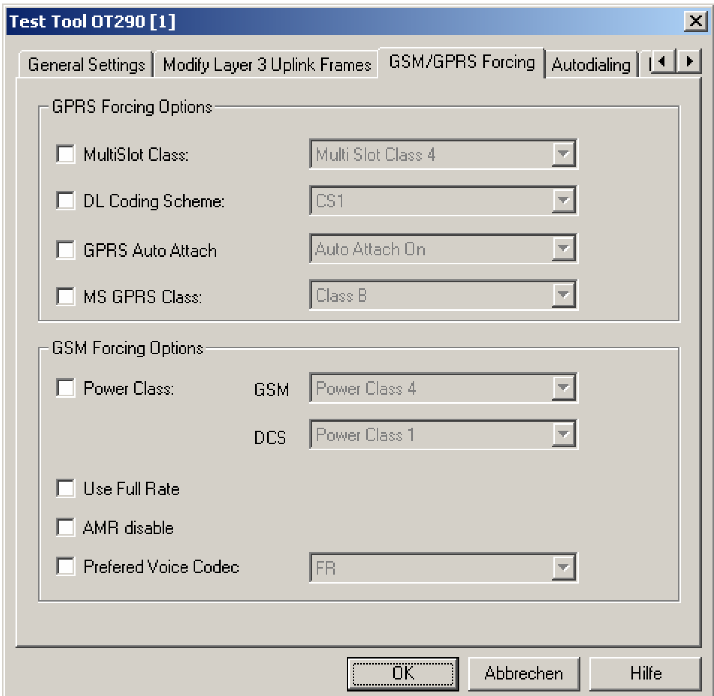


Fig. 6-9 Driver configuration – GSM/GPRS Forcing

The GPRS parameters to be forced at the mobile can be selected in the *GPRS Forcing Options* panel from several pull-down lists. Each of the lists is activated by checking the box associated to the parameter. Otherwise, the parameter will not be enforced and the mobile will use its default value.

Multislot Class GPRS multislot class according to GSM 05.02. The list indicates the MS class no. (1, 2, 4) plus (in brackets) the maximum number of receive and transmit timeslots that the MS can use per TDMA frame.

DL Coding Scheme Coding scheme (CS1 to CS4) for downlink data transfer.

GPRS Auto Attach This function allows to specify whether the mobile station shall automatically attach to the GPRS network at power-up *(On)* or not *(Off)*. If it is set to *Off*, the mobile station only attaches upon PDP Context Activation.

MS GPRS Class GPRS class of the mobile station *(Class B* or *Class C)*.

General GSM parameters can be set in the *GSM Forcing Options* panel:

Power Class Power class of the mobile while in GSM900 or GSM1800 mode. See list of power classes on page 6.29 and overview of power classes and power control levels in chapter 8.

Use Full Rate If this box is checked, the mobile is forced to use either Full Rate or Half Rate but not Enhanced Full Rate (EFR) data transfer mode. *Use Full Rate* becomes unavailable if an EFR codec is selected explicitly.

The following voice codec selections are available for SAGEM OT 2xx test mobiles only. They ensure that the test mobile does not change its voice codec, which might have an undesired impact on the measurement results:

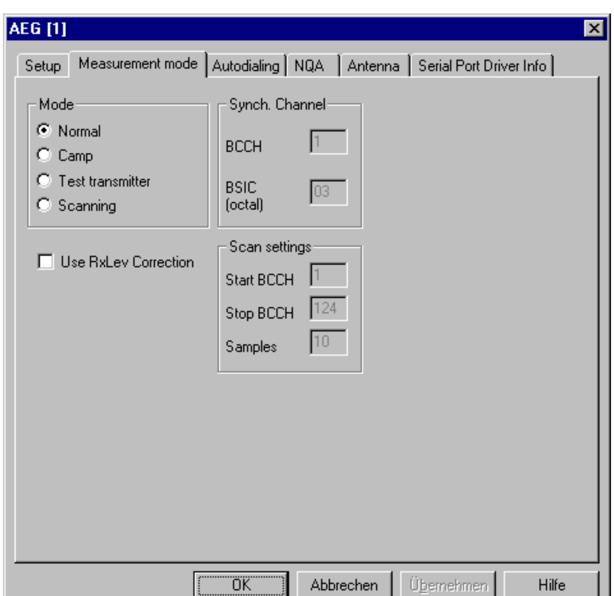
AMR Disable Prevent the test mobile from activating an Adaptive Multi Rate (AMR FR or AMR HR) codec. The test mobile uses either its Full Rate (FR), Half Rate (HR), or Enhanced Full Rate (EFR) codec.

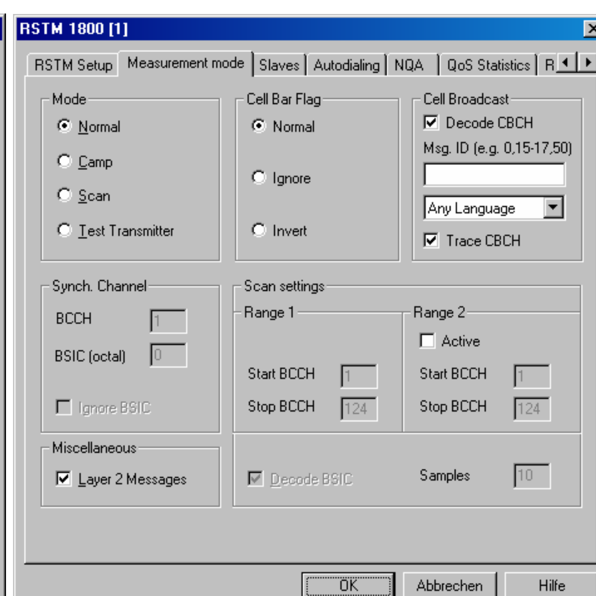
AMR Disable becomes unavailable as soon as an AMR codec is selected explicitly.

Preferred Voice Codec Explicit selection of a voice codec that the mobile will use. The explicit voice codec selection might possibly overwrite the *AMR Disable* and *Use Full Rate* settings.

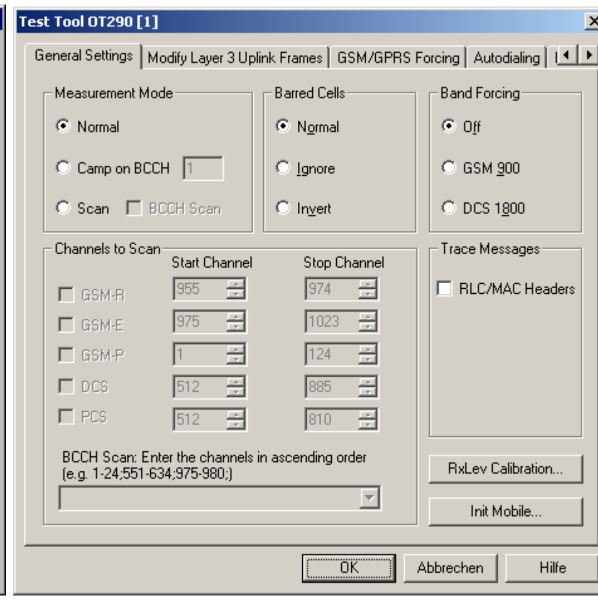
Driver Configuration – Measurement Mode / General Settings / RAT Settings

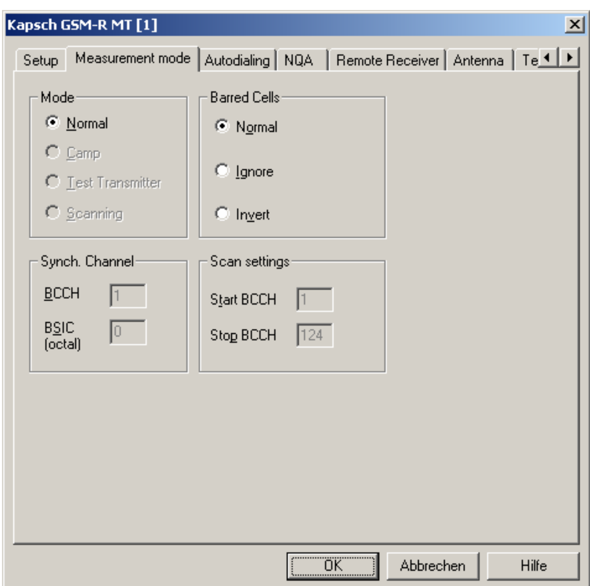
The *Measurement Mode* tab configures the measurement mode, synchronization channel, scan settings, call broadcast settings and RxLev correction. For the Sagem X6 driver, tab is labeled *General Settings;* for the Nokia 6230 driver, it is labeled *RAT Settings* (Radio Access Technology Settings).

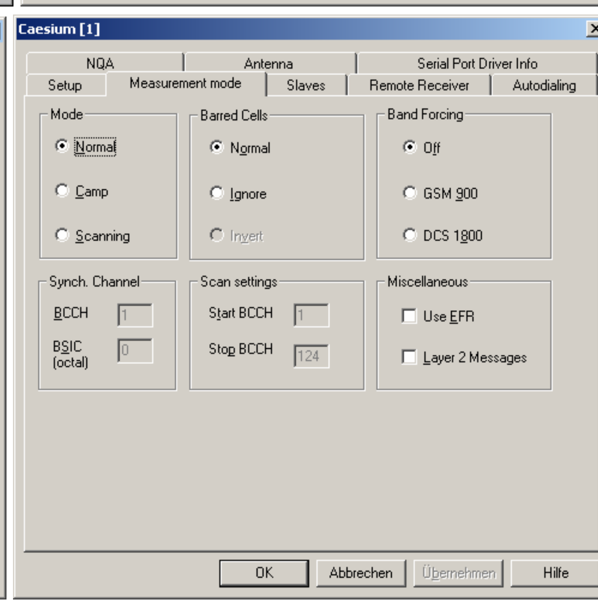





Sagem OT-35 [3]
Remote Receiver
Autodialing
NQA
Antenna
Serial Port Driver Info
Slaves
Layer 3 Uplink frames
Setup
Measurement mode
Mode
Normal
Camp
Scanning
Cell Bar Flag
Normal
Ignore
Invert
Band Forcing
Off
GSM 900
DCS 1800
Synch. Channel
BCCH
BSIC (octal)
Scan settings
Start BCCH
Stop BCCH
Miscellaneous
Use EFR
Layer 2 Messages
OK
Abbrechen
Übernehmen
Hilfe


Test Tool OT290 [1]
General Settings
Modify Layer 3 Uplink Frames
GSM/GPRS Forcing
Autodialing
Measurement Mode
Normal
Camp on BCCH
Scan
BCCH Scan
Barred Cells
Normal
Ignore
Invert
Band Forcing
Off
GSM 900
DCS 1800
Channels to Scan
Start Channel
Stop Channel
GSM-R
GSM-E
GSM-P
DCS
PCS
Trace Messages
RLC/MAC Headers
BCCH Scan: Enter the channels in ascending order
(e.g. 1-24;551-634;975-980;)
RxLev Calibration...
Init Mobile...
OK
Abbrechen
Hilfe


Kapsch GSM-R MT [1]
Setup
Measurement mode
Autodialing
NQA
Remote Receiver
Antenna
Mode
Normal
Camp
Test Transmitter
Scanning
Barred Cells
Normal
Ignore
Invert
Synch. Channel
BCCH
BSIC (octal)
Scan settings
Start BCCH
Stop BCCH
OK
Abbrechen
Hilfe


Caesium [1]
NQA
Antenna
Serial Port Driver Info
Setup
Measurement mode
Slaves
Remote Receiver
Autodialing
Mode
Normal
Camp
Scanning
Barred Cells
Normal
Ignore
Invert
Band Forcing
Off
GSM 900
DCS 1800
Synch. Channel
BCCH
BSIC (octal)
Scan settings
Start BCCH
Stop BCCH
Miscellaneous
Use EFR
Layer 2 Messages
OK
Abbrechen
Übernehmen
Hilfe

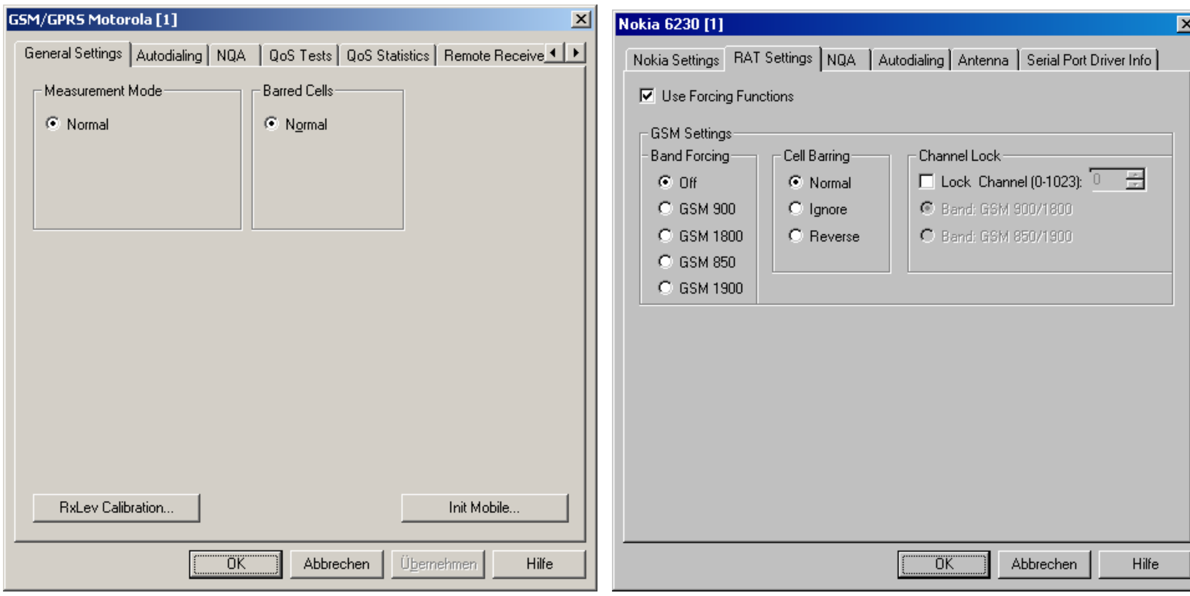


Fig. 6-10 Measurement mode (AEG, RS TM, Sagem, Kapsch, Caesium, GSM/GPRS Motorola)

(Measurement) Mode

The drivers provide the four measurement modes *Normal, Camp*, *Scan(ning)* and *Test Transmitter*. Some test mobiles do not support all test modes. The SAGEM mobiles can be used in *Test Transmitter mode* by using the *Ignore Barred Cells* feature in the *Camp* mode.

Normal measurement mode

The measurements are performed in the selected network. A valid SIM card must be inserted in the mobile phone, and the correct PIN number must be entered.

Forced handover: During the measurement, and during a call (dedicated mode), it is possible to switch over to one of the six neighbor cells by force if the conditions in the desired cell are appropriate. If several mobiles are installed, switching can be performed separately for each one. See *Handover* command in the *Action* menu (page 6.66).

Camp Mode

In Camp mode, the access to all cells except the one with a particular BCCH is denied for the mobile. Handover attempts are thus suppressed. Therefore the Camp mode is recommended for cell boarder determinations.

When the measurement is started, the mobile initiates a *Cell Reselect process* and tries to register to the BCCH and BSIC set in the *Synch. Channel* panel of the *Measurement Mode* menu (for the Sagem x6 driver, the BCCH in the entry field behind the *Camp on BCCH* radio button). Obviously this will not be successful unless the selected BCCH number and BSIC is available. For RS TM devices, selection of a definite BSIC can be disabled.

A valid SIM card has to be inserted and the correct PIN number must be entered.

Scan(ning) Mode

The scan(ning) mode allows to scan the complete frequency band or part of it. In this measurement mode the operator can get a quick overview on the current activities of the channels within the used frequency band. By default, only the signal strength of each channel in *dBm* is measured.

For this mode it is necessary to select the desired channel range in the *Scan Settings* or *Channels to Scan* panel; see below. Typically, *Start BCCH* and *Stop BCCH* define the scan range, which must be completely within the used frequency band.

The Sagem x6 driver provides a special *BCCH Scan* mode where the mobile also decodes the BSIC in a specified channel range; see *BCCH Scan* below. The RS TM driver provides an equivalent mode where the BSIC is decoded in a single channel; see *Decode BSIC* below.

The *Samples* parameter available for AEG and RS TM devices defines the sampling rate, i.e. the number of measured values to be taken for the average. A high sampling rate improves the accuracy of the result but slows down the measurement. A sampling rate of 2 or 3 is recommended.

A valid SIM card has to be inserted and the correct PIN number must be entered (not for AEG).

Test Transmitter Mode

The *Test* or *Interims Transmitter* mode is used in combination with the *TS9953 Test Transmitter System* from Rohde & Schwarz to test the geographical conditions for a proposed place to build up a new transmitter station. In this mode, a low-level signal is transmitted on the downlink path from the test transmitter to the test mobile, so that already here the *RxQual* parameter can be detected.

The desired channel is to be set via the BCCH parameter in the *Measurement Mode* menu. In addition, either the corresponding modulation type, frequency and output level must be set at the SME or SMIQ signal generator of the *TS9953* system or the TS9953 GMSK test transmitter must be used with internal GMSK modulation.

Note:

> *Test transmitter measurements can be performed in regions with operational GSM networks without influences on those - you just have to select an available channel. To avoid any conflicts, the channels on the left and right of the used channel (adjacent channels) must also be available. So first use the Scanning mode to look for a gap you can use.*

After synchronization of the test mobile on the test transmitter signal, the program flow is similar to the *Camp* mode, however, only the downlink will be performed.

In this mode, no SIM card is needed for the AEG phones.

Synch. Channel

BCCH number and octal BSIC to which the mobile has access in the Camp mode. If the *Ignore BSIC* switch is selected (for RS TM devices), all *Base Station Identity Codes* are allowed.

Use RxLev Correction

For AEG devices: If this function is active, the system uses the calibration file generated for the connected mobile. This file has to be located in the subdirectory *\Driver* . The software needed to generate the file is available from Rohde & Schwarz on request.

Scan Settings / Channels to Scan

The *Start BCCH* and *Stop BCCH* channel numbers determine the measurement range in the *Scan(ning)* mode. This range must be within the supported channel range (e.g. 1 to 124 for GSM900). The SAGEM and other dual-band mobiles support the two bands between 1 and 124 and between 512 and 885. The Sagem x6 driver provides an overview of channel ranges that can be set depending of the GSM band used. Moreover, it supports the *BCCH Scan* with BSIC decoding over an arbitrary combination of single BCCH channels and channel ranges; see *BCCH Scan* below.

The *Samples* parameter (not for SAGEM) defines the number of measured values to be acquired in each channel – see *Scanning Mode* above.

Note:

The RS TM mobile will exclusively scan the channels selected, whereas the others measure the complete band but display and save only the channels selected. This implies that the other mobiles will not be faster if the range is reduced. To improve speed and flexibility, the RS TM scan range is divided into two subranges (Range 1 and Range 2). Range 2 is only measured if explicitly activated (check Active).

Decode BSIC

For RS TM devices: If this function is active, the test mobile tries to decode the BSIC from all channels. The decoded BSIC values are displayed in the *GSM Scan View* (see chapter 4).

Note:

Decoding requires a certain minimum amount of samples per channel. Allowed range: 1...50; recommended for this feature: 20 or more. Decoding is improved if the number of channels to be measured is reduced.

BCCH Scan

For the Sagem x6 driver: If this function is active, the test mobile tries to decode the BSIC in the *BCCH Scan* channel range entered in the *Channels to Scan* panel. The decoded BSIC values are displayed in the *GSM Scan View* (see chapter 4).

Note:

While the BCCH scan is active the mobile measures each channel until the BSIC has been successfully decoded. This can cause a considerable extension of the measurement time.

Barred Cells / Cell Barring / Cell Bar Flag

For RS TM, Nokia and SAGEM devices: This function allows to ignore or even invert the cell bar flag:

Normal	Only cells that are not barred are accessible for the mobile
Ignore	Cell bar flag ignored – all cells are accessible
Invert	Cell bar flag inverted – only barred cells are accessible

Cell Broadcast

For RS TM devices: This function allows to decode the *CBCH (Cell Broadcast Channel)* which some network carriers use to transmit general information to the mobile phone (GSM 03.41). Cell Broadcast Messages (CBM) can be viewed in the *GSM CBCH View*; see chapter 3.

Decode CBCH	Display the GSM Cell Broadcast Message text content in the *GSM CBCH View.*
Page	Single page number or set of page numbers to be decoded. Page number = Message Identifier (GSM 03.41).
Language	Display only messages in the specified language or all messages *(Any Language;* GSM 03.38).
Trace CBCH	Activate the automatic Cell Broadcast Channel tracing option. See also manual tracking option in the *Measurement settings* tab of the ESVx test receiver configuration menu (section *Test Receiver Configuration* on page 6.149 ff.).

Note:
An option license is necessary for this feature.

Band Forcing

For all SAGEM dual-band mobiles and Nokia mobiles, one of the supported GSM bands can be selected:

Off	All supported GSM bands allowed
GSM900/1800/850/1900	Use a specific GSM band
DCS 1800	Use DCS 1800 band (Sagem, corresponds to GSM1800)

Misc.

Use EFR

For SAGEM devices: If this function is active, enhanced full rate encoding (EFR) is used. This function is mobile-specific and supported by the OT 75-M, OT 95-M and Caesium dual band mobiles.

RLC/MAC Headers

For SAGEM OT 190 / 290 (GPRS) devices: If this function is active, the information in the RLC/MAC headers of the transmitted radio blocks is included in the measurement data and can be displayed in the *GSM RLC/MAC Header View*.

RxLev Calibration

For SAGEM mobiles using the Sagem x6 driver: The *RxLEV Calibration...* button opens a dialog to activate the calibration of the received signal level reported by the mobile; see description of *RxLev Calibration* on p. 6.31.

Init Mobile

For SAGEM mobiles using the Sagem x6 driver: The *Init Mobile...* button starts the initialization if a mobile (even of the same type) was changed.

Channel Lock For Nokia 6230 mobiles: *Lock Channel* forces the test mobile to use a specified existing GSM channel. In the different GSM bands, the same channel numbers are used for different frequencies (see overview of GSM channels in chapter 8). The ambiguities in the channel-frequency assignment are resolved by specifying one of the two band combinations *GSM900/1800* or *GSM 850/1900*.

Driver Configuration – Remote Receiver

The *Remote Receiver* tab configures the tracking mode where a the mobile phone controls a CW test receiver and sets its receive frequency. In tracking mode, the measurement must be performed on a single frequency channel although most test receivers are able to measure at several frequencies simultaneously. The *Remote Receiver* tab is identical for all GSM and UMTS mobile drivers.

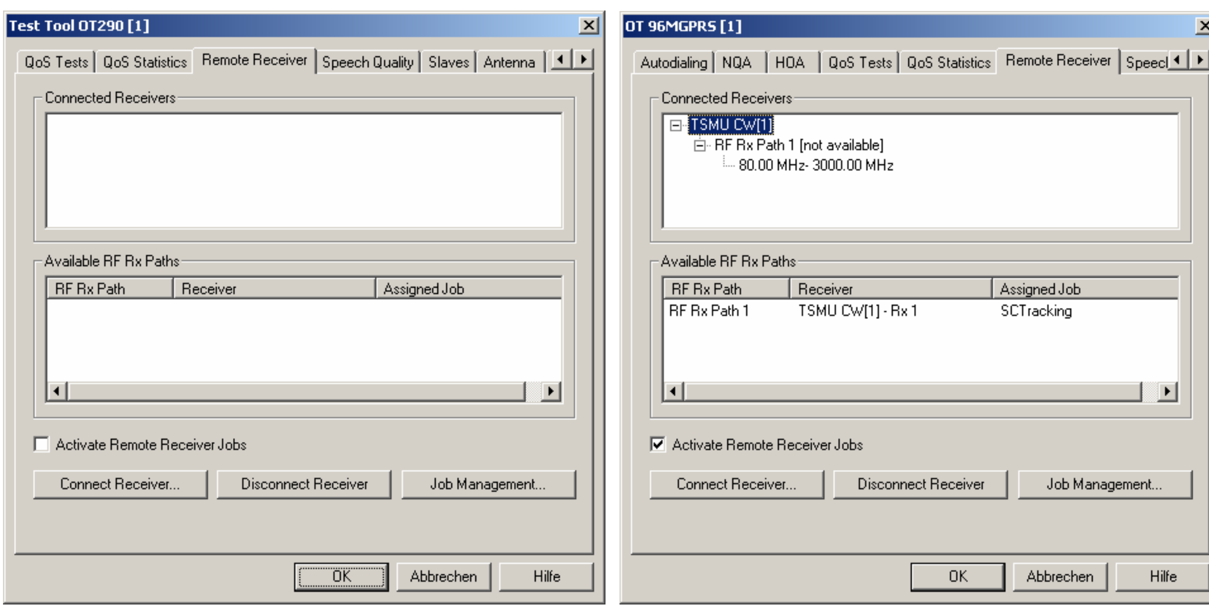


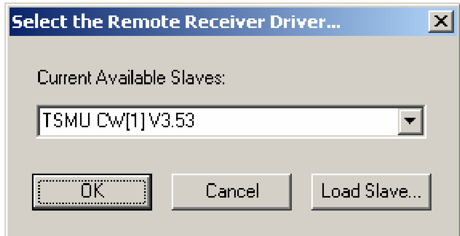
Fig. 6-11 Driver Configuration – Remote Receiver tab (all drivers)

Connected Receivers List of test available receivers. To connect an additional test receiver, click the *Connect Receiver...* button. To remove a test receiver from the list, select the receiver and click the *Disconnect Receiver...* button.

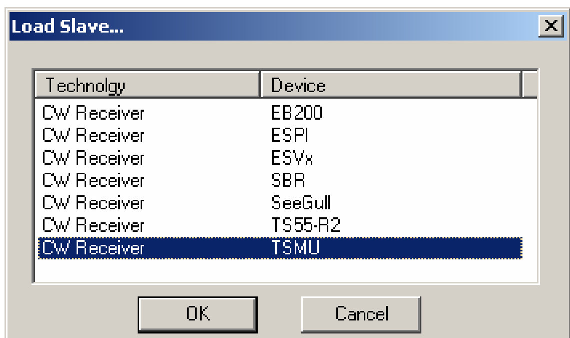
Available RF Rx Paths List of receiver signal paths, receiver, and receiver jobs assigned to each path. To select an additional job to be done, click the *Job Management...* button.

Activate Rem. Rec. Jobs If the box is checked, the jobs that are shown in the *Available RF Rx Paths* table will be done after *OK* is clicked and the configuration menu is closed.

Connect Receiver... The *Connect Receiver...* button opens a selection dialog showing all test receivers available as slaves:



Test receivers are not shown in the pull-down list before the test receiver drivers are loaded. This can be done by clicking the *Load Slave* button to call up the *Load Slave* window and select a test receiver to be loaded:



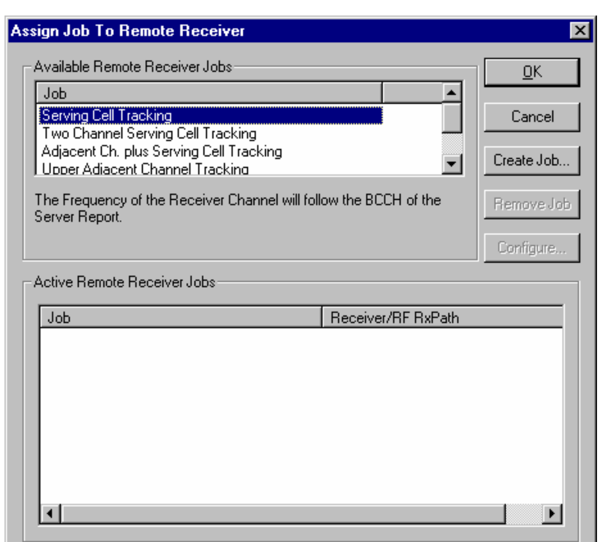
The following receiver drivers can be used for tracking: *EB200, ESPI, ESVx*, *SBR, dti SeeGull*, *TS55-R2, TSMU.*

OK Connect the selected test receiver, add it to the list of *Connected Receivers* in the *Remote Receiver* tab and close the *Load Slave* window.

Cancel Close the *Load Slave* window without connecting a test receiver.

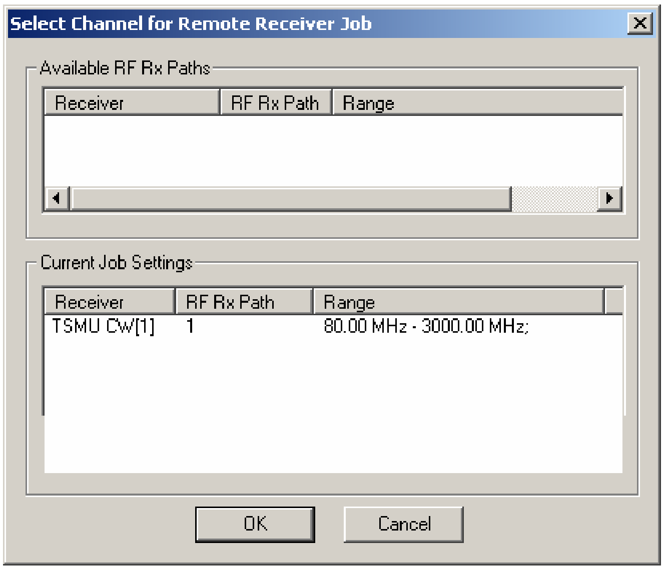
Disconnect Receiver... The *Disconnect Receiver...* button disconnects the receiver selected in the list of *Connected Receivers.*

Job Management... The *Job Management...* button opens the *Assign Job to Remote Receiver* dialog to create or select a job and assign it to a remote test receiver:



The job to be assigned to the remote receiver can be selected from the list of *Available Remote Receiver Jobs*. A description of each job is displayed below the list when the job is selected.

OK	Assign the selected job to the receiver selected in the list of *Connected Receivers* in the *Remote Receiver* tab and close the current dialog.
Cancel	Discard the current selection and close the dialog.
Create Job...	Activate the selected job and add it to the list of *Active Remote Receiver Jobs*.
Remove Job	Remove the selected job from the list of *Active Remote Receiver Jobs*. This softkey is disabled if the list is empty or if no job is selected in the list.
Configure	Open the *Select Channel...* dialog to assign one or several receiver channels *(RF Rx Paths)* to the job selected in the list of *Active Remote Receiver Jobs*. The *Configure* softkey is disabled if the list is empty or if no job is selected in the list. Some jobs require several channels which can be provided by one or several test receivers.



The *Select Channel...* dialog displays all channels that are available but not yet assigned *(Available RF Rx Paths)* and the channels that are already assigned to the current job *(Current Job Settings)*. Double-click on a channel in one of the tables to move it to the other table.

Remarks about the Tracking Mode

The tracking mode has an impact on some driver configuration menus and views.

- In the tree views for data selection (e.g. in the *Values* tab of the *2D Chart View* configuration menu), the master of a channel (i.e. the mobile phone controlling the test receiver) is indicated instead of the measurement frequency.
- The settings of test receiver channels controlled by a master cannot be changed in the *Measurement Settings* tab of the test receiver driver configuration menus; see section *Test Receiver Configuration* on page 6.149 ff.
- Each channel change and each receiver used generates an event in the measurement data. These events can be viewed together with all other events in the *Event View*, in the *Route Track View* and in the *2D Chart View.* In addition, each channel change is indicated in the *General Status View.*

Driver Configuration – Autodialing

The *Autodialing* tab configures the mode where the mobile periodically attempts a call to the network dialing a definite phone number. This mode is relevant for the network quality analysis described on page 6.47. The *Autodialing* tab is similar for all GSM mobile drivers.

The Nokia 6230 test mobile needs a 2nd virtual COM port to be operated in *autodial* mode; see paragraph on *Loading the drivers* *(Nokia)* on p. 6.5.

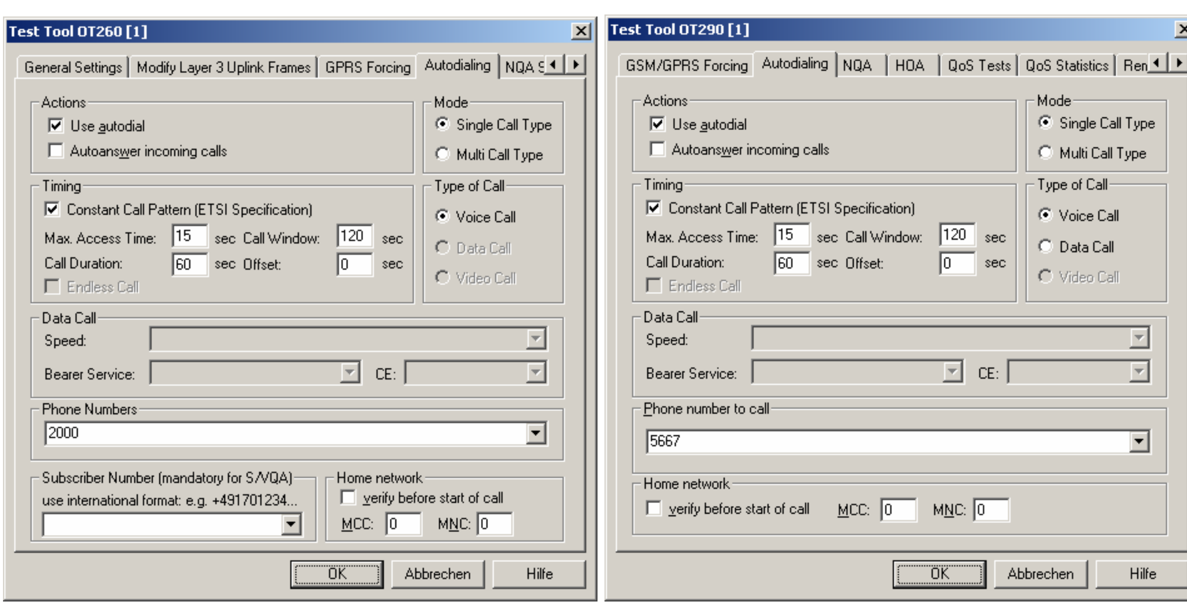


Fig. 6-12 Driver Configuration – Autodialing tab (all drivers, single call type)

Actions

The check boxes in the *Actions* panel activate automatic call options:

Use autodial	If the box is selected the mobile sets up periodic calls using the parameters in the remaining panels of the Autodialing tab. The autodial function is useful for many applications, in particular for the Network Quality Analysis.
Autoanswer incoming calls	If the box is selected the mobile automatically accepts all incoming calls after a certain number of ring tones.

Mode (Sagem x6)

To option buttons switch between a single call type and a multi call type:

- A single call is set up according to the settings in the remaining panels of the *Autodialing* tab (see Fig. 6-12 on p. 6.43). The call is periodically repeated if *Use autodial* is selected.
- A multi call is a sequence of calls with individual call settings, to be configured in the multi call version of the *Autodialing* tab (see Fig. 6-13 on p. 6.46). The call sequence is periodically repeated if *Use autodial* is selected.

Type of Call (Sagem X6, Nokia etc.)

Several drivers display the *Type of Call* panel:

- All test mobiles support voice calls.
- Data calls can be set up with Nokia devices, provided that *Use autodial* is active. They can also be used with Qualcomm test devices; see Fig. 6-36 on p. 6.83 ff, with the Samsung Z105 test mobile, and with all other test devices supporting GSM and UMTS. When the driver is loaded, ROMES automatically initializes the data call service using an appropriate AT command.
- Some test devices (e.g. the Samsung Z105) support video calls. To test this call type, the called party must be configured for video calls as well and *Autoanswer incoming calls* must be enabled.

Data and video calls are not supported by Sagem mobiles, even if the splitter box is used.

Timing

Defines the periodicity of the autodial process.

Constant Call Pattern (ETSI Specification)	If this option is enabled (box checked), the calls are repeated in the fixed Call duration/Call Window pattern, no matter whether a connection is released or lost before the end of the Call duration. This setting is in accordance with IREG specifications and ensures that several connected test mobiles operate synchronously. It is required for an analysis of the calls in the UMTS/GSM NQA State View. In the alternative setting, the call duration ends and the next Idle Time starts at the moment when a call is lost. This ensures that a maximum number of calls per unit of time can be set up at fixed call duration and idle time.
Max. Access Time	Maximum time allowed for cell access. If no call can be established within this time, the call is classified as a blocked call.
Call Duration	Time between start and release of a call in the range between 15 s and 86400 s. For some mo-

	biles it may be necessary to set the Call duration time higher than 15 s to get a Good Call, e.g. to 25 s. Therefore check the call statistics in the GSM NQA View before you start the measurement tour.
Idle Time	Time between release of a call or connection loss and dialing for the next call in the range between 10 s and 86400 s. For an endless call, which is usually intended to be continued without interruption, it is advisable to set the idle time to a minimum. This ensures that a dropped connection is restored as quickly as possible. The Idle Time is available while Constant Call Pattern is disabled.
Call Window	Time between two subsequent call attempts, including the access time, the call duration and a possible idle time until the next call is initiated. The Call Window is available while Constant Call Pattern is enabled.
Offset	Time offset for dialing. Different Offset times for different test mobiles (e.g. 0 s for the first, 20 s for the second mobile etc.) ensure that the test mobiles will not dial simultaneously. Possible problems in the connection setup are avoided.
Endless call	For an endless call (box checked), the call duration is set to infinity; the Call duration input field is disabled. Endless call is disabled while Constant Call Pattern (ETSI Specification) is selected.

The timing of the calls can be monitored in the *UMTS/GSM NQA State View.*

Data Call (Nokia)

If a data call is selected, then the input fields in the *Data Call* panel are enabled. They provide a subset of the possible parameters for the +CBST call control command described in standard 3GPP TS 07.07. The values depend on the test mobile type.

Speed	Baud rate of the data connection. The Nokia 6230 test mobile provides automatic baud rate selection according to the quality of the radio link or a list of fixed baud rates.
Bearer Service	The value *data circuit asynchronous (UDI or 3.1 kHz modem)* cannot be changed.
CE	Connection Element; the value *non-transparent* cannot be changed.

Subscriber Number

The Subscriber Number, which is mandatory for S/VQA, is entered or selected in this list field.

The number must be entered using the international format, e.g. (089) 12345678 would be entered as "+498912345678" without fillers (such as blanks or hyphens).

Home network Home network identified by the mobile country code (MCC) and the mobile network code (MNC). If *verify before start of call* is checked, the mobile will be out of service if a call is attempted from a foreign network (e.g. during a measurement tour near the border of a network where roaming is possible). This ensures that calls from foreign networks will not impair the network quality analysis; see next section.

By default, the *verify before start of call* function is not active.

Phone Numbers One or more phone number(s) can be entered via the keyboard and the input field.

The *Autodialing* tab of the Sagem x6 driver configuration menu changes if a *Multi Call Type* is selected:

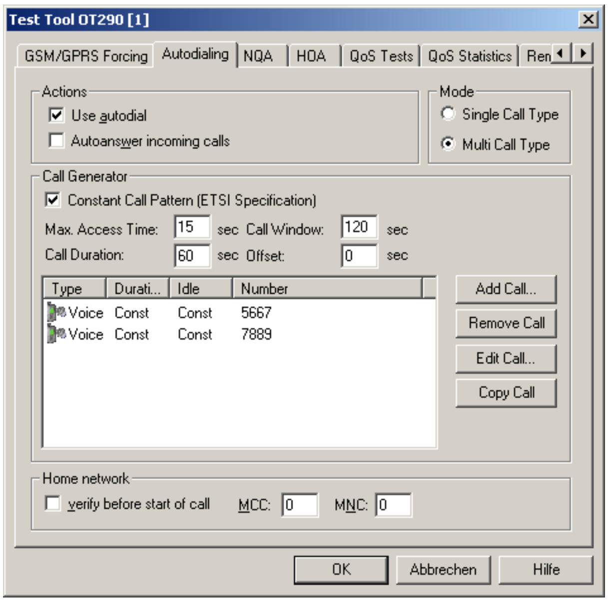


Fig. 6-13 Driver Configuration – Autodialing tab (Sagem x6, multi call type)

A multi call is sequence of single calls with independent call settings. The settings for each call are identical with the single call settings described above. The individual calls are listed in the center of the *Call Generator* panel. If *Constant Call Pattern* is active, the timing settings in this panel are valid for all calls in the list.

The buttons to the right of the list add or remove calls from the list and edit or modify a selected call. *Add Call…* or *Edit Call* opens the following *Call Settings* dialog:

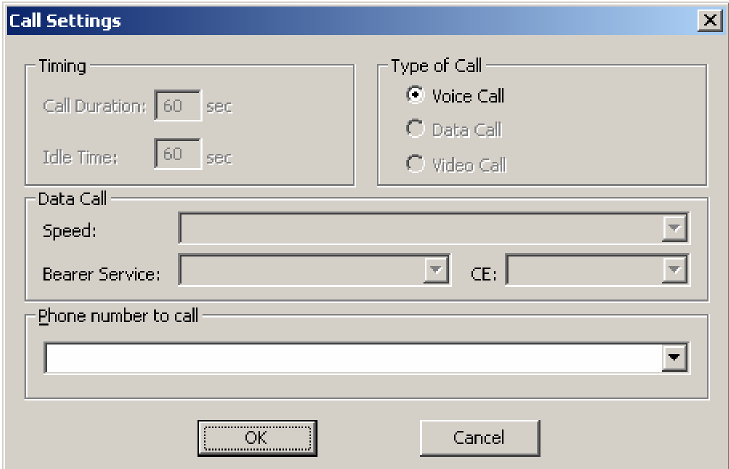


Fig. 6-14 Call Settings (Sagem x6, multi call type)

The *Timing* settings in the *Call Settings* dialog are unavailable if a *Constant Call Pattern* is active.

Driver Configuration – NQA

The *NQA* tab provides the parameters for *Network Quality Analysis*. NQA is a prerequisite for drawing up a call statistics where the calls are classified and the classes are visualized separately (see *UMTS/GSM NQA View* window in chapter 3). The *NQA* tab is identical for all GSM mobile drivers.

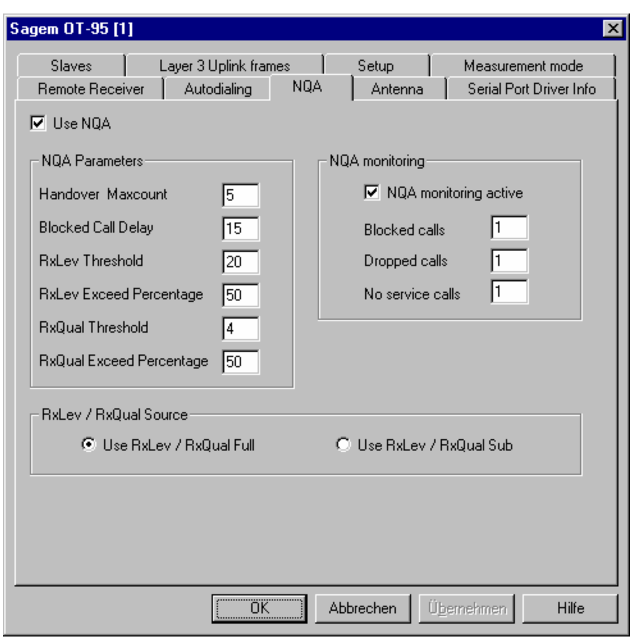


Fig. 6-15 Driver Configuration – NQA tab (all drivers)

Use NQA If checked, the box activates the network quality analysis (default).

NQA Parameters

The following numeric parameters configure the NQA by defining conditions and limits for the different call classes (the ranges for all parameters are quoted; default values are underscored)

Handover Maxcount — Maximum number of handover procedures during a call in the range 1 to 5 to 100. If the defined value is exceeded, the call will be classified as EXCESSIVE HO.

Blocked Call Delay — Maximum delay (in seconds) between CM_SERV_REQ and ASSIGNMENT_COMMAND in the range 1 (s) to 15 (s) to 63 (s). If the defined delay is exceeded, the call will be classified as DELAYED CALL.

RxLev Threshold — Minimum received signal input level in the range 1 to 20 to 63. RxLev values which fall below this threshold contribute to NOISY.

RxLev Exceed Perc. — Minimum ratio (in percent) of reported RxLev values falling below the RxLev Threshold in the range 1 (%) to 50 (%) to 99 (%). If the actual ratio falls below the *specified percentage the call is classified as NOISY.*

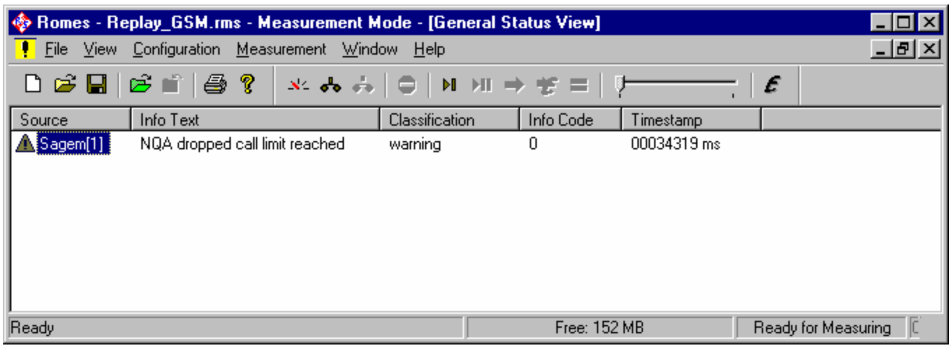
RxQual Threshold — Maximum value of RxQual (i.e. minimum received signal quality) in the range 1 to 4 to 7. RxQual values above this threshold contribute to NOISY.

RxQual Exceed Perc. — Minimum ratio (in percent) of reported RxQual values exceeding the RxQual Threshold in the range 1 (%) to 50 (%) to 99 (%). If the actual ratio exceeds the specified percentage the call is classified as NOISY.

NQA monitoring

If checked, the *NQA monitoring active* box activates NQA monitoring. In this mode, a message is displayed in the *General Status* view (see chapter 3) as soon as the number of *Blocked Calls*, *Dropped Calls*, or *No Service Calls* entered in the three input fields of the *NQA monitoring* panel is reached.

Example for a *General Status* view message:



RxLev/RxQual Source

The radio buttons in the *RxLev/RxQual Source* field determine the type of values used for the NQA:

Use RxLev/RxQual Full — Both parameters are assessed over the full range of TDMA frames within a SACCH block

Use RxLev/RxQual Sub — Both parameters are assessed over a subset of 12 TDMA frames

The full and sub values are displayed separately in the *GSM Measurement Report View*, see chapter 3.

Important note on NQA in downlink DTX mode:

If the BTS uses discontinuous transmission (DTX), the BTS transmitter is switched off during time periods where no information needs to be transferred. The BTS (downlink) signal shows strong variations in time resulting in a large difference between the measured *RXLev/RXQual Full* and *RXLev/RXQual Sub* values. The NQA must be performed with the *Use RxLev/RxQual Sub* option, otherwise it will generally underestimate the network quality.

Display of results

If NQA is active during a measurement *(Use NQA* box checked), the *NQA View* displays a bar graph showing the percentages of the current call statistics, i.e. the percentage of *Good, Blocked, Dropped* and *No Service* calls.

Call Classes

The *NQA View* shows the following call classes:

Good: Every call successfully established and terminated by the system after exactly the *Call duration* set in the *Autodialing* tab.

Blocked: A call is qualified as blocked if one of the following applies:

An idle message was detected during call setup but the call was not canceled. This happens in all cases where a call setup was performed at least up to the layer-3 message SERVICE REQUEST, but not up to ALERTING / CONNECT, and where no DISCONNECT, RELEASE or CHANNEL RELEASE was executed **or**...

The call was canceled, call setup was not performed up to ALERTING and/or CONNECT **or**...

A dial command has been sent to the mobile, but because of insufficient coverage no call could be established: The NQA machine remains IDLE. On the next dialing the system recognizes that no call could be established and one blocked call is added.

Dropped: A call is qualified as dropped if one of the following applies:

An established call is cancelled before the *Call duration* set in the *Autodialing* tab has passed **or**...

An established call is terminated not to order. A NQA data package will be generated when an *Idle or Error (No Service)* state is detected after a call was completely established and the *Call duration* has not passed yet.

No service: A *No service* call is added every time the system wants to dial but the mobile is out of service. If the mobile remains out of service the time interval between two subsequent *No service* calls is equal to the *Call duration* plus the *Idle time*, both set in the *Autodialing* tab.

Note:
A single call can fit into more than one class and can therefore contribute to several bars. The percentages do not necessarily sum up to 100 %.

Extensions

For an extended NQA evaluation, *Rohde & Schwarz* offers the NQA evaluation software *TS9954 NQA* for use with MS EXCEL. The software is described in chapter 7 of this manual.

Driver Configuration – Mobile Options

The *Mobile Optons* tab shows the additional registered options found for the test mobile.

It is identical for all GSM mobile drivers.

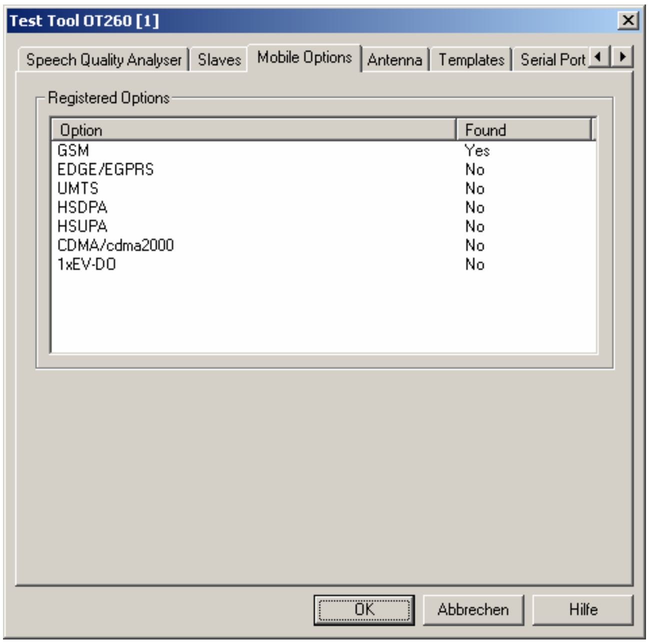


Fig. 6-16 Driver Configuration – Mobile Options tab (all drivers)

Driver Configuration – Antenna

The *Antenna* tab defines *Antenna Name, Antenna Gain* and *Cable Loss*. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors. The *Antenna* tab is identical for all GSM mobile drivers.

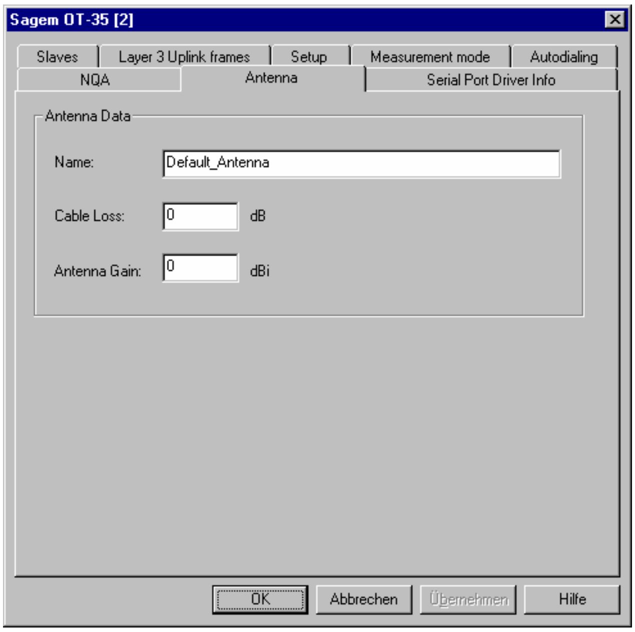


Fig. 6-17 Driver Configuration – Antenna tab (all drivers)

Driver Configuration – Slaves

For RS TM, Sagem and Caesium mobiles, the *Slaves* tab controls the link to the fax and data terminal drivers.

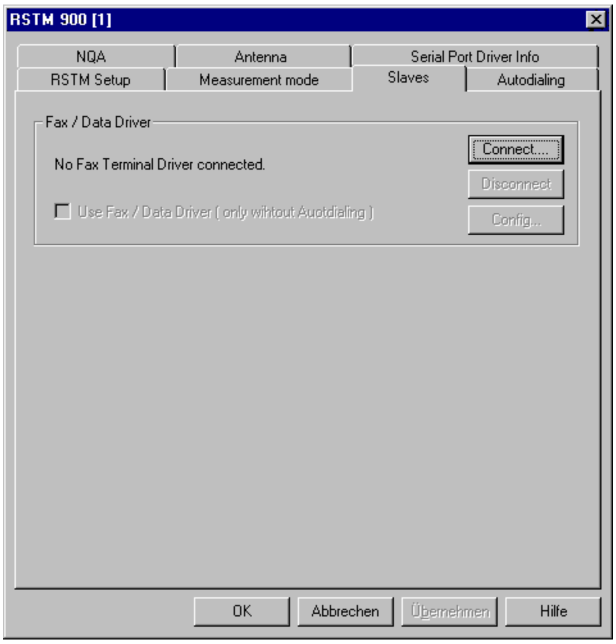
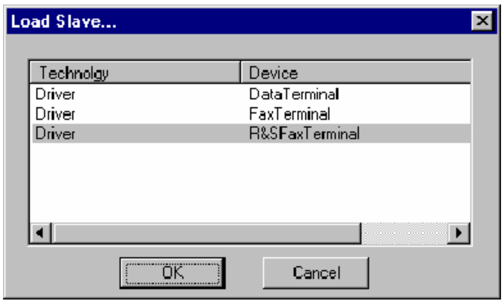


Fig. 6-18 Driver Configuration – Slaves tab (all drivers)

Connect The *Connect* button initiates the fax/data driver installation. The *Load Slave* dialog box is opened:



The *Load Slave* dialog box provides a list of all available drivers. Only one driver may be selected at one time.

OK Load the selected driver and close the dialog box

Cancel Close the dialog box without loading any drivers

Disconnect The *Disconnect* button disconnects the current driver from the system. The message *No Fax Terminal Driver connected* is displayed in the *Slaves* tab.

Config The *Config* button opens the driver configuration menu, see next section.

Driver Configuration – SMS Tester

The *SMS Tester* tab, which is available for the RS TM mobile, configures the short message tester. The result can be viewed in the *GSM SMS View*.

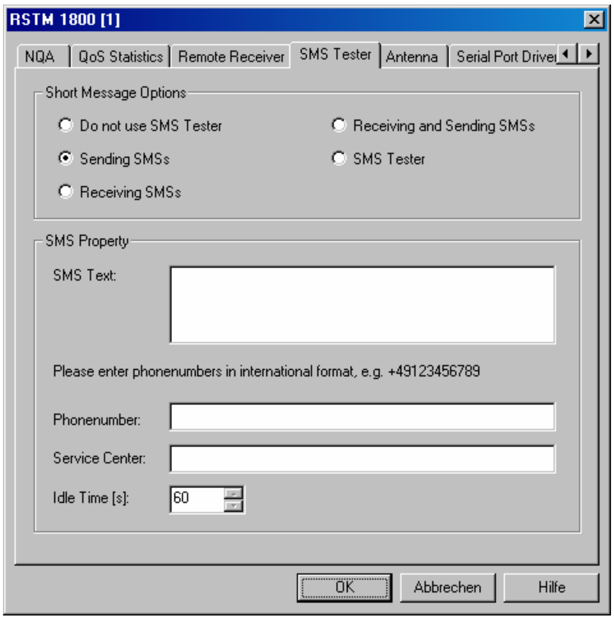


Fig. 6-19 Driver Configuration – SMS Tester tab

Short Message Options

The *Short Message Options* panel provides five alternative options:

Do not use SMS Tester	SMS tester disabled: the mobile can send and receive ordinary short messages but no signalling information will be recorded. No result for the *GSM SMS View* is generated.
Sending SMSs	Send short messages and record signalling information. No result for the *GSM SMS View* is generated.
Receiving SMSs	Receive short messages and record signalling information. No result for the *GSM SMS View* is generated.
Rec. and Sending SMSs	Send and receive short messages and record signalling information. No result for the *GSM SMS View* is generated.
SMS Tester	SMS tester enabled, a test short message will be sent to the network, looped back and received every n seconds where n seconds is the *Idle Time* defined in the *SMS Property* panel

SMS Property

The *SMS Property* panel configures the SMS Tester:

SMS Text	SMS text (max. 160 characters) to be transferred
Phone Number	Phone number to dial in international format
Service Center	Service center address of the network
Idle Time [s]	Time interval between two subsequent short messages

Driver Configuration – Layer 3 Uplink frames

The *Layer 3 Uplink frames* tab modifies up to four layer 3 messages that the Sagem mobile sends to the network.

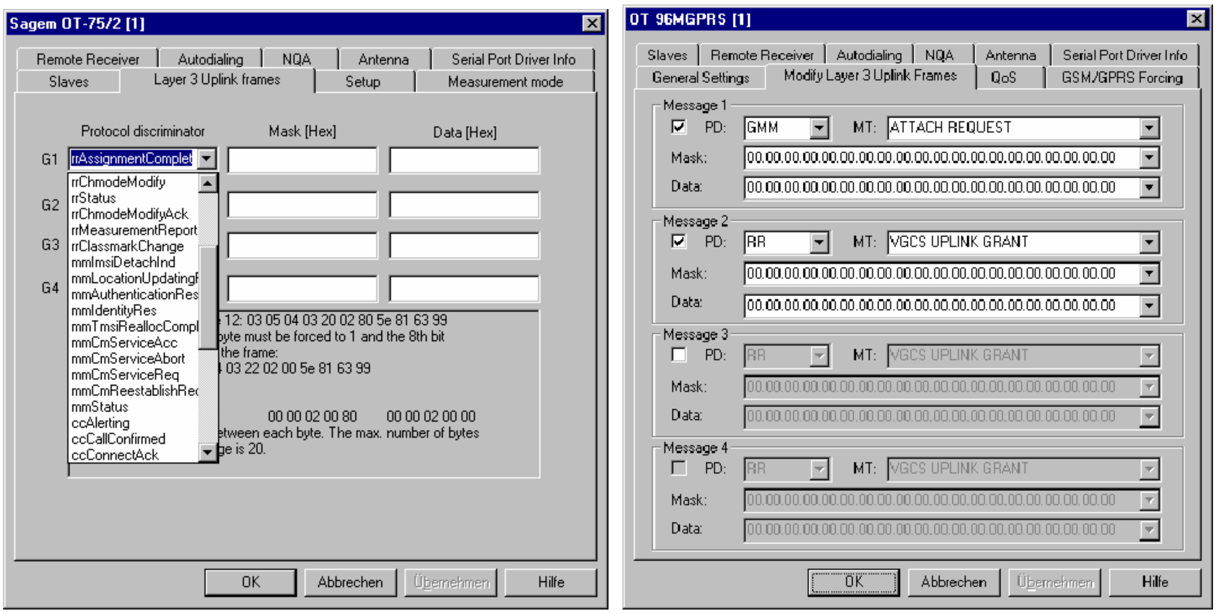


Fig. 6-20 Driver Configuration – Layer 3 Uplink frames tab

The layout of the *Layer 3 Uplink frames* tab depends on the mobile type, however, all functions are equivalent.

Protocol discriminator / PD and MT This column indicates the *Protocol Discriminator* (PD, first two characters) and *Message Type* value of the GSM or GPRS layer 3 message that shall be modified; see GSM 04.08.

Mask [Hex] Mask to be applied on the GSM or GPRS layer 3 message for the modification.

Data [Hex] Data for the modification. For further reference see also user documentation of the Sagem mobile.

Driver Configuration – QoS Tests

The *QoS Tests* tab configures the mode where important GPRS mobility management actions *(GPRS Attach/Detach, Routing Area Update)*, GPRS packet routing actions *(Activate/Deactivate PDP Context),* GSM layer 3 actions *(Location Area Update),* or *Cyclic Handover* procedures of a GPRS mobile in dedicated mode are initiated periodically. A statistical evaluation of the actions provides an overview of the Quality of Service (QoS), e.g. the amount of network resources given to the mobile. It can be displayed in the *GSM QoS View*.

Note:
To be recorded and evaluated, the actions must be enabled in the QoS Statistics tab of the driver configuration menu; see Fig. 6-22 on p. 6.56.

The *QoS Tests* tab is only provided for the SAGEM x6 driver.

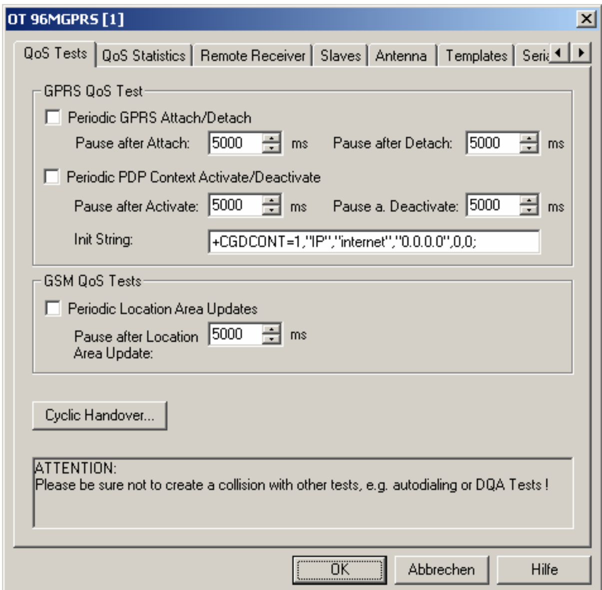


Fig. 6-21 Driver Configuration – QoS Tests tab (all drivers)

The entries to control *Periodic GPRS Attach/Detach, Periodic PDP Context Activate/Deactivate* and *Periodic Location Update* are analogous.

Enable/Disable

The three types of periodic actions can be activated independently; they are compatible with each other.

> ***Note:***
> *GSM test mobiles can be used for various automatically controlled, periodic tests, e. g. Autodialing, DQA analysis. Some of the periodic tests cause conflicts when activated simultaneously. E.g. the QoS test functions can not be performed after the autodialing function has released the call.*

Pause after…

Defines the periodicity of the actions:

- The *GPRS Attach/Detach* cycle consists of an attach, followed by the *Pause after Attach*, detach, *Pause after Detach*.
- The *PDP Context Activate/Deactivate* cycle consists of a PDP context activate, followed by the *Pause after Activate*, PDP context deactivate, *Pause after Deactivate*.
- The *Location Area Update* cycle consists of an location update procedure followed by the *Pause after Location Update*.

Init String

PDP Context +CGDCONT command, specifies PDP context parameter values for a PDP context identified by the (local) context identification parameter (first numeric parameter after “=”). The command is described in standard 3GPP TS 07.07 and is preset as shown in Fig. 6-21 above.

In most networks, adjusting the third string parameter *(Access Point Name (APN),* preset as “internet”) will be sufficient to activate a PDP context.

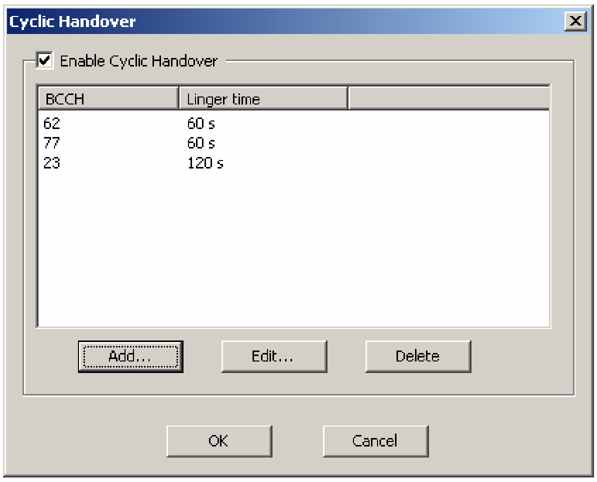
Cyclic Handover… Configures the neighbor cell BCCH and timing parameters necessary for cyclic handover that a GPRS mobile can initiate while it is in dedicated mode (during a call).

For a cyclic handover the mobile manipulates the received signal strengths in its receiver reports in such a way that the network periodically initiates a handover to a given neighbor cell. The cells are arranged in a BA list. The mobile cycles through the list, lingering in each cell for a definite amount of time.

The process is stopped if one of the cells is no longer detected, so cyclic hand-over is typically tested on a fixed location. Cyclic handover and manual hand-over exclude each other. It is recommendable to perform cyclic handover tests in autodial mode and with an endless call duration (see *Autodialing* tab on p. 6.43).

If the network fails to initiate a handover, the *General Status View* displays a timeout warning. Other warnings and error messages (e.g. *Autodial switched off, Telephone number is empty, No endless call selected, BA list empty)* are also displayed in the *General Status View.*

The *Cyclic Handover…* button opens the following dialog:



Cyclic handover must be enabled explicitly *(Enable Cyclic Handover).* The BA list contains the BCCH channel numbers of all cells to be allocated during the cyclic handover process. The mobile dwells in each cell for a definite *Linger time*. The *Add…, Edit…,* and *Delete* buttons are used to modify the BA list and its entries.

Driver Configuration – QoS Statistics

The *QoS* tab selects special layer 3 and RLC/MAC actions performed by a Sagem GPRS mobile to be recorded in the measurement file. The *QoS Statistics* tab selects special layer 3 actions performed by a RS TM mobile to be recorded.

A statistical evaluation of the actions initiated by these messages provides an overview of the Quality of Service (QoS), e.g. the amount of network resources given to the mobile. It can be displayed in the *GSM QoS View*.

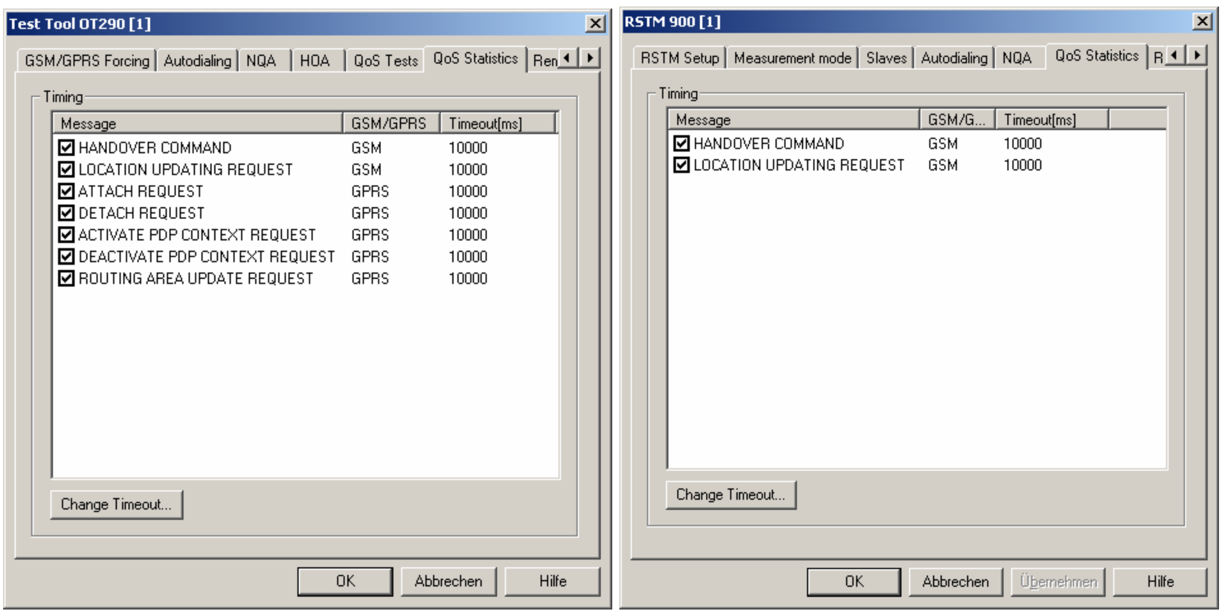


Fig. 6-22 Driver Configuration – QoS Statistics tab

Message / GSM/GPRS
List of layer 3 and RLC/MAC control messages generated or received by the mobile. The actions initiated by the checked messages will be included in the measurement file. The messages are related to either GSM or GPRS service.

Timeout
Maximum time that the selected actions can take until they are classified as *No Response* actions. For mobile-initiated actions, the time is measured from the time the mobile transmits the *... REQUEST* message to the time it receives the response from the network.

An individual timeout can be set for each selected action.

Driver Configuration – Templates

The *Templates* tab stores the current driver configuration as a template, lists, loads or deletes driver templates. It is provided for many GSM mobile drivers and is identical for all of them.

Note:
When a driver is loaded using Configuration – Preferences – Hardware (see section Driver Installation on p. 6.1 ff.) ROMES checks whether a driver template is stored in the Driver Templates directory and its subdirectories (see below). The driver can be loaded with default settings or with the settings stored in any of the templates found.

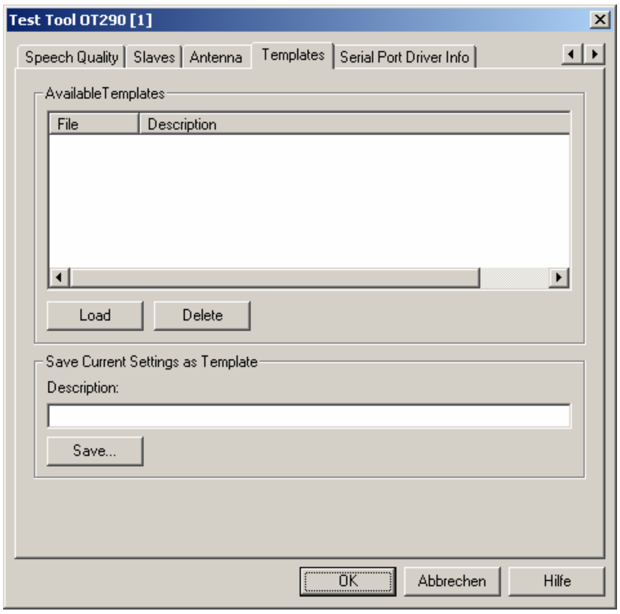
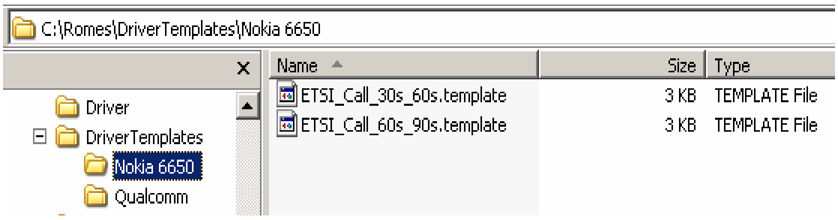


Fig. 6-23 Driver Configuration – Templates

Load/Delete Loads a driver template or deletes a template displayed in the list of *Available Templates*. Template files are ASCII files with the extension *.template. The template definition is independent from the workspace. A selection of template files for different drivers is supplied with the ROMES installation:



Save Saves the current driver settings together with the *Description* to a selected template file.

Driver Configuration – Handover Analyzer

The *Handover Analyzer* tab (HOA) enables or disables the handover analyzer (option ROMES-U1) and sets the timeout for the HO analysis. The HO analysis and the meaning of the timeout is described in chapter 4, section *UMTS/GSM Handover Analyzer View*. The *HOA* tab is provided for many GSM mobile drivers and is identical for all of them.

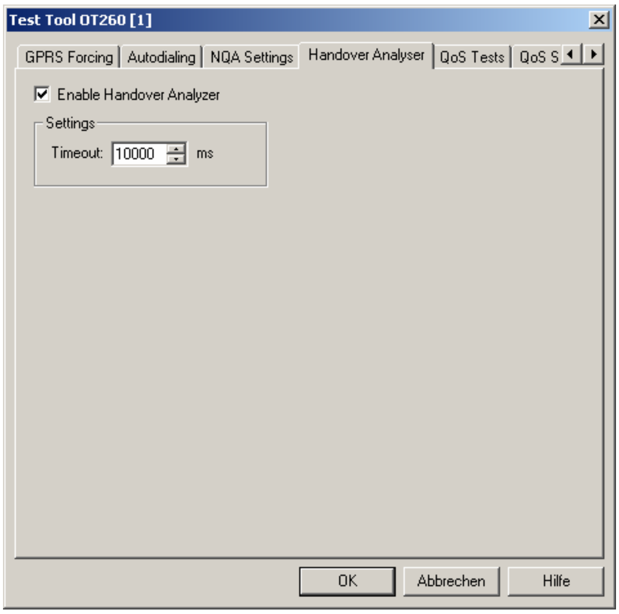


Fig. 6-24 Driver Configuration – Handover Analyzer

Driver Configuration – Speech Quality

The *Speech Quality* tab enables and configures the Speech Quality Analysis (SQA, with option ROMES-Z8, *Voice Quality PESQ)*. SQA results can be displayed in the *SQA Message* view (see chapter 4). The *Speech Quality* tab is provided for many mobile types and technologies (GSM, GPRS, UMTS, cdmaOne/IS-95, CDMA2000) and is identical for all of them.

The purpose of the SQA is to test the quality of the speech codec while the mobile operates in the network; see section *SQA – Principle and Test Setup* on p. 6.62. The SQA involves the following steps:

1. Establish the basic test setup according to Fig. 6-27 on p. 6.62, ensuring that the answering machine/SQA server and the local PC contain copies of the same *.wav file.

2. Load the appropriate mobile driver, e.g. the GSM driver, as described in section *Driver Installation* on p. 6.1.

3. In the *Autodialing* tab of the driver configuration menu, select *Use Autodial* and set an appropriate *Call Duration*.

4. Open the *Speech Quality* tab, click *Connect SQA,* and load the SQA slave driver as described below.

5. Click *Configure SQA…* and select the measurement mode and the appropriate configuration settings.

6. Back in the *Speech Quality* tab, select *Enable Speech Quality* and click *OK.*

7. Open the *SQA Message* view (*View – QoS Views – SQA Messages View)* and observe the displayed results.

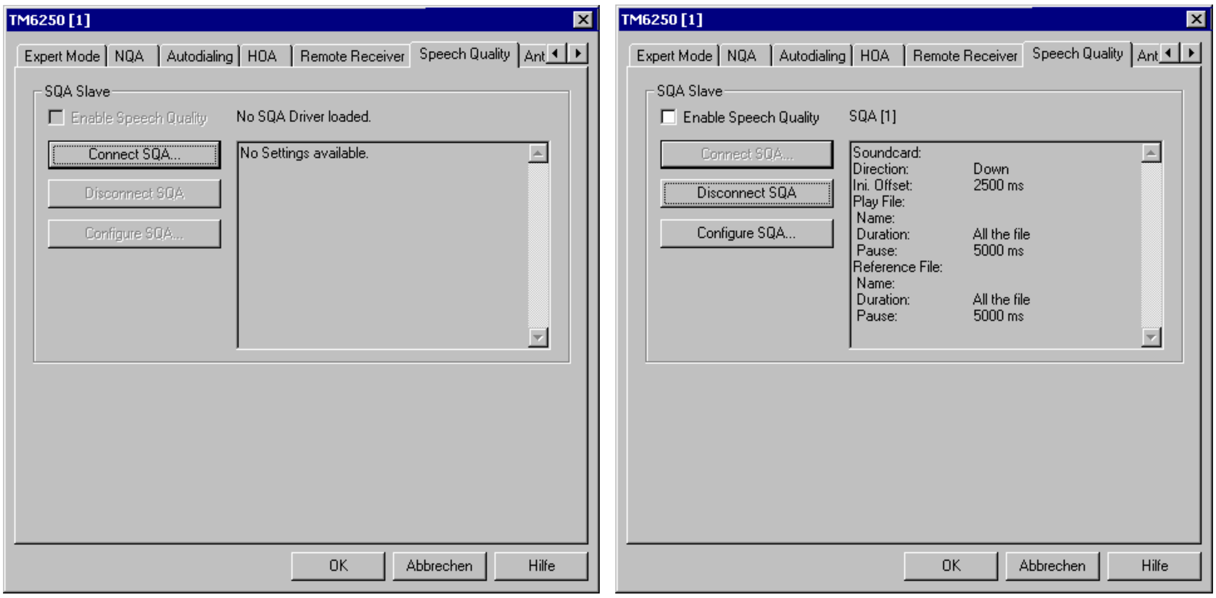
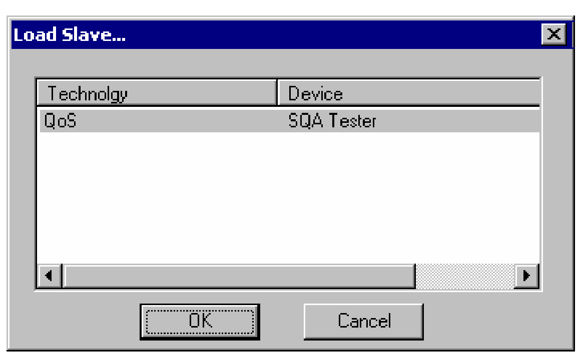


Fig. 6-25 Driver Configuration – Speech Quality

Enable Speech Quality Enables the SQA, causing ROMES to initiate the data transfer and the analysis as soon as the test mobile has set up a call. It is recommended to use the autodial feature (see p. 6.43) in order to repeat a call of fixed duration in periodic time intervals.

Connect SQA… Loads the *SQA Tester* driver. The driver must be selected in the following dialog box:



After loading the driver ROMES displays its name and parameters in the settings table of the *Speech Quality* tab; see right side of Fig. 6-25 above. The parameters can be changed using the configuration menu. The *Disconnect SQA…* and *Configure SQA…* buttons are available as soon as a driver has been loaded. Only one SQA driver can be active at one time.

Disconnect SQA… Releases/disconnects the loaded SQA driver.

Configure SQA Opens the configuration menu for the loaded SQA driver. The *SQA* configuration menu provides all settings for downlink or uplink SQA tests and displays information about the driver version.

SQA Settings

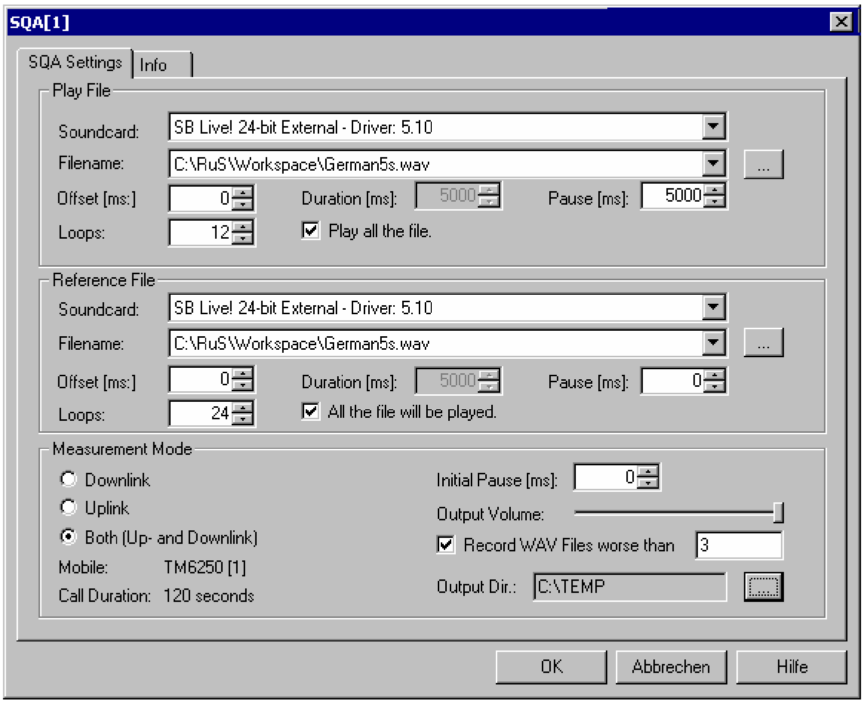


Fig. 6-26 SQA Settings

The *SQA Settings* tab is divided into three panels. The lower panel *(Measurement Mode)* selects the signal direction and global test parameters. The *Play File* and *Reference File* panels are relevant for downlink and uplink tests, respectively. They are only available after the corresponding measurement mode has been selected.

Play File Configures the *Uplink* SQA test. The uplink test consists of a repeated conversion of a test file located on the local PC to an analog speech signal and the transmission of this signal to a remote device using the test mobile speech coder (see section *SQA – Principle and Test Setup* on p. 6.62). The *Play File* parameters determine how often and how long the sound card will play the test file.

Sound card Selection of the sound card used to play the local test file and convert it into an analog signal.

Filename Name and location of the played test file.

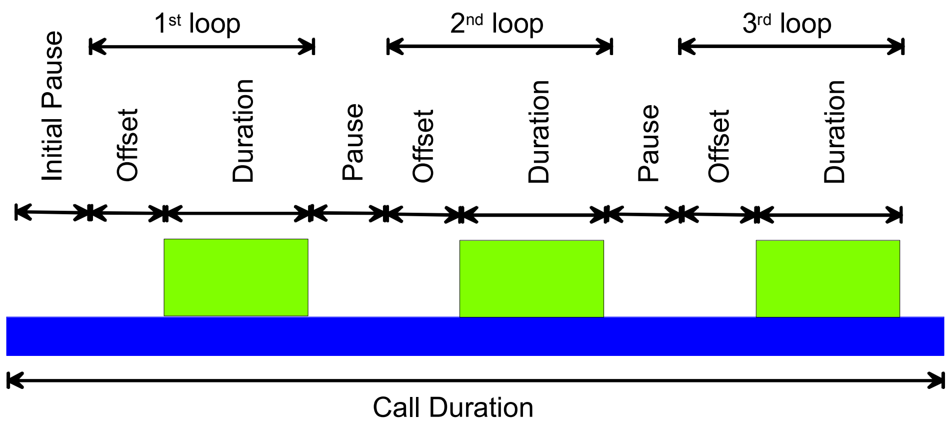
Offset [ms] Delay from the beginning of the loop (beginning of the play file) until the sound card starts playing the file. During the offset time, the sound card plays silence. In contrast to the *Initial Pause,* this offset is used once at the beginning of each loop.

Duration [ms] Duration of the played section of the file. If *Play all the file* is selected, *Duration* is unavailable and shows the time needed to play the entire file.

Pause [ms] Pause time after each test loop, i.e. after each single transmission of the test file. During the pause the sound card plays silence.

Loops Number of test loops.

The configured measurement time must be smaller or equal than the *Call Duration* defined in the *Autodialing* tab of the driver configuration menu.



The entire call is periodically repeated if autodialing is enabled.

Reference file

Configures the *Downlink* SQA test. The downlink test consists of a repeated transmission of a test file from a remote device (typically: an answering machine) to the local PC using the test mobile speech decoder and a subsequent conversion of the analog speech signal to a digital sample file.

The parameters are analogous to the uplink parameters in the *Play File* section.

If parallel SQA tests are performed with different test mobiles, each test mobile must be configured with its own copy of the reference file.

Measurement mode

Selects the measurement mode (*Downlink* test, *Uplink* test or combined, simultaneous *Up- and Downlink);* see section *SQA – Principle and Test Setup* on p. 6.62) and specifies the following global settings:

Initial Pause [ms]	Delay time between the start of each call and the beginning of the first loop. An initial pause can be set in order to allow the hardware to settle at the beginning of the call before the actual SQA measurement is started.
Output Volume	Volume at the analog output of the sound card (minimum value to maximum value). The output volume is relevant for uplink tests where it controls the input level at the mobile's audio input.
Record WAV Files worse than	Store the downloaded files (or the part of the files used for the PESQ evaluation) provided their speech quality is below a specified PESQ score (for downlink tests only). If the highest PESQ value is entered, all files will be stored.
Output Dir.	Selection of an output directory for the downloaded files. If parallel SQA tests are performed with different test mobiles, each test mobile must be configured with its own output directory to avoid file access conflicts.

The *Call Duration* defined in the *Autodialing* tab of the driver configuration menu and the test mobile type is displayed for information.

SQA – Principle and Test Setup

The objective of the Speech Quality Analysis is to assess the subjective quality of speech codecs operating in a real network. The SQA is carried out as a cyclic end-to-end measurement in downlink and/or uplink direction.

Downlink

In downlink mode, a remote device (typically an answering machine) plays a known .wav file. The output of the test mobile speech decoder is digitalized using a sound card and the acquired sample file is compared to a copy of the original played file (reference file). ROMES assesses the quality of the mobile's speech decoder using the PESQ algorithm described below.

Uplink

In uplink mode, a file is played on a sound card; the analog output of the sound card is fed to the mobile speech coder. The speech coder data is transferred to a remote device (typically an SQA server) where it can be compared to a copy of the original play file.

PESQ algorithm

The PESQ (Perceptual Evaluation of Speech Quality) algorithm compares an original .wav file with a degraded file .wav' that is obtained by passing the original file through a communication system. The result of the comparison is translated into a PESQ score in the range between –0.5 and +4.5 (+1 to approx. +4.55 after conversion), where low values indicate poor speech quality, high values indicate good quality (see description of the *SQA Message View* in chapter 4).

The PESQ model was built with the aim of ensuring that the objective PESQ score is closely correlated to subjective scores of the speech quality acquired in listening tests with real subjects. For a description of the PESQ method, its use and its limitations refer to the ITU-T recommendation P.862.

Preconditions

The SQA requires option ROMES-Z8, *Voice Quality Test PESQ*. A test file (.wav) must be stored both on the local PC (reference file, play file) and on the remote device. The test mobile must be equipped with an appropriate connector so that its audio circuit can be fed to the analog input/output of a sound card. The basic test setup is shown below.

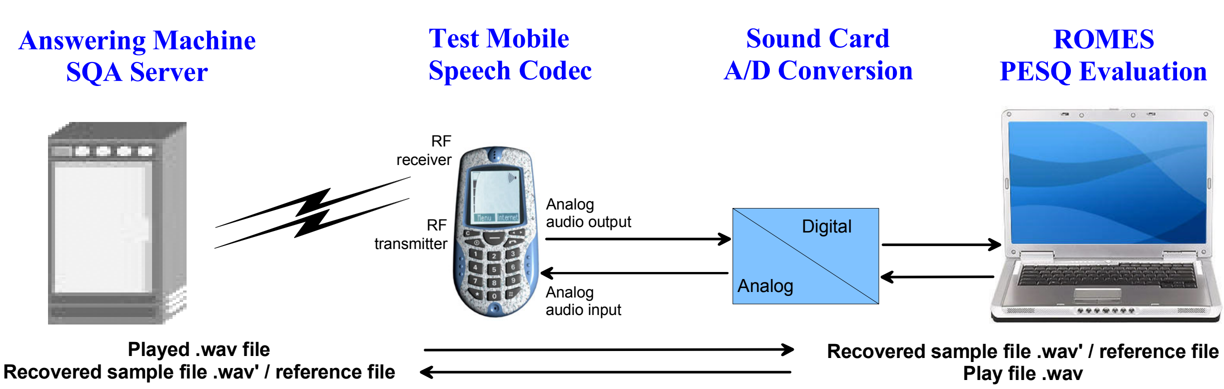


Fig. 6-27 Basic SQA Test Setup

Driver Configuration – Serial Port Driver Info

The *Serial Port Driver Info* tab displays information on the file version of the GSM driver, the serial port assigned to it and the transfer parameters. It is identical for all GSM mobile drivers.

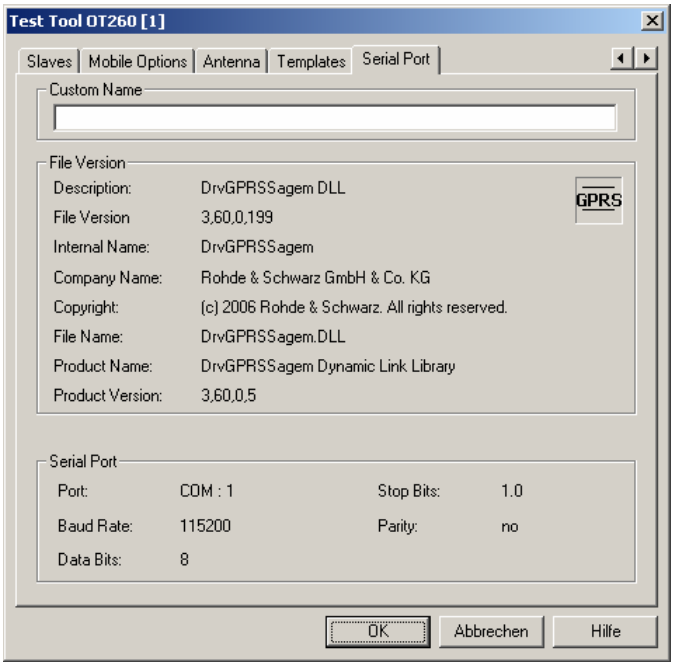


Fig. 6-28 Driver Configuration – Serial Port Driver Info tab (all drivers)

Custom Name Used to assign a name to a mobile, e.g. to make a quick association of a test mobile to its designated test network provider.

An example is provided in section *Configuration of Installed Drivers* on p. 6.21.

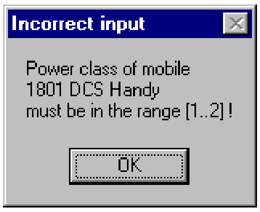
OK Confirms all settings made in the *Driver Configuration* menu and closes the menu.

If any of the settings made are wrong (i.e. not compatible with the connected device) an error message box pops up – see section *Settings Check and Loading of a Symbol File* below.

Cancel Discards all changes made and closes the *Driver Configuration* menu.

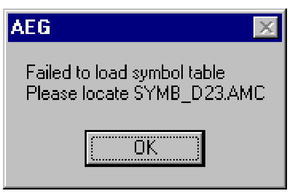
Settings Check and Loading of a Symbol File

On closing the *Driver Configuration* menu (see *OK* button above), the system checks whether the configuration to be saved conforms to the connected mobile. (Analogously, the driver configurations are checked when a driver is loaded, see section *Driver Installation* on page 6.1 ff). If there is any incompatibility an error message pops up as in the following example (wrong power class):



On clicking *OK* the message box is closed, and the wrong setting can be corrected in the *Driver Configuration* menu. This procedure must be repeated for all wrong settings.

For AEG mobiles the system will then automatically search for the **symbol file**. If this file, located in the *Driver* subdirectory, is found immediately, no message will appear. Otherwise:



On clicking *OK* an *Open file* box opens. Here all detected symbol files are shown, the one which corresponds to the current configuration is entered in the *File name:* field.

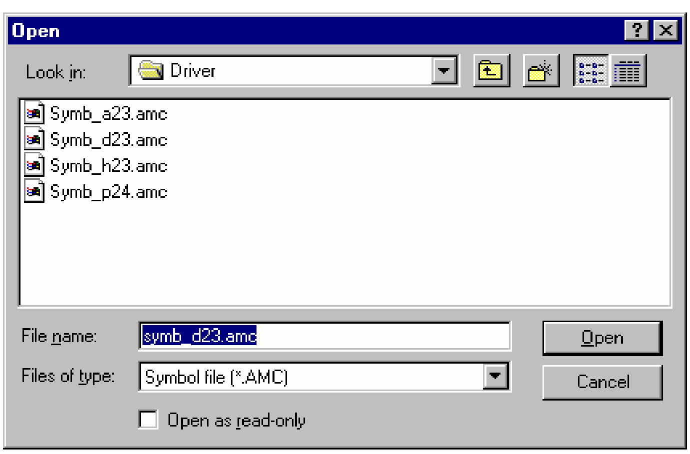


Fig. 6-29 Loading of symbol files

Symbol files

Symbol files are only used with AEG mobiles. They contain all information about the connected mobile, such as type, firmware version or software communication parameters.

The matching firmware version of the mobile is indicated in the name of the symbol file, e.g.:

`SYMB_`*`D23`*`.AMC` where *D* denotes a DCS (GSM1800) mobile and *23* the firmware version. The extension *.AMC* stands for *A*EG *m*obile *c*ompany.

If any problems concerning the test mobile should occur, please include the firmware version number in your service request. Also add the *ROMES* software version number indicated in the *About ROMES* box (see section *Help menu* in chapter 2).

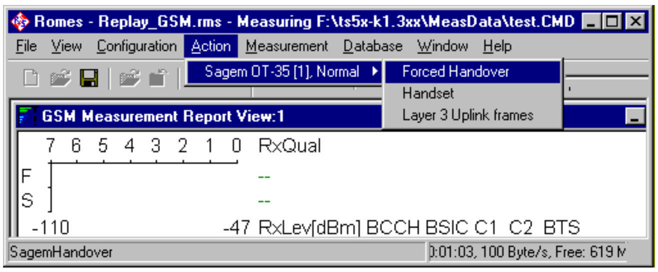
Note:
The firmware version of all AEG mobiles must be 16, 23 or 24 to operate with ROMES.

OK Loads the selected symbol file. If all settings are correct the *Open file* dialog is closed.

Cancel Does not load any new symbol file.

Action Menu

The *Action* menu opens popup boxes used to perform various actions at the mobile phone, e.g. set up a call, force a handover to a neighbor cell, perform a location update. It is added to the menu bar as soon as a mobile driver has been successfully installed (see section *Driver Installation* on page 6.1 ff). The *Action* menu and its functionality depends on the driver and mobile type; the examples in Fig. 6-30 *below* have been taken from the Sagem OT 95-M (driver SAGEM) and the Sagem OT 96-M GPRS mobile (driver SAGEM x6). If several mobiles are connected, separate command lines are displayed for each of them.



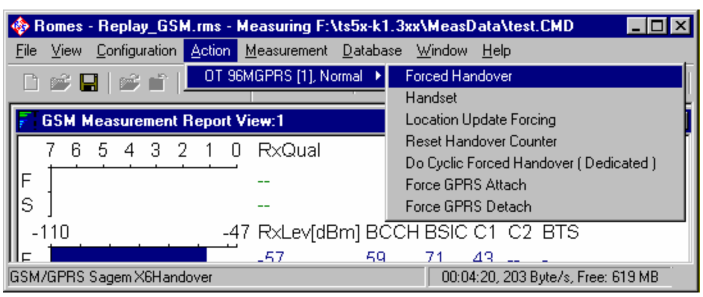
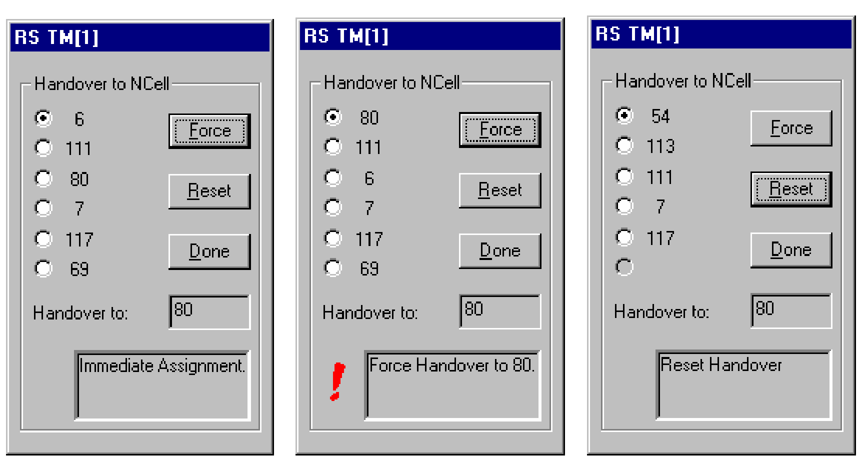


Fig. 6-30 Action menu for different driver types

Handover

Switches over to one of the six neighbor cells if possible.

Handover is possible in dedicated mode (during a call) only. The *Handover* command opens the following dialog box (equal for all drivers).



NCell BCCH channel numbers of the neighbor cells. The available neighbor cells might be less than six. One of the cells must be selected for handover.

Force	Initiates a forced handover to the selected neighbor cell. This can be done several times in succession. After a forced handover the mobile is locked on the former neighbor cell which is now the serving cell.
Reset	Cancel all forced handover procedures and return to Normal measurement mode.
Done	Closes the Handover window.

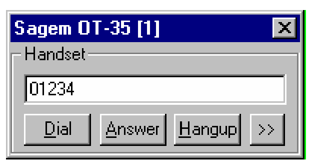
The current action is indicated in the two output fields below the buttons.

Note:
This function is only possible in NORMAL measurement mode (see Fig. 6-10 on page 6.36).

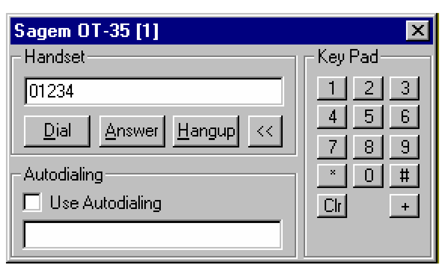
Handset

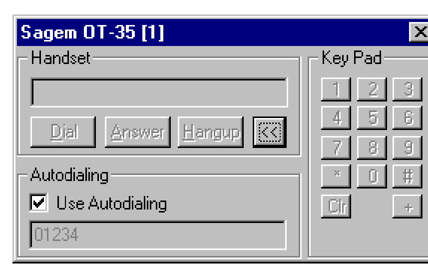
Activates the entry of a number to dial, set up and terminate a call .

The *Handset* command opens the following dialog box (equal for all drivers).



The **>>** button enlarges the dialog box, giving access to the Key pad and the *Autodialing* option:

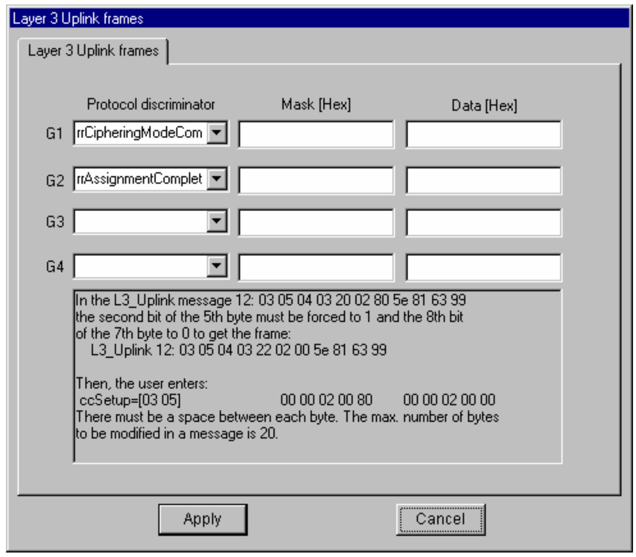




Dialed number	The number to be dialed can be entered either via the keyboard and the input field or by clicking the on-screen keypad.
	Closes the window without any further action.
Dial	Starts dialing the number entered before.
Answer	Instructs the phone to accept the call.
Hangup	Drops the line.
Autodialing	If the box is checked, the phone number entered below is called periodically, the Dial, Answer, and Hangup buttons are disabled (grayed). The autodialing mode (see p. 6.43) can be set even during the measurement, but only in Idle mode.

Layer 3 Uplink Frames

Opens a dialog to modify up to four layer 3 messages that the Sagem OT95-M mobile sends to the network.



The *Layer 3 Uplink Frames* dialog corresponds to the tab of the same name in the GSM driver configuration menu; see *Fig. 6-20* on p. 6.53. This option is provided for the Sagem OT95-M mobile only. For OT35, OT55 and OT75 mobiles, the dialog can be opened but is not effective.

Location Update Forcing

Forces the mobile phone to attempt a location update.

This option is provided for SAGEM mobiles supporting GPRS only.

Reset Handover Counter

Resets the counter for handovers during the current call to 0.

This option is provided by the SAGEM X6 driver only. A reset of the handover counter has an influence on the Network Quality Analysis (NQA); see *Handover Maxcount parameter in* Fig. 6-15.

Do Cyclic Forced Handover

Forces the mobile to cyclically attempt a handover procedure.

This option is provided by the SAGEM X6 driver only; see Cyclic Handover on p. 6.55. It is grayed unless the mobile is in dedicated mode (during a call).

Force GPRS Attach

Forces the mobile phone to attempt a GPRS attach.

This option is provided by the SAGEM X6 driver only. It is grayed unless a SAGEM mobile supporting GPRS is used.

Force GPRS Detach

Forces the mobile phone to attempt a GPRS detach.

This option is provided by the SAGEM X6 driver only. It is grayed unless a SAGEM mobile supporting GPRS is used.

UMTS Mobile Drivers

The measurement system provides UMTS mobile drivers for the following UMTS test mobiles:

- Devices based on the Qualcomm MSM6200 chipset, e.g. the Qualcomm TM6200 test mobile (dual mode UMTS 2100 MHz/GSM900/1800 + GPRS), the Samsung Z105 test mobile or the Novatel or Option PCMCIA cards.
- Devices based on the Qualcomm MSM6250 chipset, e.g. the Qualcomm TM6250 test mobile or the Samsung Z500 test mobile.
- Devices based on the Qualcomm MSM6275 chipset, e.g. the Qualcomm TM6275 test mobile.
- Nokia test mobiles Nokia 6630, 6650, 6680, or Nokia 7600.
- Motorola test mobiles E1000, V1100, RAZRV3x,and RAZRV6.

The driver is installed as described in section *Driver Installation* on page 6.1 ff.; its configuration is described in the following sections. The maximum number of test mobiles to be used simultaneously is limited by the option file, the number of interfaces and the performance of the controller. The test mobiles must be connected via USB interface; see section *Connection via USB Interface* on p. 6.5.

Caution:
The Samsung mobiles rely on the USB interface for their power supply. A supply current of approx. 0.5 A is required. Check the specification of your USB interface, especially when connecting several Samsung mobiles or other power-consuming devices in parallel. If necessary, use a self-powered USB hub.

All UMTS channels and frequencies are listed in chapter 8, section *UMTS Channels.*

The Nokia and Qualcomm test mobiles can be used to acquire data for most of the UMTS and UMTS/GSM views described in chapter 4. Limitations are listed in the following table.

Table 6-3 Views for Nokia, Qualcomm and Motorola test mobiles

View	**NOKIA 6650/6630/ 6680/7600**	**Qualcomm MSM6200-based Qualcomm MSM6250-based**	**Qualcomm MSM6275-based**	**Motorola E1000, V1100, RAZRV3x and RAZRV6**
UMTS Finger Data View	No	Yes	Yes	Yes
UMTS Layer 1 View	Yes	Yes	Yes	Yes
UMTS Cell Set View	Yes, only active, monitored set	Yes, active set and neighbor set	Yes, active set and neighbor set	Yes
UMTS NAS Status View	No (only Cell Id, Name)	Yes	Yes	No (only Cell Id, Name)
UMTS TrCH View	No	Yes	Yes	No
UMTS Physical Channel View	No	Yes	Yes	No
UMTS SIB View	Yes	Yes	Yes	Partly
UMTS RLC/MAC View	No	Yes	Yes	Yes
UMTS Measurement Report View	Yes	Yes	Yes	No
UMTS Reselection View	Yes	Yes	Yes	
UMTS Power Control View	Yes	Yes	Yes	Yes

View	NOKIA 6650/6630/ 6680/7600	Qualcomm MSM6200-based Qualcomm MSM6250-based	Qualcomm MSM6275-based	Motorola E1000, V1100, RAZRV3x and RAZRV6
UMTS Layer 1 Graph View	Yes	Yes	Yes	Yes
UMTS Neighborhood Analyzer View	Yes	Yes	Yes	
All UMTS HSDPA Views	No	No	Yes	In development
UMTS/GSM Layer 3 View	Yes	Yes	Yes	Yes
UMTS/GSM NQA View	Yes	Yes	Yes	Yes
UMTS/GSM ETSI QoS View	Yes	Yes	Yes	Yes
UMTS/GSM Handover Analyzer View	Yes	Yes	Yes	
UMTS/GSM NQA State View	Yes	Yes	Yes	Yes

Analogous to GSM, the UMTS test mobiles and drivers are now grouped into the R&S support classes 1 and 2. The mobiles of R&S support class 1 are continuously tested with new ROMES versions and service packs, they are permanently available to our testing staff. The mobiles of R&S support class 2 are not always available for testing, but they have been tested successfully at least once with the current ROMES software release. The introduction of the R&S support classes is necessary due to the sheer number of supported mobiles. The mobile types with R&S support class 1 are listed with normal title typeface in the table below, the mobiles with R&S support class 2 are marked with ***italic*** title typeface.

Table 6-4 UMTS properties of UMTS test mobiles

Manufacturer: Nokia	Manufacturer: Qualcomm	Manufacturer: Samsung	Manufacturer: Motorola[8]
Nokia 6630 UMTS 2100 MHz GSM900/1800/1900 + GPRS + EDGE **Nokia 6650** UMTS 2100 MHz GSM900/1800 + GPRS **Nokia 6680** UMTS 2100 MHz GSM900/1800/1900 + GPRS + EDGE ***Nokia 7600*** UMTS 2100 MHz GSM900/1800/1900 + GPRS **Nokia N80** UMTS800/1900/2100 MHz + HSDPA GSM850/900/1800/1900 + GPRS + EDGE	***Qualcomm TM6200*** UMTS 2100 MHz GSM900/1800 + GPRS **Qualcomm TM6250** UMTS 2100 MHz GSM850/900/1800 + GPRS **Qualcomm TM6275** UMTS 2100 MHz (platform 1) or 1900/850 (platform 2) + HSDPA GSM850/900/1800/1900 + GPRS + EDGE **Qualcomm TM6280** UMTS800/1900/2100 MHz + HSDPA GSM850/900/1800/1900 + GPRS + EDGE **Qualcomm TM7200** UMTS800/1900/2100 MHz + HSDPA + HSUPA GSM850/900/1800/1900 + GPRS + EDGE	**Samsung Z105/107** UMTS 2100 MHz GSM900/1800 + GPRS ***Samsung Z130/Z500/ ZV10/ZV50*** UMTS 2100 MHz GSM900/1800/1900 + GPRS **Samsung Z560** UMTS 2100 MHz + HSDPA GSM900/1800/1900 + GPRS	**Motorola E1000** UMTS 2100 MHz GSM900/1800/1900 + GPRS + EDGE **Motorola V1100** UMTS 2100 MHz GSM900/1800/1900 + GPRS + EDGE **Motorola RAZRV3x** UMTS 2100 MHz GSM900/1800/1900 + GPRS + EDGE **Motorola RAZRV6** UMTS 2100 MHz + HSDPA GSM900/1800/1900 + GPRS + EDGE

[8] The support classes of the Motorola test mobiles are not defined yet.

Recently UMTS services have become available for PCMCIA slot-based data cards, therefore the following cards (based on the Qualcomm chipset) are now supported.

Table 6-5 UMTS properties of UMTS test data cards

Manufacturer: Novatel Wireless	Manufacturer: Option	Manufacturer: Sierra Wireless
Merlin U740 UMTS 2100 MHz + HSDPA 1.8 MBit GSM850/900/1800/1900 + GPRS + EDGE **Merlin U870** UMTS 2100 MHz + HSDPA 7.2 MBit GSM850/900/1800/1900 + GPRS + EDGE	**Globetrotter GT 3G + EMEA** UMTS 2100 MHz + HSDPA 1.8 MBit GSM 900/1800 + GPRS	***A850*** UMTS 2100 MHz GSM 900/1800 + GPRS

Driver Configuration Menu

The *Qualcomm* driver configuration menu contains various tabs to select the message types evaluated by the test system *(Configuration, Expert Mode),* configure the network quality analysis *(NQA)* and the autodialing and autoanswer call mode *(Autodialing)*, define the characteristics of the antenna used *(Antenna),* and display information on the driver and the serial port assigned *(Serial Port Driver Info).* It can be opened by clicking the *Driver* command line of the *Configuration* menu which is available as soon as a mobile driver is loaded (see Fig. 6-4) or via the *Driver* tab in the *Configuration of Software Modules* menu opened via the Configuration – Settings command.

Qualcomm – Configuration

The *Configuration* tab defines the PIN number and allows a rough pre-selection of the evaluated message type. The message type selection can be refined in the *Expert Mode* tab (see p. 6.73 ff.).

Note:

The UMTS test mobiles provide a wealth of information that the test system is able to store and evaluate. In many applications, only a subset of this information is actually needed. Restricting the recorded data saves system resources and reduces the size of the measurement files.

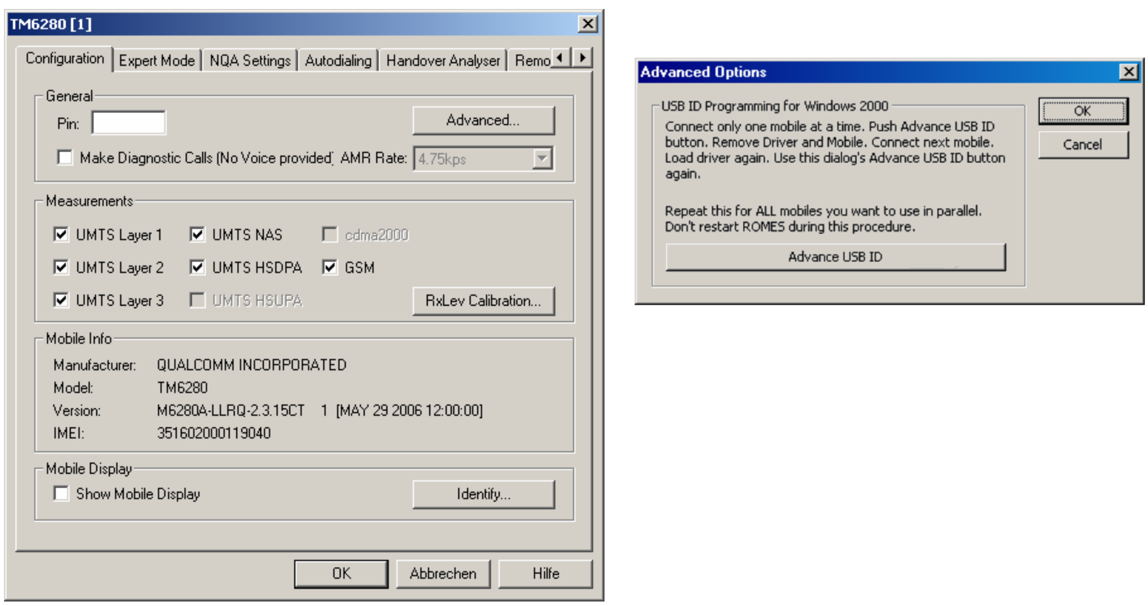


Fig. 6-31 UMTS driver configuration – Configuration

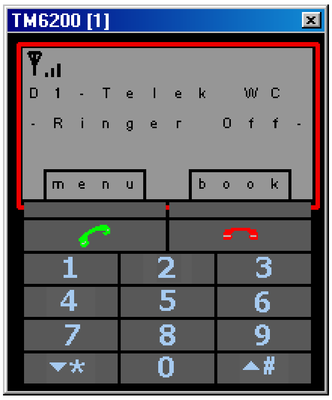
General The PIN number for identification after switching on the test mobile can be entered in the *General* panel of the configuration dialog. If nothing is entered, the SIM must be entered manually at the mobile each time it is started.

If *Make Diagnostic Calls…* is selected, the mobile will set up connections (no voice calls) at a fixed data rate. This option is particularly suitable for connections with test devices that are not equipped with an audio circuit.

Measurements The six UMTS/GSM-related checkboxes in the *Measurements* group are used for a rough preselection of the messages and information types to be recorded and written to the measurement (*.cmd) file. The selection can be refined in the *Expert Mode* tab. For an overview of available messages, views and signals see Table 6-6 below.

Advanced The *Advanced Options* menu is needed if several Qualcomm mobiles are connected to a Windows 2000-based test system; see the paragraph on *Connecting several Qualcomm mobiles* on p. 6.6.

Mobile Display *Show Mobile Display* opens a view of the test mobile so that it is possible to observe the display, dial numbers and browse the menu from the controller while a measurement is performed. This function is also provided in the *Action* menu; see section *Action Menu* on p. 6.87 ff.



Qualcomm – Expert Mode

The *Expert Mode* tab selects the message types to be recorded to the measurement file. A *Layer 1, Layer 2, Layer 3,* or *UMTS* message type can be selected only if the driver has been configured to do *Layer 1, Layer 2, Layer 3,* or *UMTS* measurements; see description of the *Configuration* tab above.

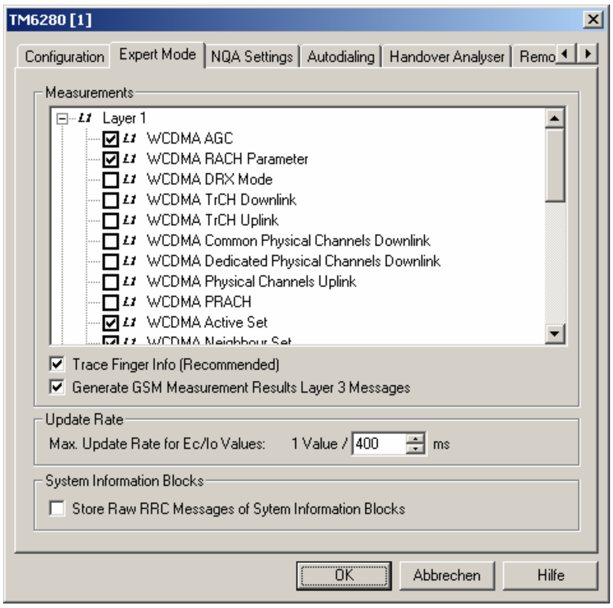


Fig. 6-32 UMTS driver configuration – Expert Mode

The available message types are listed in the table Table 6-6 below, together with the names of the corresponding views and data structures/signals in the data tree. For an explanation of the recorded parameters refer to the description of the UMTS and UMTS/GSM views in chapter 4.

Table 6-6 UMTS message types, views and signals

Message type	View	Data structure / signal
Layer 1 Messages		
WCDMA AGC	UMTS Layer 1	Layer 1
WCDMA RACH Parameters	Only general purpose views (e.g. Alphanumeric View)	RACH Parameters
WCDMA DRX Mode	Only general purpose views (e.g. Alphanumeric View)	DRX Mode
WCDMA TrCH Downlink	UMTS TrCH	
WCDMA TrCH Uplink	UMTS TrCH	
WCDMA Common Physical Channels Downlink	UMTS Physical Channels	
WCDMA Common Dedicated Physical Channels Downlink	UMTS Physical Channels	
WCDMA Physical Channels Uplink	UMTS Physical Channels	
WCDMA PRACH	UMTS Physical Channels	
WCDMA Active Set	UMTS CellSet, UMTS Network Analyzer	Active Set
WCDMA Neighbour Set		
WCDMA BLER		
WCDMA SIR Estimation		SIR
WCDMA Cell Reselection	UMTS Reselection View	
WCDMA List Searcher		
WCDMA compressed mode interfrequency Step 1 search		
WCDMA compressed mode interfrequency list search		
Layer 2 Messages	–	–
Layer 3 Messages	UMTS SIB, UMTS Layer 3, UMTS Measurement Report, all	Layer 3, RRC Message
UMTS		
UMTS NAS GMM State	UMTS NAS Status	NAS State
UMTS NAS MM State	UMTS NAS Status	NAS State
UMTS NAS REG State	UMTS NAS Status	NAS State
UMTS NAS CS Connection Management		CS Call Management
UMTS NAS MM Characteristics	UMTS NAS Status	MM Info
UMTS NAS OTA Messages		NAS Message
UMTS NAS QoS		NAS QoS
UMTS NAS Connection Bearer Capability		Connection Bearer Capability
UMTS NAS AMR Uplink (only older firmware versions)		AMR Uplink
UMTS NAS AMR Downllink (only older firmware versions)		AMR Downlink

The *NQA State Machine* signals require several layer 3 and layer 1 messages; they are available in the default configuration of the driver configuration menu.

Table 6-7 GSM/GPRS message types, views and signals

Message type	**View**	**Data structure / signal**
GSM Messages		
GSM surround cell BA list	MMR	MMR, SVR
GSM serving cell info	MMR	MMR, SVR
GSM TxLev Timing Advance		SVR
GSM L3 RR state		SVR
GSM L3 RR protocol error	-	-
GSM L3 RR signaling message	GSM/UMTS Layer 3	Layer 3
GSM L3 RR cell selection and reselection parameters	GSM Layer 1	Layer 1 ext.
GSM L3 RR RACH control parameters		SVR
GSM L3 RR control channel description parameters		MM Info
GSM L3 RR cell options		SVR
GSM L3 RR cell information	MMR	MMR, SVR
GSM L3 RR channel configuration		SVR, MM Info
GSM L3 RR ciphering mode		MM Info
GSM L3 RR cell selection and reselection measurements	MMR	MMR, SVR
GSM L3 RR downlink signaling counter		SVR
GSM L3 RR radio link timeout counter		SVR
GSM L3 RR SACCH report	MMR	MMR, SVR
GSM L3 RR 3G rejected cells	Rejected 3G Cells	RR 3G Rejected Cells
GSM L3 idle WCDMA known list	Idle 3G Cell List	Idle Mode WCDMA Known List
GSM L3 dedicated WCDMA cell list	Dedicated 3G Cell List	3G Dedicated Measurements
GSM 3G dedicated measurements	Dedicated 3G Cell List	3G Dedicated Measurements
GPRS Messages		
GPRS indicators	GSM Layer 1	Layer 1 ext.
GPRS general parameters	RLC/MAC	MAC Info
GPRS cell options	RLC/MAC	MAC Info
GPRS power control parameters	RLC/MAC	MAC Info
GPRS mobile allocation		
GPRS PBCCH description		
GPRS GRR State		
GPRS RR cell reselection parameters	GSM Layer 1	Layer 1 ext.
GPRS RR cell reselection measure-ments	GSM Layer 1	Layer 1 ext.
GPRS RR packet system information 1	RLC/MAC	GPRS RR Info
GPRS RR packet system information 2	RLC/MAC	GPSR MM Info
GPRS RLC-UL statistics	RLC/MAC	QoS Info
GPRS RLC-DL statistics	RLC/MAC	QoS Info
GPRS RLC-UL Release Indicators		
GPRS RLC-DL Release Indicators		
GPRS LLC ME information	RLC/MAC	QoS Info

Message type	View	Data structure / signal
GPRS LLC PDU statistics	RLC/MAC	QoS Info
GPRS LLC XID Information		
GPRS SNDCP PDP context information		SNDCP Info
GPRS MAC signaling message	GSM/UMTS Layer 3	GPRS RLC Msg.
GPRS MAC UL TBF establish	RLC/MAC	MAC Info, RLC Info
GPRS MAC UL TBF release	RLC/MAC	MAC Info, RLC Info
GPRS MAC DL TBF establish	RLC/MAC	MAC Info, RLC Info
GPRS MAC DL TBF release	RLC/MAC	MAC Info, RLC Info
GPRS SM/GMM OTA signaling message	GSM/UMTS Layer 3	GPRS GMM Msg.
GPRS air interface summary		RAT Info
GPRS timing advance		SVR
GPRS power control	RLC/MAC	RLC Info
GPRS transfer summary	RLC/MAC	MAC Info, RLC Info
GPRS L1 Message Metrics A	RLC/MAC	MAC Info, RLC Info
GPRS L1 Message Metrics B	RLC/MAC	MAC Info, RLC Info
GPRS L1 Message Metrics C	RLC/MAC	MAC Info, RLC Info
GPRS L1 Message Metrics D	RLC/MAC	MAC Info, RLC Info
GPRS L1 Burst Metrics A		
GPRS L1 Burst Metrics B		
GPRS L1 Burst Metrics C		
GPRS L1 Burst Metrics D		
GPRS RR 3G reselection measurements parameter	RR 3G Reselection Measurements Parameters	GRR 3G Reselection Measurements Parameters
GPRS RR 3G reselection measurements	RR 3G Reselection Measurements	GRR 3G Reselection Measurements
GPRS/EGPRS RLC Uplink Header	GPRS/EGPRS	EGPRS Info
GPRS/EGPRS RLC Downlink	GPRS/EGPRS	EGPRS Info
GPRS/EGPRS RLC Uplink	GPRS/EGPRS	EGPRS Info
HSDPA Messages (only 6275, 6280, and 7200 chipsets)		
HSDPA Configuration	UMTS HSDPA Configuration	HSDPA DL Configuration HSDPA DL Configuration Disable HSDPA UL Configuration HSDPA UIL Configuration Disable HSDPA Finger Configuration
HSDPA UL Beta Gain Table	–	–
HSDPA Demodulator Control Table	–	–
HSDPA Modulator Control Table	–	HSDPA Modulator Control Table
HSDPA Decode Status	UMTS HSDPA Decode Status	HSDPA Decode Summary
HSDPA HS-SCCH Statistics		HSDPA SCCH Statistics
HSDPA HS-DSCH HARQ Statistics	UMTS HSDPA HARQ Statistic	HSDPA DSCH HARQ Statistics HSDPA DSCH HARQ
HSDPA UL HS DPCCH Information	UMTS HSDPA UL HS DPCCH	
HSDPA MAC HS Configuration	UMTS HSDPA MAC Configuration	
HSDPA MAC HS Headers	UMTS HSDPA MAC Header	
HSDPA MAC HS Status	UMTS HSDPA MAC Status	
HSUPA Messages (7200 chipset only)		
HSUPA EUL DL Channel Configuration		
HSUPA EUL UL Channel Configuration		

Message type	View	Data structure / signal
HSUPA EUL UL E-DPCH		
HSUPA EUL combined L1/MAC		
HSUPA EUL L1/MAC statistics		
HSUPA EUL MAC-e/es Configuration		
HSUPA EUL MAC-e/es Header		
HSUPA EUL UL UM PDU		
HSUPA EUL DL UM PDU		
HSUPA EUL Ciphering		

Trace Finger Info

The WCDMA finger info is necessary for the *UMTS Layer 1 View, UMTS Finger View,* and the *UMTS Network Analyzer View.* It must be selected as well to obtain the *Finger Info* signals.

Generate GSM Layer 3 Messages

The GSM L3 "Measurement Report" messages are actually not reported by a phone with Qualcomm chipset, despite the fact that the message is defined in the Qualcomm message list (siehe driver configuration). However, the phone sends the "GSM RR SACCH Report" messages, which basically contain the same information.

If this option is activated, the Qualcomm reports "GSM surround cell BA list" and "GSM L3 RR SACCH report" (see GSM message tree in *Measurements*), both of which have to be enabled are used to create GSM Measurement Layer 3 Messages. These can be analyzed in the Layer 3 View as usual.

If this option is deactivated, no GSM Measurement Layer 3 Messages are created.

Update Rate

Sets the maximum update rate for Ec/Io values. A lower update rate decreases the size of the measurement file.

System Information Blocks

Layer 3 Radio Resource Control (RRC) messages are broadcast in system information blocks of various types (see standard 3GPP TS 25.331). If the box *Store Raw RRC Messages…* is checked, the complete information transmitted in the layer 3 RRC signaling messages is stored to the measurement file.

If only the system information blocks are needed, the default configuration (box unchecked) is sufficient. This will reduce the size of the measurement file.

Driver Configuration – Nokia Settings

The *Nokia Settings* tab selects GSM/GPRS and UMTS-related parameters to be measured and recorded by Nokia mobile phones.

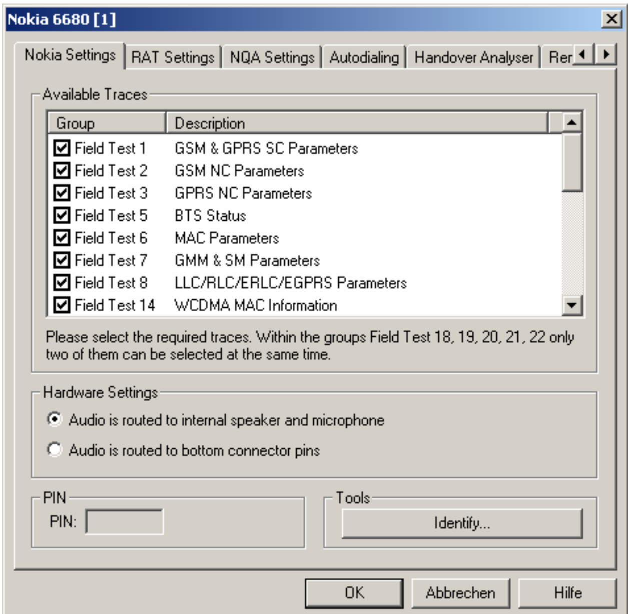


Fig. 6-33 UMTS driver configuration – Nokia Settings

The available message types are arranged in the groups listed in the table Table 6-8 below, together with the names of the corresponding views and data structures/signals in the data tree. For an explanation of the recorded parameters refer to the description of the GSM and UMTS views in chapter 4.

All parameters are selected by default. Deselecting some of the groups reduces the size of the measurement file but does not speed up the measurement.

Hardware settings The input and output signals of the mobile audio circuit are usually routed to the speaker and microphone. As an alternative it is possible to route the signals to the bottom connector pins of the mobile to be tapped off and analyzed.

Table 6-8 GSM/GPRS message types, views and signals

Message type	**View**	**Data structure / signal**
Field Test 1: GSM & GPRS SC Parameters	GSM Measurement Report, GSM System Information, GSM GPRS/EGPRS, GSM Layer 1	Measurement Report, Server Report, Packet Server Report Layer 1 Ext
Field Test 2: GSM Neighbor Cell Parameters	GSM Measurement Report, GSM Layer 1	Measurement Report, Server Report
Field Test 3: GPRS Neighbor Cell Parameters	GSM GPRS/EGPRS	Packet Server Report
Field Test 5: BTS Status		
Field Test 6: MAC Parameters	GSM GPRS PDP Info	GPRS LLC Info GPRS MAC Info
Field Test 7: GMM & SN Parameters		
Field Test 8: LLC/ RLC/ERLC/EGPRS Parameters	GSM GPRS/EGPRS	Packet Server Report, EGPRS Info
Field Test 14: WCDMA MAC Information	–	–
Field Test 15:WCDMA RRC Information	UMTS Layer 1	UMTS Layer 1
Field Test 18: General WCDMA Information	UMTS Layer 1	UMTS Layer 1

Message type	View	Data structure / signal
Field Test 19: Inter-System GSM Neighbor information		
Field Test 20: WCDMA Intra-Frequency Neighbor information	UMTS Cellset View	Active Set, Neighbor Set
Field Test 21: WCDMA Inter1- Frequency Neighbor information	UMTS Cellset View	Neighbor Set
Field Test 22: WCDMA Inter2- Frequency Neighbor information	UMTS Cellset View	Neighbor Set
Trace 1: GSM System Information Messages		
Trace 2: GSM Layer 3 Messages		
Trace 3: GSM & GPRS Parameters		
Trace 4: GPRS & EGPRS Configuration Parameters		
Trace 5: LLC PDU Size Information		
Trace 6: GPRS Context & GMM/SM Messages		
Trace 7: WCDMA Layer 3 Parameters		
Trace 8: WCDMA RLC Messages		

Table 6-9 GSM/GPRS message types, views and signals (Nokia 6630, older firmware versions)

Message type	View	Data structure / signal
Field Test 1: GSM & GPRS SC Parameters	GSM Measurement Report, GSM System Information, GSM GPRS/EGPRS, GSM Layer 1	Measurement Report, Server Report, Packet Server Report Layer 1 Ext
Field Test 2: GSM NC Parameters	GSM Measurement Report, GSM Layer 1	Measurement Report, Server Report
Field Test 3: GPRS NC Parameters	GSM GPRS/EGPRS	Packet Server Report
Field Test 4: BTS Status		
Field Test 5: MAC & GPRS Parameters	GSM GPRS PDP Info	GPRS LLC Info GPRS MAC Info
Field Test 6: GMM & SN Parameters	–	–
Field Test 7: LLC/RLC/ERLC/EGPRS Parameters	GSM GPRS/EGPRS	Packet Server Report, EGPRS Info
Field Test 10: WCDMA MAC Information	–	–
Field Test 11: WCDMA RRC Information	GSM Layer 3	
Field Test 12: General WCDMA Information	UMTS Layer 1	
Field Test 13: Inter System GSM Neighbor Information	–	–
Field Test 14: WCDMA Intra Freq. Neighbor Information	UMTS Cellset View	Active Set, Neighbor Set
Field Test 15: WCDMA Inter1 Freq. Neighbor Information	UMTS Cellset View	Neighbor Set
Field Test 16: WCDMA Inter2 Freq. Neighbor Information	UMTS Cellset View	Neighbor Set
Field Test 17: GSM System Information Messages	GSM System Information View GSM GPRS System Information View	
Field Test 18: GSM Layer 3 Messages	UMTS/GSM Layer 3 View	Layer 3
Field Test 19: GSM & GPRS Parameters	RLC MAC View	
Field Test 20: GSM & EGPRS Configuration Parameters	GSM GPRS/EGPRS View	
Field Test 21: GPRS Context & GMM/SM Messages	RLC MAC View	
Field Test 22: WCDMA Layer 3 Messages	UMTS/GSM Layer 3 View	Layer 3
Field Test 23: WCDMA RLC Messages (recommended: disable this message group)	–	–

Driver Configuration – RAT Settings

The *RAT Settings* (Radio Access Technology Settings) tab restricts the GSM bands, the channels or technologies that the mobile is allowed to use.

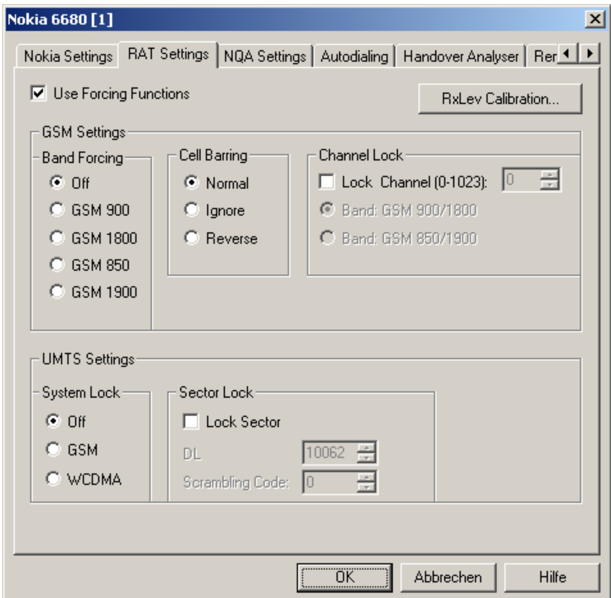


Fig. 6-34 UMTS driver configuration – RAT Settings

All settings are only effective if *Use Forcing Functions* is selected.

RxLev Calibration… Open the dialog of the same name in order to calibrate the GMSK modulated or CW input signals against a calibration file; see *RxLev Calibration* on p. 6.31.

GSM Settings – Band Forcing Selects one of the supported GSM bands for communication:

Off	All supported GSM bands allowed
GSM900/1800/850/1900	Use a specific GSM band

Cell Barring This function allows to ignore or invert the cell bar flag:

Normal	Only cells that are not barred are accessible for the mobile
Ignore	Cell bar flag ignored – all cells are accessible
Invert	Cell bar flag inverted – only barred cells are accessible

Channel Lock *Lock Channel* forces the test mobile to use a specified GSM channel. In the different GSM bands, the same channel numbers are used for different frequencies (see overview of GSM channels in chapter 8). The ambiguities in the channel-frequency assignment are resolved by specifying one of the two band combinations *GSM900/1800* or *GSM 850/1900*.

UMTS Settings – System Lock Locks a particular technology for the mobile:

Off	The mobile can access GSM and UMTS cells.
GSM	GSM cells enforced, only GSM cells allowed.
UMTS	UMTS cells enforced, only UMTS cells allowed.

Sector Lock — *Sector Lock* forces the test mobile to use a specified UTRAN cell. If *Lock Sector* is selected, the *DL* channel number and Primary *Scrambling Code* of the locked (enforced) cell can be entered below.

Qualcomm / Nokia – NQA Settings

The *NQA Settings* tab provides the parameters for *Network Quality Analysis*. NQA is a prerequisite for drawing up a call statistics where the calls are classified and the classes are visualized separately (see *2G/3G NQA View* in chapter 4).

The driver settings for Qualcomm and Nokia devices are identical.

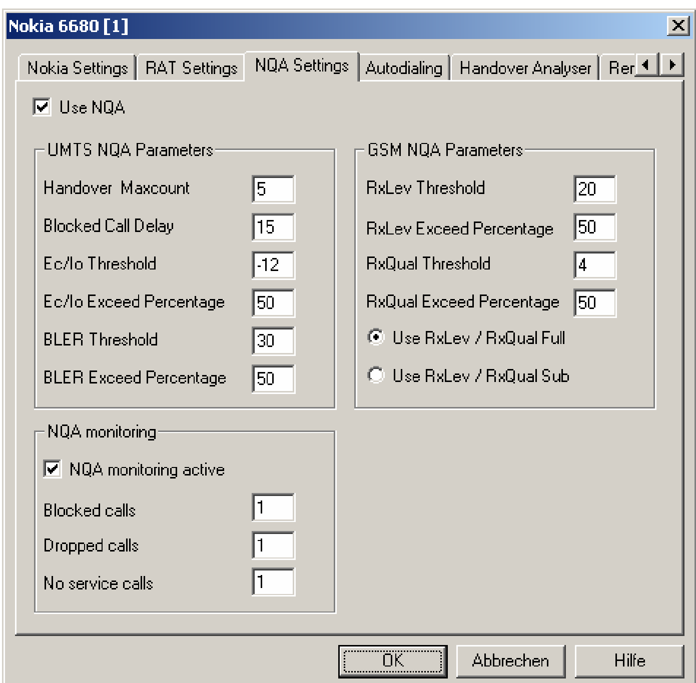


Fig. 6-35 Driver Configuration – NQA Settings tab

The parameters in the *GSM NQA Parameters* and *NQA Monitoring* sections are identical to the NQA parameters for GSM; see section *Driver Configuration – NQA* on p. 6.47 ff.

Use NQA — If checked, the box activates the network quality analysis (default).

UMTS NQA Parameters — The following numeric parameters configure the UMTS NQA by defining conditions and limits for the different call classes (we quote the ranges for all parameters; default values are underscored)

- *Handover Maxcount* — Maximum number of handover procedures during a call in the range 1 to 5 to 100. If the defined value is exceeded, the call will be classified as EXCESSIVE HO.
- *Blocked Call Delay* — Maximum delay (in seconds) between CM_SERV_REQ and ASSIGNMENT_COMMAND in the range 1 (s) to 15 (s) to 63 (s). If the defined delay is exceeded, the call will be classified as DELAYED CALL.

Ec/Io Threshold Minimum signal to noise ratio in dB and in the range –20 (dB) to –12 (dB) to 0 (dB). Ec/Io values which fall below this threshold contribute to NOISY.

Ec/Io Exceed Perc. Minimum ratio (in percent) of reported RxLev values falling below the RxLev Threshold in the range 0 (%) to 50 (%) to 100 (%). If the actual ratio falls below the specified percentage the call is classified as NOISY.

BLER Threshold Maximum Block Error Rate in percent in the range 0 (%) to 30 (%) to 100 %). BLER values above this threshold contribute to NOISY.

BLER Exceed Perc. Minimum ratio (in percent) of reported BLER values exceeding the BLER Threshold in the range 0 (%) to 50 (%) to 100 (%). If the actual ratio exceeds the specified percentage the call is classified as NOISY.

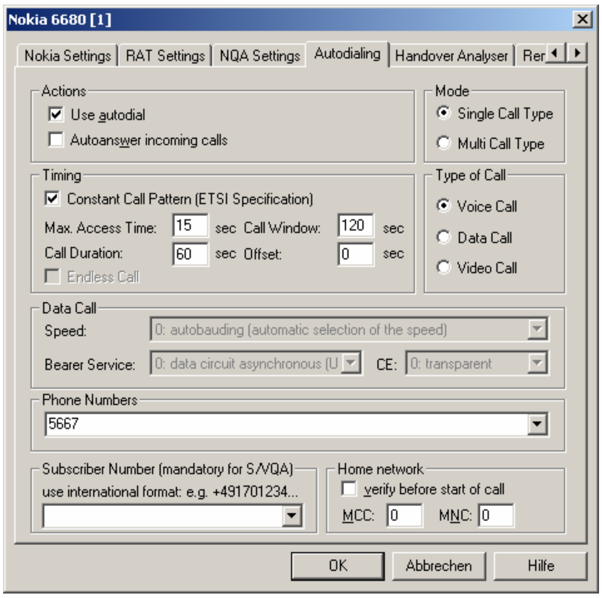
GSM NQA Parameters Configures the GSM NQA, see *NQA* on p. 6.47 ff.

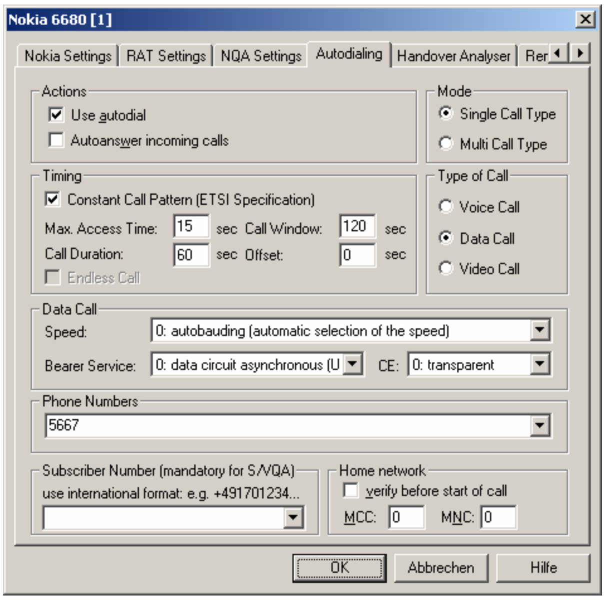
NQA Monitoring Activates NQA monitoring and displays the number of *Blocked Calls, Dropped Calls,* and *No Service Calls,* see *NQA* on p. 6.47 ff.

Qualcomm / Nokia – Autodialing

The *Autodialing* tab configures the mode where a definite phone number is dialed periodically, and a call is set up to the mobile phone. This mode is relevant for the network quality analysis described on page 6.47. All settings are analogous to the GSM driver settings described on p. 6.43 ff.

The driver settings for Qualcomm and Nokia devices are identical. The Nokia test mobiles need a 2nd virtual COM port to be operated in *autodial* mode; see paragraph on *Loading the drivers (Nokia)* on p. 6.5.





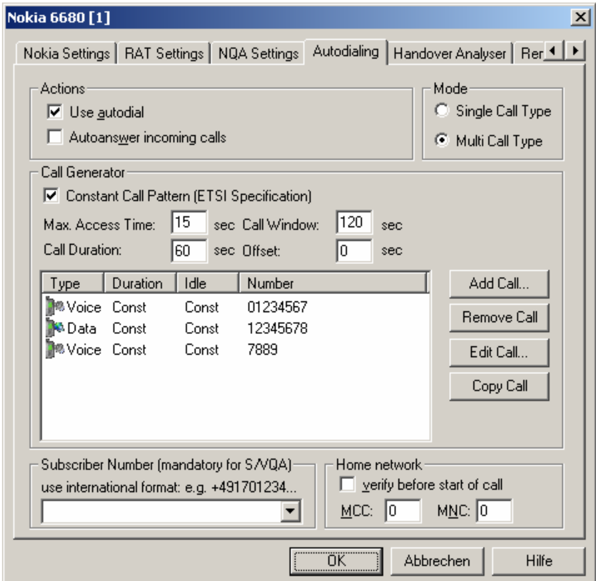


Fig. 6-36 Driver Configuration – Autodialing tab

Qualcomm / Nokia – Handover Analyzer

The *Handover Analyzer* tab enables or disables the handover analyzer (option ROMES-U1) and sets the timeout for the HO analysis. The HO analysis and the meaning of the timeout is described in chapter 4, section *UMTS/GSM Handover Analyzer View*.

The driver settings for Qualcomm and Nokia devices are identical.

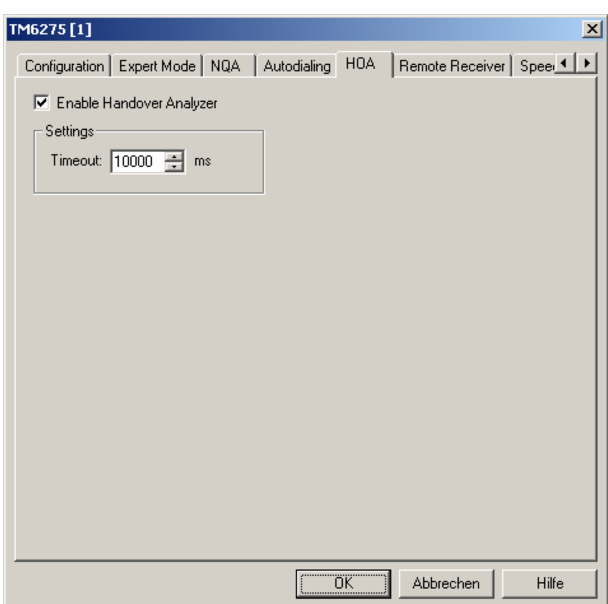


Fig. 6-37 Driver Configuration – Handover Analyzer tab

Qualcomm / Nokia – Remote Receiver

The *Remote Receiver* tab configures the tracking mode where a the mobile phone controls a CW test receiver and sets its receive frequency. All settings are analogous to the GSM driver settings described on p. 6.40 ff.

The driver settings for Qualcomm and Nokia devices are identical.

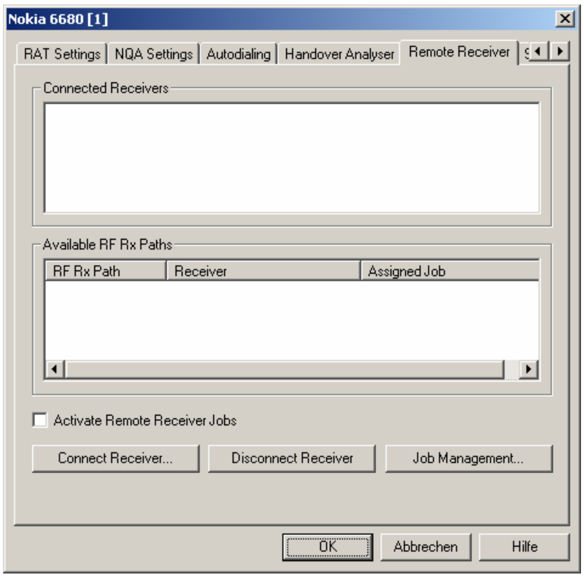


Fig. 6-38 Driver Configuration – Remote Receiver tab

Qualcomm / Nokia – Speech Quality

The *Speech Quality* tab enables and configures the Speech Quality Analysis (SQA, with option ROMES-Z8, *Voice Quality PESQ)*. SQA results can be displayed in the *SQA Message* view (see chapter 4). All settings are analogous to the GSM driver settings described on p. 6.58 ff.

The driver settings for Qualcomm and Nokia devices are identical.

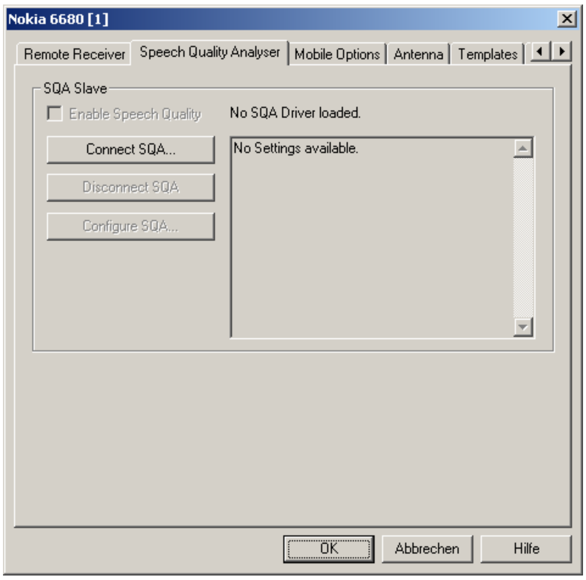


Fig. 6-39 Driver Configuration – Speech Quality tab

Qualcomm / Nokia – Mobile Options

The *Mobile Optons* tab shows the additional registered options found for the test mobile. All settings are analogous to the GSM driver settings described on p. 6.50 ff.

The driver settings for Qualcomm and Nokia devices are identical.

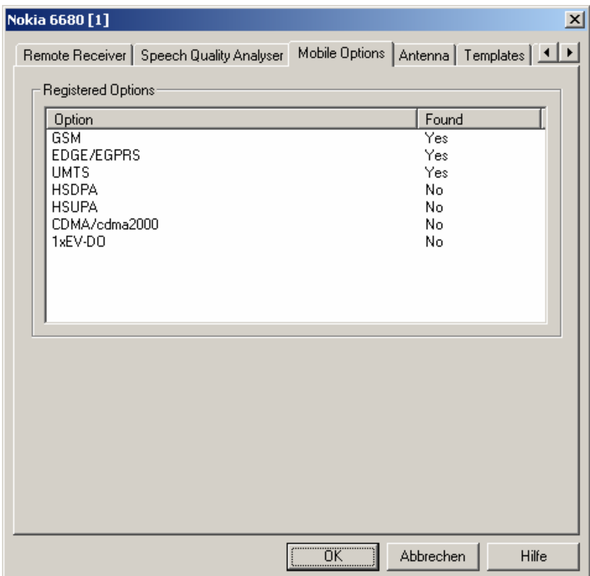


Fig. 6-40 Driver Configuration – Mobile Options tab

Qualcomm / Nokia – Antenna

The *Antenna* tab defines *Antenna Name, Antenna Gain* and *Cable Loss*. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

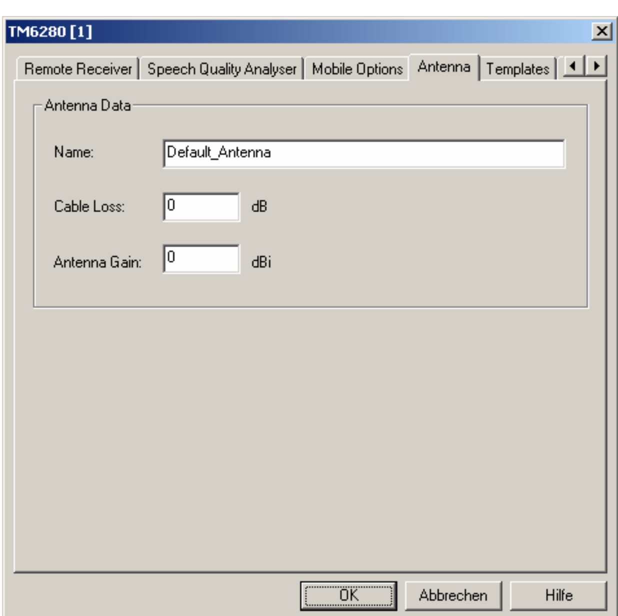


Fig. 6-41 Driver Configuration – Antenna tab

Qualcomm / Nokia – Templates

The *Templates* tab stores the current driver configuration as a template, lists, loads or deletes driver templates. All settings are analogous to the GSM driver settings described on p. 6.56 ff.

The driver settings for Qualcomm and Nokia devices are identical.

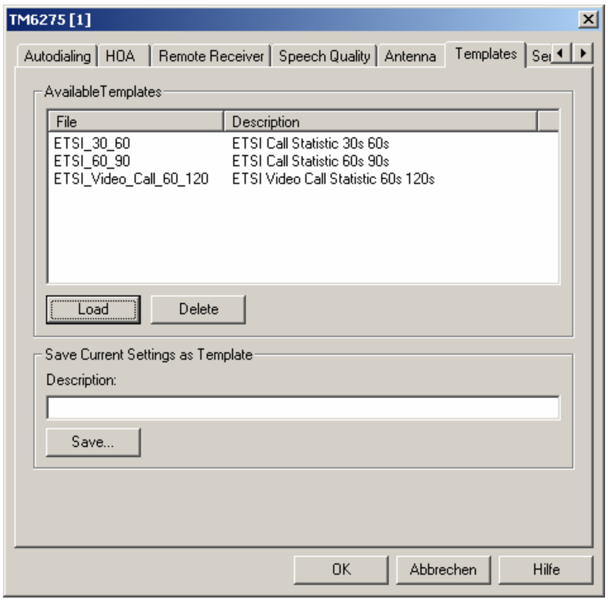


Fig. 6-42 Driver Configuration – Templates tab

Qualcomm / Nokia – Serial Port Driver Info

The *Serial Port Driver Info* tab displays the custom name of the device, information on the file version of the UMTS driver, the serial port assigned to it and the transfer parameters.

The *Custom Name* is used to assign a name to a mobile, e.g. to make a quick association of a test mobile to its designated test network provider. An example is provided in section *Configuration of Installed Drivers* on p. 6.21.

The tabs for Qualcomm and Nokia devices are identical.

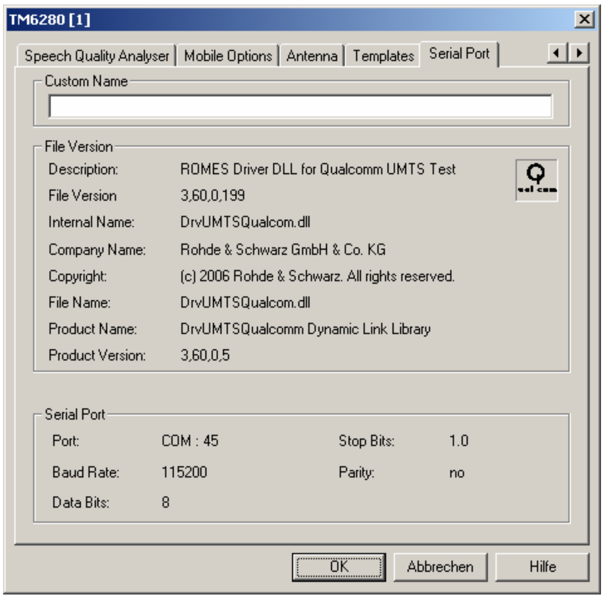


Fig. 6-43 Driver Configuration – Serial Port Driver Info tab

Action Menu

The *Action* menu opens popup boxes used to set up a call or show the contents of the mobile display. It is added to the menu bar as soon as a mobile driver has been successfully installed (see section *Driver Installation* on page 6.1 ff). If several mobiles are connected, separate command lines are displayed for each of them.

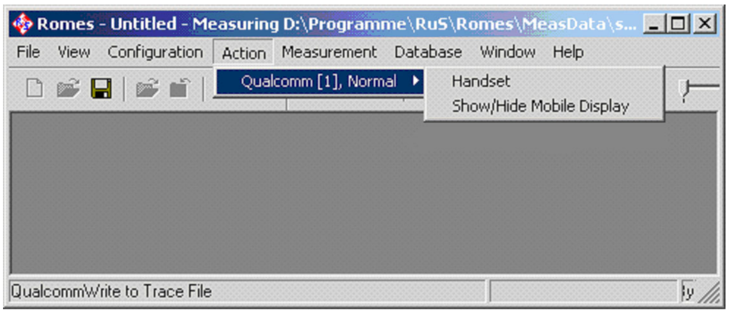
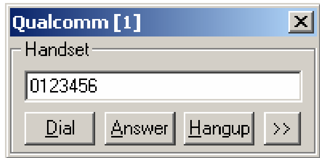


Fig. 6-44 Action menu for different driver types

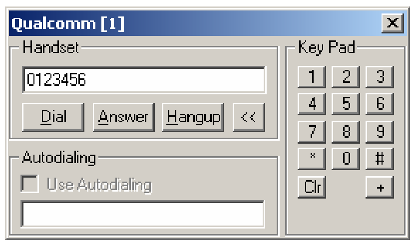
Handset

Activates the entry of a number to dial, set up and terminate a call .

The *Handset* command opens the following dialog box:



The **>>** button enlarges the dialog box, giving access to the Key pad and the *Autodialing* option:



Dialed number	The number to be dialed can be entered either via the keyboard and the input field or by clicking the on-screen keypad.
	Closes the window without any further action.
Dial	Starts dialing the number entered before.
Answer	Instructs the phone to accept the call.
Hangup	Drops the line.
Autodialing	If the box is checked, the phone number entered below is called periodically, the Dial, Answer, and Hangup buttons are disabled (grayed). The autodialing mode (see p. 6.43) can be set even during the measurement, but only in Idle mode.

Show/Hide Mobile Display

Shows or hides a view of the test mobile.

With the view it is possible to observe the display, dial numbers and browse the menu from the controller while a measurement is performed (for Qualcomm mobiles only).

Motorola – Configuration

The *Motorola Settings* tab defines the PIN number and allows UMTS system and sector lock related settings.

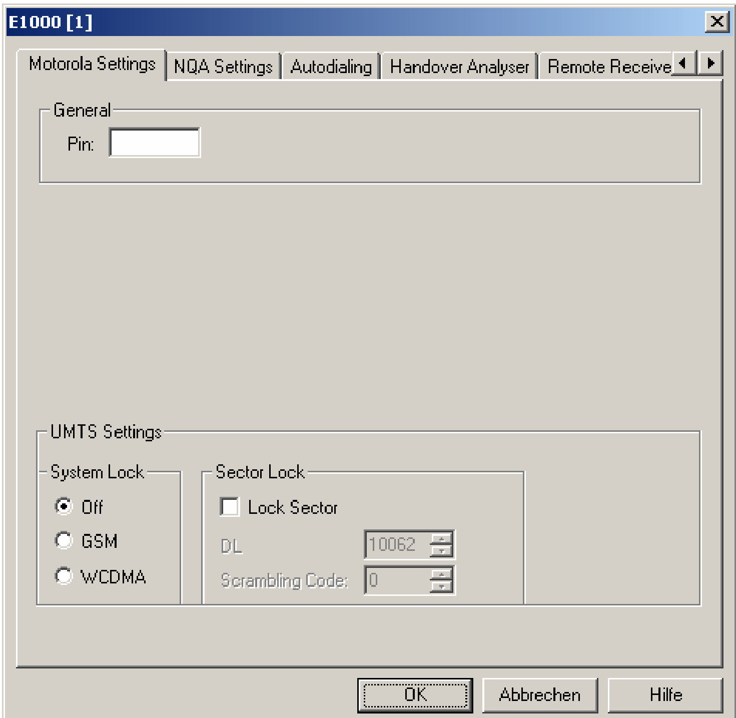


Fig. 6-45 UMTS driver configuration – Configuration

General

The PIN number for identification after switching on the test mobile can be entered in the *Motorola Settings* panel of the configuration dialog. If nothing is entered, the SIM must be entered manually at the mobile each time it is started.

UMTS Settings – System Lock

Locks a particular technology for the mobile:

Off	The mobile can access GSM and UMTS cells.
GSM	GSM cells enforced, only GSM cells allowed.
UMTS	UMTS cells enforced, only UMTS cells allowed.

UMTS Settings – Sector Lock

Sector Lock forces the test mobile to use a specified UTRAN cell. If *Lock Sector* is selected, the *DL* channel number and Primary *Scrambling Code* of the enforced (locked) cell can be entered below.

Motorola – NQA Settings

The *NQA Settings* tab provides the parameters for *Network Quality Analysis*. NQA is a prerequisite for drawing up a call statistics where the calls are classified and the classes are visualized separately (see *2G/3G NQA View* in chapter 4).

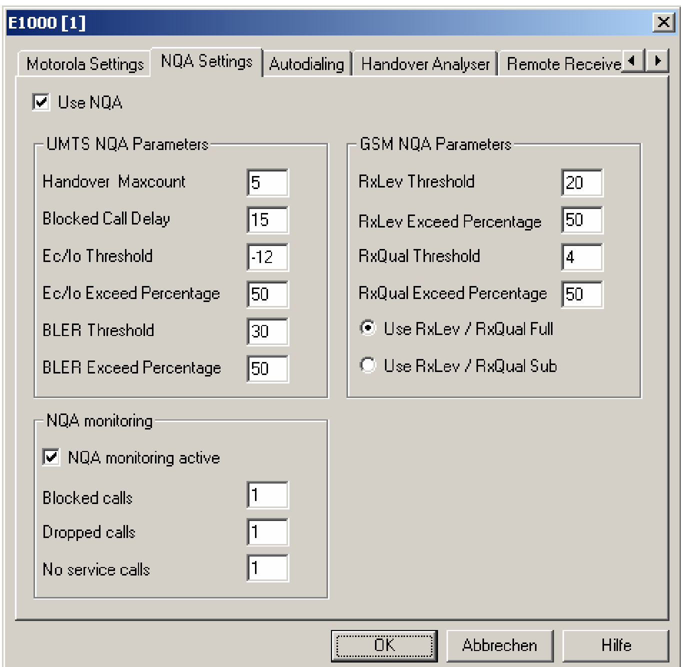


Fig. 6-46 Driver Configuration – NQA Settings tab

The parameters in the *GSM NQA Parameters* and *NQA Monitoring* sections are identical to the NQA parameters for GSM; see section *Driver Configuration – NQA* on p. 6.47 ff.

Use NQA If checked, the box activates the network quality analysis (default).

UMTS NQA Parameters The following numeric parameters configure the UMTS NQA by defining conditions and limits for the different call classes (we quote the ranges for all parameters; default values are underscored)

Handover Maxcount Maximum number of handover procedures during a call in the range 1 to 5 to 100. If the defined value is exceeded, the call will be classified as EXCESSIVE HO.

Blocked Call Delay Maximum delay (in seconds) between CM_SERV_REQ and ASSIGNMENT_COMMAND in the range 1 (s) to 15 (s) to 63 (s). If the defined delay is exceeded, the call will be classified as DELAYED CALL.

Ec/Io Threshold Minimum signal to noise ratio in dB and in the range

–20 (dB) to –12 (dB) to 0 (dB). Ec/Io values which fall below this threshold contribute to NOISY.

Ec/Io Exceed Perc. Minimum ratio (in percent) of reported RxLev values falling below the RxLev Threshold in the range 0 (%) to 50 (%) to 100 (%). If the actual ratio falls below the specified percentage the call is classified as NOISY.

	BLER Threshold	Maximum Block Error Rate in percent in the range 0 (%) to <u>30</u> (%) to 100 (%). BLER values above this threshold contribute to NOISY.
	BLER Exceed Perc.	Minimum ratio (in percent) of reported BLER values exceeding the BLER Threshold in the range 0 (%) to <u>50</u> (%) to 100 (%). If the actual ratio exceeds the specified percentage the call is classified as NOISY.
GSM NQA Parameters	Configures the GSM NQA, see *NQA* on p. 6.47 ff.	
NQA Monitoring	Activates NQA monitoring and displays the number of *Blocked Calls, Dropped Calls,* and *No Service Calls,* see *NQA* on p. 6.47 ff.	

Motorola – Autodialing

The *Autodialing* tab configures the mode where a definite phone number is dialed periodically, and a call is set up to the mobile phone. This mode is relevant for the network quality analysis described on page 6.47. All settings are analogous to the call modes and types described for *Qualcomm / Nokia – Autodialing* on p. 6.82 ff.

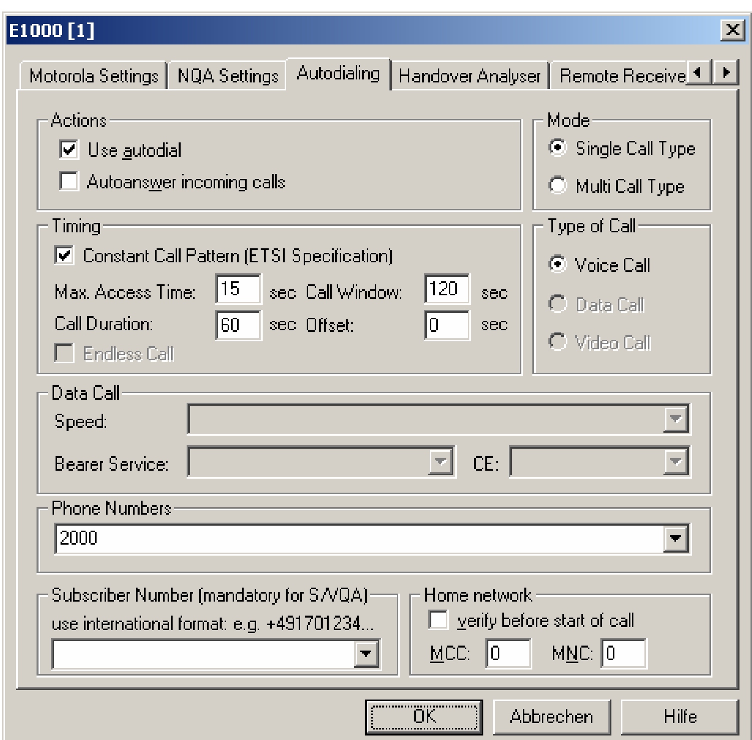


Fig. 6-47 Driver Configuration – Autodialing tab

Motorola – Handover Analyzer

The *Handover Analyzer* tab enables or disables the handover analyzer (option ROMES-U1) and sets the timeout for the HO analysis. The HO analysis and the meaning of the timeout is described in chapter 4, section *UMTS/GSM Handover Analyzer View*.

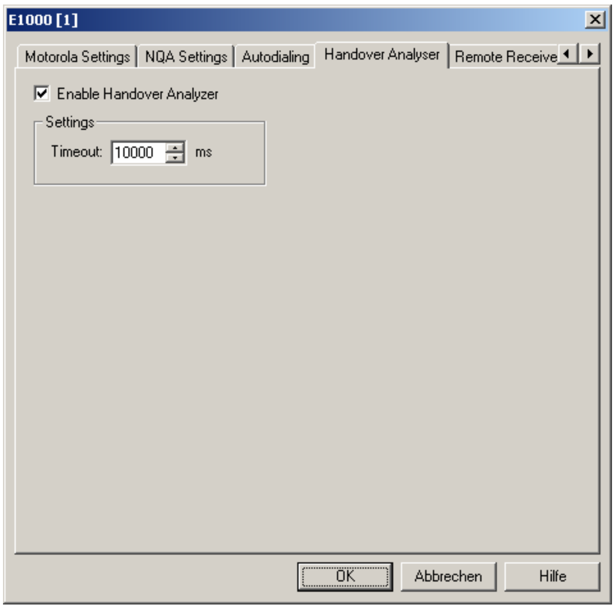


Fig. 6-48 Driver Configuration – Handover Analyzer tab

Motorola – Remote Receiver

The *Remote Receiver* tab configures the tracking mode where a the mobile phone controls a CW test receiver and sets its receive frequency. All settings and the *Connect Receiver..., Disconnect Receiver..., and Job Management...* buttons are analogous to the GSM driver configuration settings for remote receivers described on p. 6.40 ff.

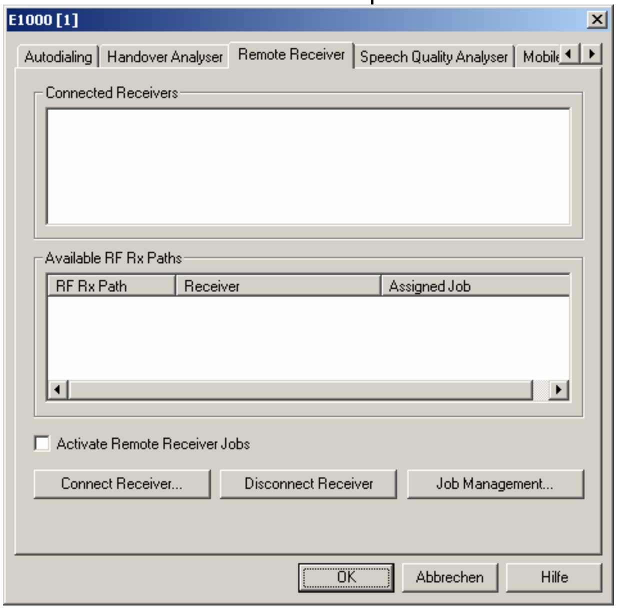


Fig. 6-49 Driver Configuration – Remote Receiver tab

Motorola – Speech Quality Analyser

The *Speech Quality Analyser* tab enables and configures the Speech Quality Analysis (SQA, with option ROMES-Z8, *Voice Quality PESQ)*. SQA results can be displayed in the *SQA Message* view (see chapter 4). All settings are analogous to the GSM driver settings described on p. 6.58 ff.

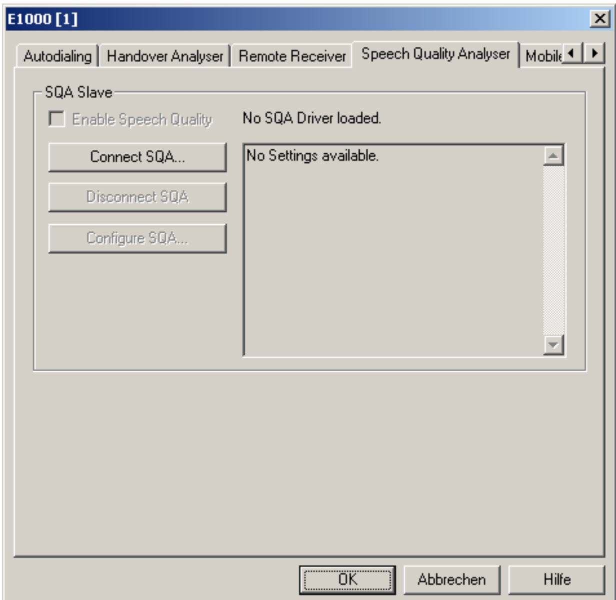


Fig. 6-50 Driver Configuration – Speech Quality Analyser tab

Motorola – Mobile Options

The *Mobile Optons* tab shows the additional registered options found for the test mobile.

All settings are analogous to the GSM driver settings described on p. 6.50 ff.

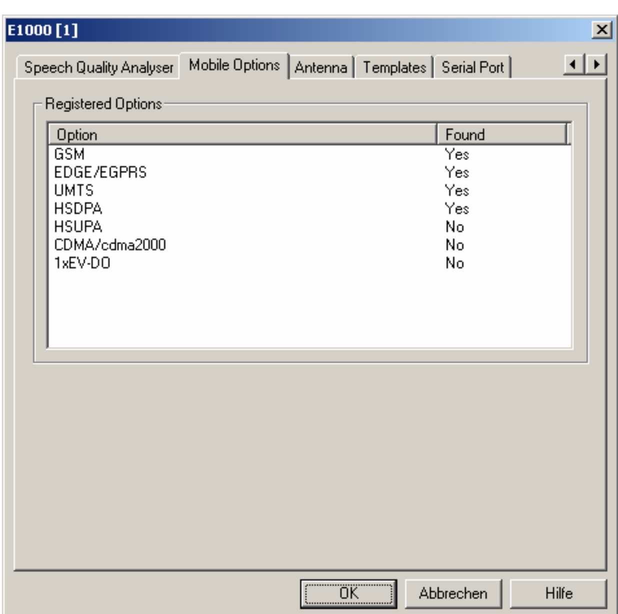


Fig. 6-51 Driver Configuration – Mobile Options tab

Motorola – Antenna

The *Antenna* tab defines *Antenna Name, Antenna Gain* and *Cable Loss*. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

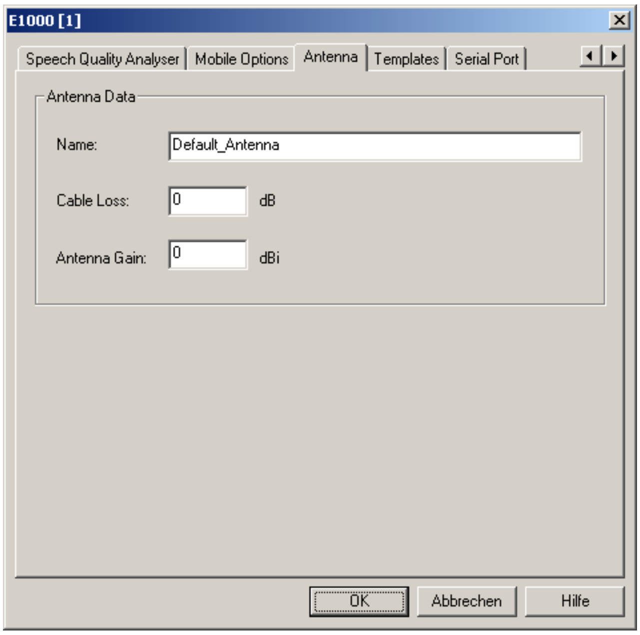


Fig. 6-52 Driver Configuration – Antenna tab

Motorola – Templates

The *Templates* tab stores the current driver configuration as a template, lists, loads or deletes driver templates. All settings and buttons are analogous to the GSM driver settings described on p. 6.56 ff.

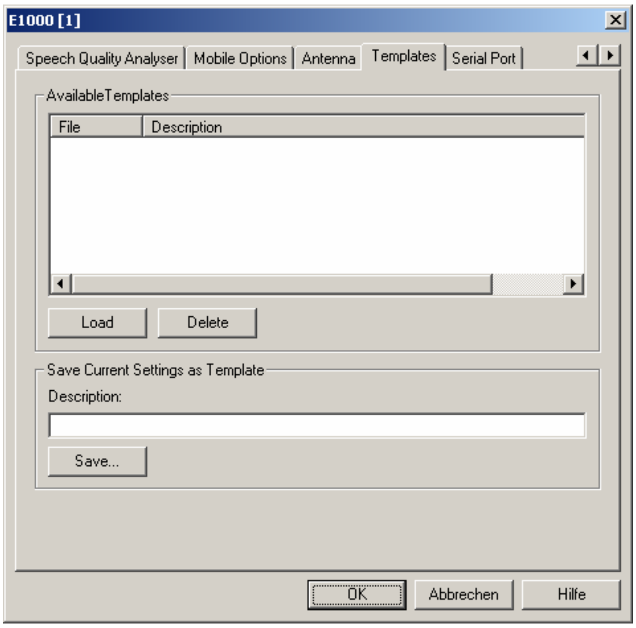


Fig. 6-53 Driver Configuration – Templates tab

Motorola – Serial Port Driver Info

The *Serial Port Driver Info* tab displays the custom name of the device, information on the file version of the UMTS driver, the serial port assigned to it and the transfer parameters.

The *Custom Name* is used to assign a name to a mobile, e.g. to make a quick association of a test mobile to its designated test network provider. An example is provided in section *Configuration of Installed Drivers* on p. 6.21.

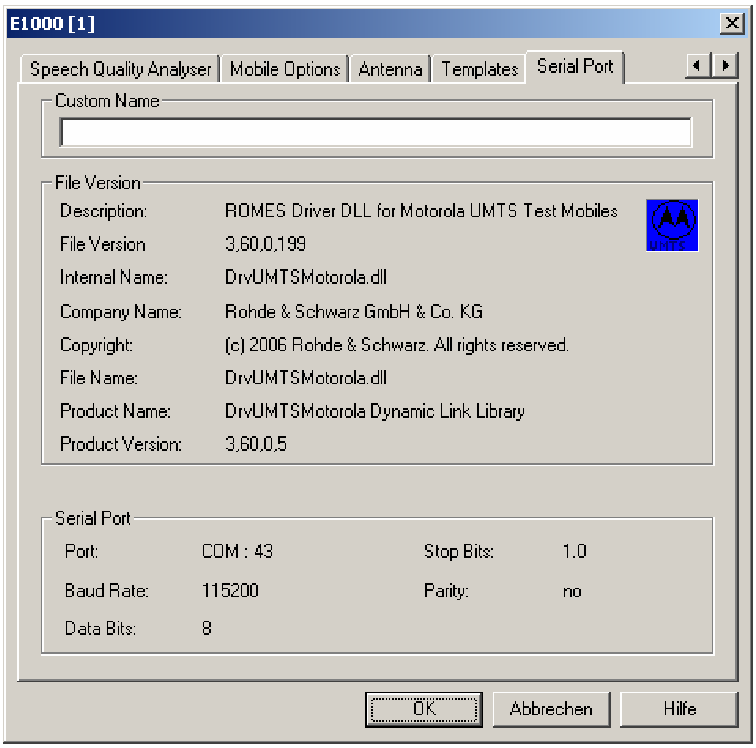


Fig. 6-54 Driver Configuration – Serial Port Driver Info tab

CDMA2000 and 1xEV-DO Mobile Drivers

The selection of CDMA2000/1xEV-DO-capable test devices is performed separately from the IS-95 CDMA hardware selection. This is shown in the *Hardware Configuration - Load Drivers* screenshot below, where the *CDMA/QCP* menu item loads the IS-95 related driver (see section *CDMA IS-95 Mobile Drivers* on p. 6.104), and the *cdma2000/Qualcomm* menu item loads the CDMA2000/1xEV-DO related driver.

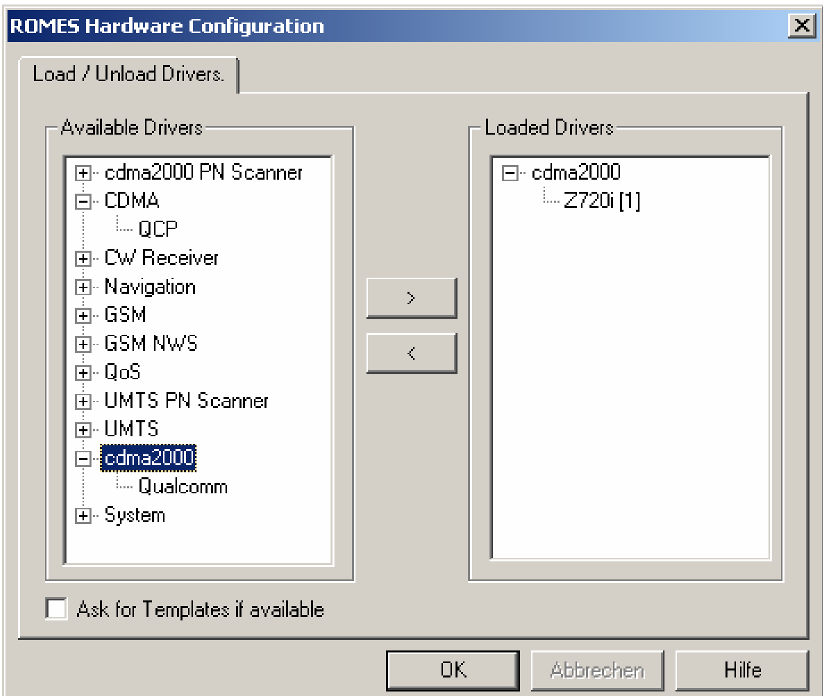


Fig. 6-55 Hardware Configuration – Load/Unload Drivers tab

The measurement system provides CDMA2000 and 1xEV-DO mobile drivers for the following test mobiles:

- Devices based on the Qualcomm MSM6500 chipset, e.g. the Qualcomm TM6500 test mobile (dual mode GSM 850 / 900 / 1800 / 1900 MHz, CDMA2000 Cell 850 / JCDMA 800 / KPCS 1700 / PCS 1900 MHz + GPRS),
- Devices based on the Qualcomm 5100 and 6025 chipset, e.g. the Pantech Zapp Z720i test mobile (GSM 450 MHz, CDMA2000 450, 1xEV-DO), the Huawei ETS310 (GSM 450 MHz, CDMA2000 450), or the Zapp EVDO Modem Z010 (GSM 450 MHz, CDMA2000 450, 1xEV-DO),
- Devices based on the Qualcomm 60xx chipsets, e.g. the Samsung SCH-A-940 / SCH-A-890 (GSM 800 / 1900 MHz, CDMA2000 850/1900, 1xEV-DO) or the Huawei ETS318 (GSM 800 MHz, CDMA2000 450),
- Hyundai test mobile Zapp H-150 (CDMA2000 450)

The CDMA2000/Qualcomm driver is installed by selecting *cdma2000* in the *Hardware Drivers* window (see *Fig. 6-55* on page 6.96). It is possible to load up to four CDMA mobile drivers at the same time.

Caution:
The Samsung mobiles rely on the USB interface for their power supply. A supply current of approx. 0.5 A is required. Check the specification of your USB interface, especially when connecting several Samsung mobiles or other power-consuming devices in parallel. If necessary, use a self-powered USB hub.

The configuration menus and additional settings are explained below.

The CDMA2000/1xEV-DO test mobiles can be used to acquire data for most of the CDMA and 1xEV-DO views described in chapter 4.

Analogous to GSM, the CDMA2000 / 1xEV-DO test mobiles and drivers are now grouped into the R&S support classes 1 and 2. The mobiles of R&S support class 1 are continuously tested with new ROMES versions and service packs, they are permanently available to our testing staff. The mobiles of R&S support class 2 are not always available for testing, but they have been tested successfully at least once with the current ROMES software release. The introduction of the R&S support classes is necessary due to the sheer number of supported mobiles. The mobile types with R&S support class 1 are listed with normal title typeface in the table below, the mobiles with R&S support class 2 are marked with ***italic*** title typeface.

Table 6-10 Properties of CDMA2000 / 1xEV-DO test mobiles

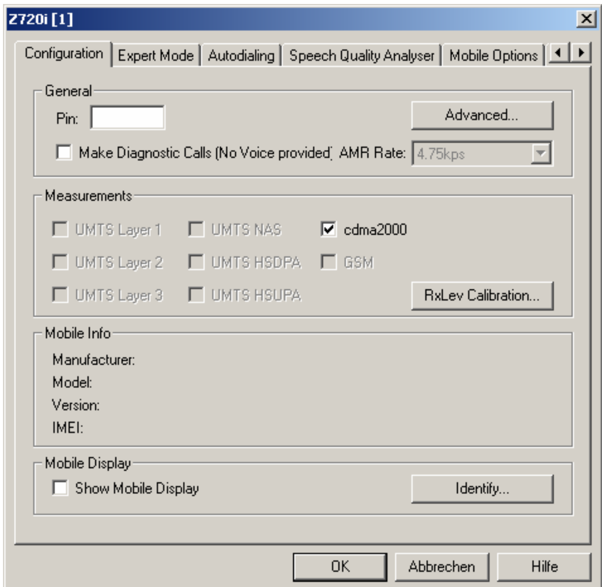
Chipset: MSM6500	Chipset: 5100 and 6025	Chipset: 60xx	Chipset: xxxx
Qualcomm TM6500 GSM 850 / 900 / 1800 / 1900 MHz, CDMA2000 Cell 850 / JCDMA 800 / KPCS 1700 / PCS 1900 MHz + GPRS	**Pantech Zapp Z720i** GSM 450 MHz, CDMA2000 450, 1xEV-DO ***Huawei ETS310*** GSM 450 MHz, CDMA2000 450 **Zapp EVDO Modem Z010** GSM 450 MHz, CDMA2000 450, 1xEV-DO	***Huawei ETS318*** GSM 800 MHz, CDMA2000 450 **Samsung SCH-A-940/ SCH-A-890** GSM 800 / 1900 MHz, CDMA2000 850/1900, 1xEV-DO	***Hyundai Zapp H-150*** CDMA2000 450

Driver Configuration Menu

The *Qualcomm* driver configuration menu contains various tabs to select the measurement and message types evaluated by the test system *(Configuration, Expert Mode),* to configure the network quality analysis *(NQA)* and the autodialing and autoanswer call mode *(Autodialing)*, to define the characteristics of the antenna used *(Antenna),* and to display information on the driver and the serial port assigned *(Serial Port Driver Info).* It can be opened by clicking the *Driver* command line of the *Configuration* menu which is available as soon as a mobile driver is loaded (see Fig. 6-4) or via the *Driver* tab in the *Configuration of Software Modules* menu opened via the *Configuration – Settings* command.

Configuration

The *Configuration* tab defines the PIN number and allows a rough pre-selection of the evaluated message type. The message type selection can be refined in the *Expert Mode* tab (see p. 6.99 ff.).



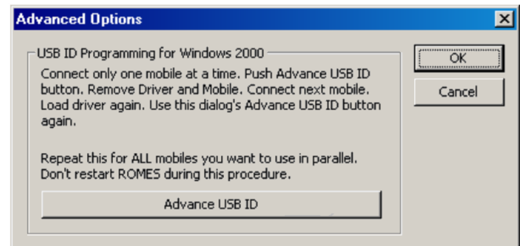


Fig. 6-56 CDMA2000 / 1x EV-DO driver configuration – configuration

General The PIN number for identification after switching on the test mobile can be entered in the *General* panel of the configuration dialog. If nothing is entered, the SIM must be entered manually at the mobile each time it is started.

If *Make Diagnostic Calls…* is selected, the mobile will set up connections (no voice calls) at a fixed data rate. This option is particularly suitable for connections with test devices that are not equipped with an audio circuit.

The *Advanced Options* menu is needed if several Qualcomm mobiles are connected to a Windows 2000-based test system; see the paragraph on *Connecting several Qualcomm mobiles* on p. 6.6.

Measurements The available CDMA2000 checkbox in the *Measurements* is used to enable CDMA2000 messages and information types to be recorded and written to the measurement (*.cmd) file. The selection can be refined in the *Expert Mode* tab. For an overview of available messages, views and signals see Table 6-6 above.

All other options are automatically greyed out, unless the mobile is actually capable to support one of the listed technologies.

Please note that the *RXLev Calibration...* button is permanently grayed out, because the calibration is only useful in a GSM context.

Mobile Display *Show Mobile Display* opens a view of the test mobile so that it is possible to observe the display, dial numbers and browse the menu from the controller while a measurement is performed. This function is also provided in the *Action* menu; see section *Action Menu* on p. 6.87 ff.

The *Identify...* button is useful when several test mobiles are connected. Clicking the button causes the currently active test mobile to identify itself by showing its IMEI on the mobile display, and the following message box pops up:

After confirmation with OK the IMEI on the mobile display disappears.

Expert Mode

The *Expert Mode* tab selects the message types to be recorded to the measurement file. A *Layer 1 cdma2000* message type can be selected only if the driver has been configured to do *cdma2000* measurements; see description of the *Configuration* tab above.

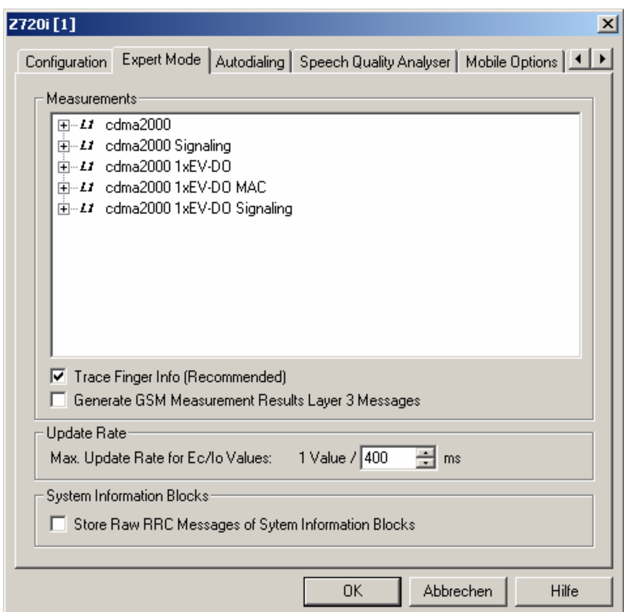


Fig. 6-57 CDMA2000 / 1x EV-DO driver configuration – Expert Mode

For an explanation of the recorded parameters refer to the description of the CDMA200 and 1xEV-DO views in chapter 4.

Trace Finger Info The CDMA finger info is necessary for the *CDMAFinger View.* It must be selected as well to obtain the *Finger Info* signals.

Generate GSM Layer 3 Messages The checkbox has no effect in a CDMA2000/1xEV-DO context.

Update Rate Sets the maximum update rate for Ec/Io values. A lower update rate decreases the size of the measurement file.

System Information Blocks

Radio Resource Control (RRC) messages are broadcast in system information blocks of various types (see standard 3GPP TS 25.331). If the box *Store Raw RRC Messages…* is checked, the complete information transmitted in the RRC signaling messages is stored to the measurement file.

If only the system information blocks are needed, the default configuration (box unchecked) is sufficient. This will reduce the size of the measurement file.

Autodialing

The *Autodialing* tab configures the mode where a definite phone number is dialed periodically, and a call is set up to the mobile phone. This mode is relevant for the network quality analysis described on page 6.47. All settings (except for SID and NID in the *Home Network* group as described below) are analogous to the GSM driver settings described on p. 6.43 ff.

The driver settings for the CDMA2000/1xEV-DO devices are identical. If a 2nd virtual COM port is needed to be operated in *autodial* mode; see the paragraph on *Loading the drivers* on p. 6.5.

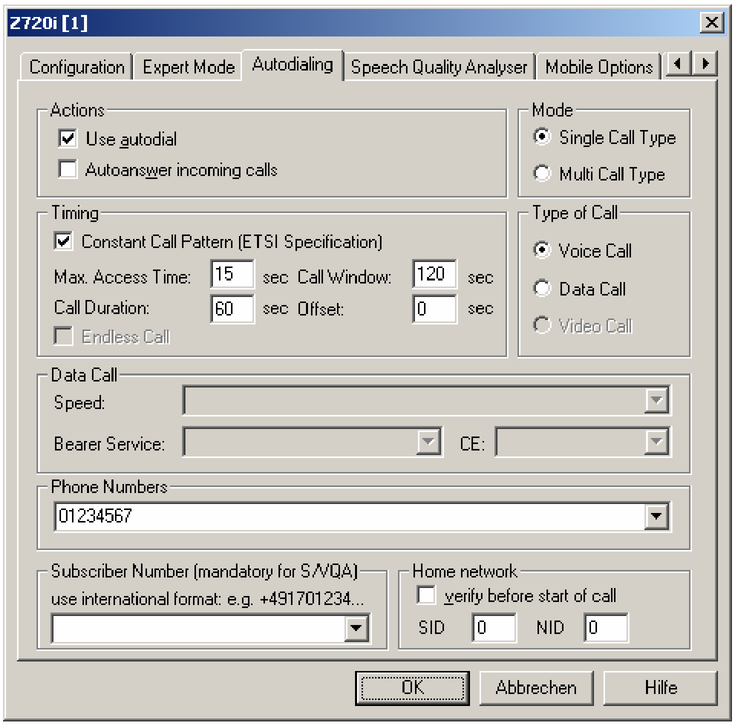


Fig. 6-58 Driver Configuration – Autodialing tab

Home network

The home network identified by the system identification code (SID, range 0 to 32767) and the network identification code (NID, range 0 to 65535).

If *verify before start of call* is checked, the mobile will be out of service if a call is attempted from a foreign network (e.g. during a measurement tour near the border of a network where roaming is possible). This ensures that calls from foreign networks will not impair the network quality analysis; see next section.

By default, the *verify before start of call* function is not active.

Speech Quality Analyzer

The *Speech Quality Analyzer* tab enables and configures the Speech Quality Analysis (SQA, with option ROMES-Z8, *Voice Quality PESQ)*. SQA results can be displayed in the *SQA Message* view (see chapter 4). All settings are analogous to the GSM driver settings described on p. 6.58 ff.

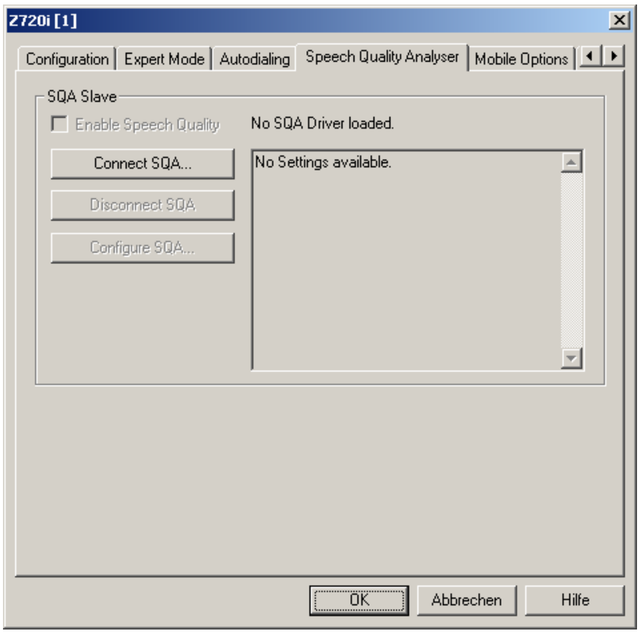


Fig. 6-59 Driver Configuration – Speech Quality tab

Mobile Options

The *Mobile Optons* tab shows the additional registered options found for the test mobile, the displayed option information is retrieved from the registered ROMES dongle options, not from the mobile itself.

All settings are analogous to the GSM driver settings described on p. 6.50 ff.

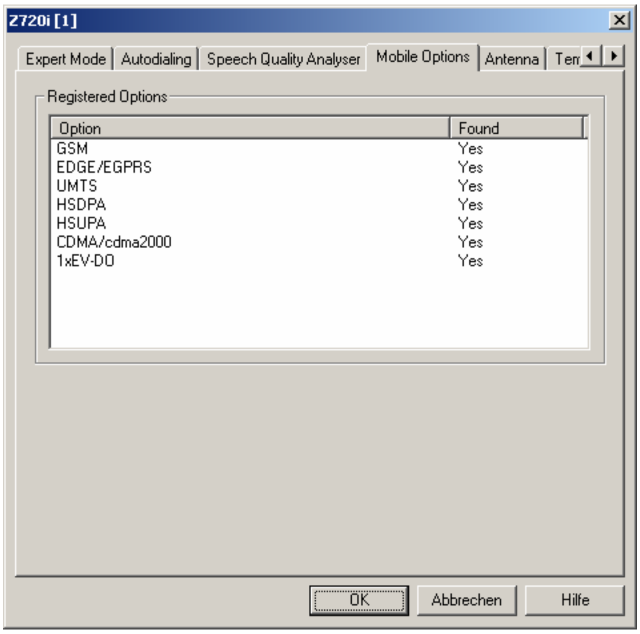


Fig. 6-60 Driver Configuration – Mobile Options tab

Antenna

The *Antenna* tab defines *Antenna Name, Antenna Gain* and *Cable Loss*. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

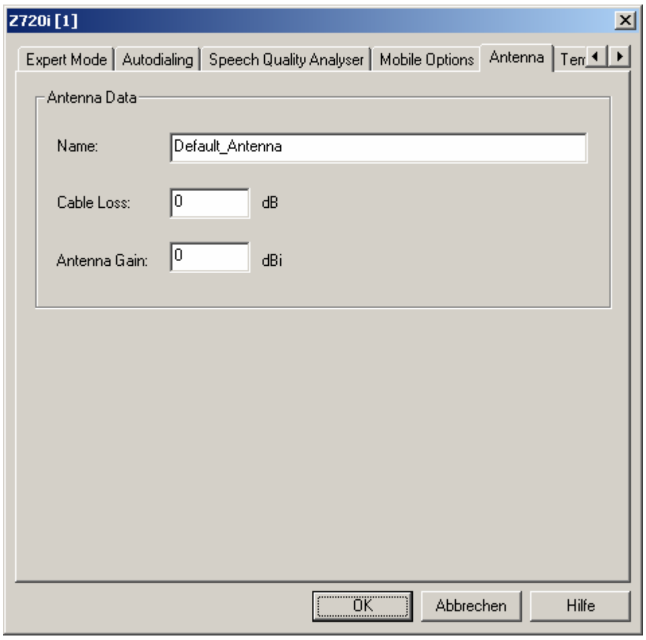


Fig. 6-61 Driver Configuration – Antenna tab

Templates

The *Templates* tab stores the current driver configuration as a template, lists, loads or deletes driver templates. All settings and buttons are analogous to the GSM driver settings described on p. 6.56 ff.

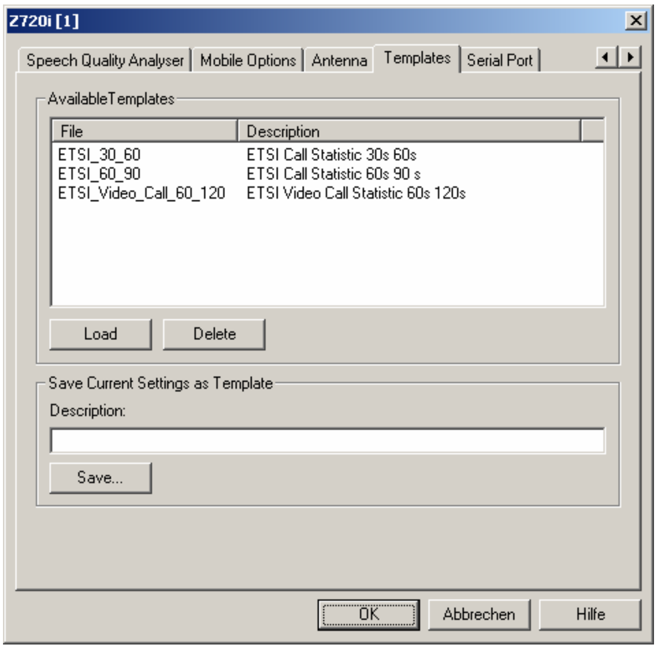


Fig. 6-62 Driver Configuration – Templates tab

Serial Port Driver Info

The *Serial Port Driver Info* tab displays the custom name of the device, information on the file version of the UMTS driver, the serial port assigned to it and the transfer parameters.

The *Custom Name* is used to assign a name to a mobile, e.g. to make a quick association of a test mobile to its designated test network provider. An example is provided in section *Configuration of Installed Drivers* on p. 6.21.

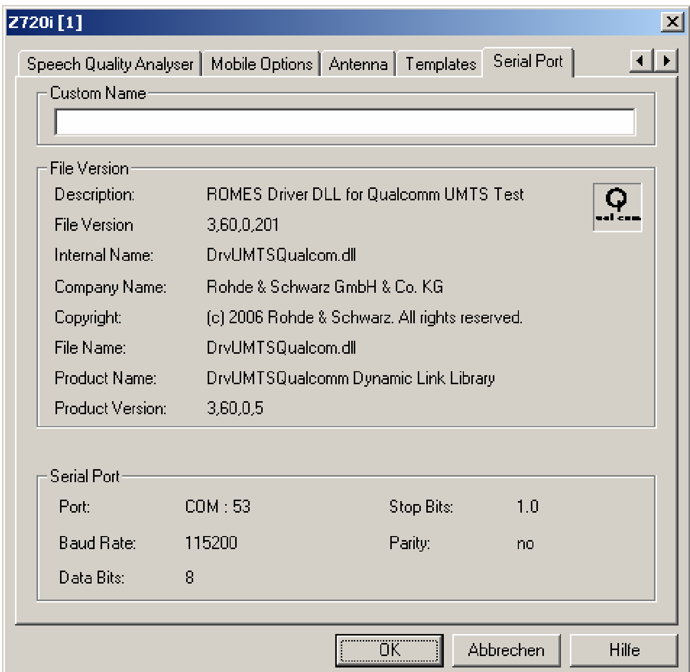


Fig. 6-63 Driver Configuration – Serial Port Driver Info tab

CDMA IS-95 Mobile Drivers

The CDMA (IS-95) mobile driver provided with the measurement system supports the following devices manufactured by Qualcomm Inc.:

Table 6-11 Supported CDMA mobile phones

Type	Description	According to Standard
pdQtm 800	CDMA digital and analog cellular phone	IS-95-A
pdQtm 1900	CDMA digital PCS phone	J-STD-008
Qtm 800	CDMA digital and analog cellular phone	IS-95-A
Qtm1900	CDMA digital PCS phone	J-STD-008
QCM 800	CDMA digital and analog cellular phone	IS-95-A
QCM1900	CDMA digital PCS phone	J-STD-008
QCP 800	CDMA digital and analog cellular phone	IS-95-A
QCP 820	CDMA digital and analog cellular phone	IS-95-A
QCP 860	CDMA digital and analog cellular phone	IS-95-A
QCP 1900	CDMA digital PCS phone	J-STD-008
QCPtm 1920	CDMA digital PCS phone	J-STD-008
QCP 2700	CDMA digital PCS and analog cellular phone	J-STD-008
QCPtm 2760	CDMA digital PCS and analog cellular phone	J-STD-008
QCP 3035*)	CDMA digital PCS, digital cellular and analog cellular phone (trimode)	J-STD-008 and IS-95-A
QCT 1000	CDMA digital cellular phone	IS-95-A
QCTtm 1200	CDMA digital PCS phone	J-STD-008
QCT 6000	CDMA digital cellular phone	IS-95-A
QCTtm 6200	CDMA digital PCS phone	J-STD-008
QCTtm 7000	CDMA digital cellular phone	IS-95-A
QCTtm 7200	CDMA digital PCS phone	J-STD-008

The CDMA driver is installed by selecting *CDMA* in the *Hardware Drivers* window (see *Fig. 6-1* on page 6.1). It is possible to load up to four CDMA mobile drivers at the same time. The configuration menus and additional settings are explained below.

Note:
The CDMA Test Mobile Kyocera QCP3035A-B is allowed only for use outside Europe.
It is not allowed to put this mobile into operation inside Europe.

Configuration Menu

The *QCP Configuration* menu contains three tabs configuring the measurement *(Define Measurement),* the *Autodialing* mode, and the RF parameters of the connected *Antenna*.

The *QCP Configuration* menu is opened by clicking the *Driver* command line in the *Configuration* menu which is available as soon as a receiver driver is loaded. Besides, it is opened automatically whenever a driver for a mobile which does not conform to the default configuration settings is loaded, i.e. on confirming the driver selection and port assignment made in the *Hardware Drivers* menu (see *Fig. 6-1* on page 6.1).

Define Measurement

The *Define Measurement* tab sets measurement control parameters and selects the measurements that are performed and the kind of data and messages that are recorded during the measurement. All options can be selected concurrently, however, it is advisable to make a selection to improve system performance.

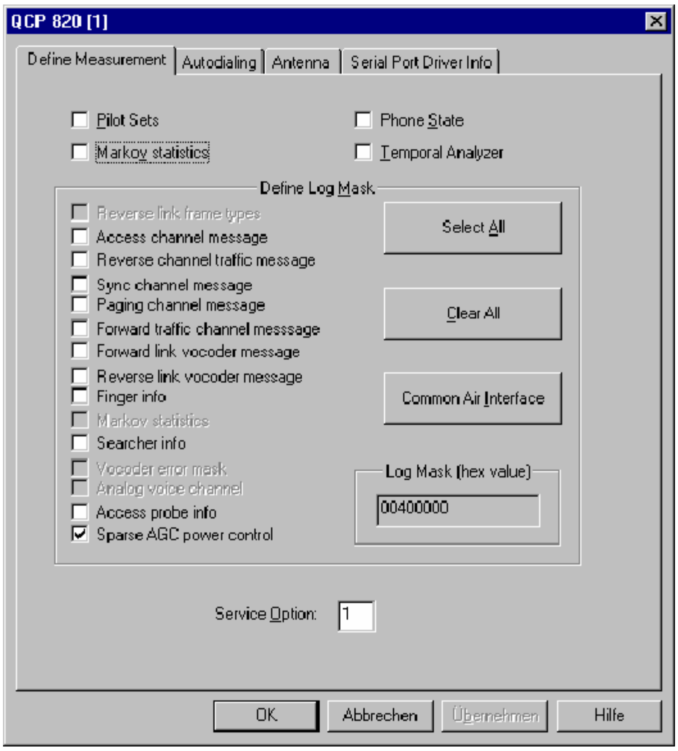


Fig. 6-64 CDMA driver configuration – Define Measurement

Setting	Meaning	Necessary for View Type, Remarks
Pilot Sets	Enables monitoring of active pilot and neighbor cell channel strengths	CDMA Pilot View; the *Pilot Sets Measurement* mode may impair the system performance, especially if you select an extended range of measurements in the *Log Mask* (see below).
Phone State		It is always recommended to select *Phone State Measurement* (no performance problem).
Markov statistics	Perform a statistical evaluation of the call	CDMA Markov Statistic View. To enable the measurement, an appropriate service option must be set in addition.
Temporal Analyzer	Acquire data determining the vocoder rate, frame error rate, RX power, TX power	CDMA Frame Error Rate View CDMA Vocoder Rate View With Temporal Analyzer, the following signals are generated: Bad frames received Total frames received Forward vocoder rate Reverse vocoder rate AGC power value (RX power) TX power
Define Log Mask		
In the *Log Mask* panel, a variety of measurements can be selected from a list. All selected measurements are performed. The buttons on the right side of the list make the selection more convenient:		
Reverse link frame types	Not used	–
Access channel message	CAI message	CDMA CAI View (at least one CAI message switched on)

Reverse channel traffic message	CAI message	CDMA CAI View (at least one CAI message switched on)
Sync channel message	CAI message	CDMA CAI View (at least one CAI message switched on)
Paging channel message	CAI message	CDMA CAI View (at least one CAI message switched on)
Forward traffic channel message	CAI message	CDMA CAI View (at least one CAI message switched on)
Forward link vocoder message	Not used	–
Reverse link vocoder message	Not used	–
Finger info	Record info from the mobile's RAKE receiver	CDMA Finger view
Markov statistics	Perform a statistical evaluation of the call	CDMA Markov Statistic View. To enable the measurement, an appropriate service option must be set in addition.
Searcher info	Record the multipath components	CDMA Searcher View
Vocoder error mask	Not used	–
Analog voice channel	Not used	–
Access probe info	Record estimated TX power (open loop power control)	CDMA Power View (Access probe: Estimated TX power)
Sparse AGC power control	Record RX and TX power, power control info and TX power limit (closed loop power control)	CDMA Power View
Select All	Activate all measurements	All views. To avoid performance problems, it is recommended to limit the selection to the measurements really needed.
Clear All	Deselect all measurements	All views are empty.
Common Air Interface	Clear the log mask and select the CAI type messages	CDMA CAI View. Further log mask options can be added after the *Common Air Interface* button has been pressed.
Log Mask (hex value)	Number encoding the selected log mask options, to be transmitted to the CDMA mobile station	Control field only, cannot be edited
Service Option	Set service option	Service option 1: Voice (IS-96) for all measurements except Markov statistics Service option 3: Markov Statistic View Service option 7: Rate Set 2 Markov (new 13k) Service option 8: Rate Set 1 Markov (new 8k) Service option 10: Markov (old 13k) ***Note:*** *The CDMA Test Mobile Kyocera QCP3035A-B requires a service option 2 or 3. With other service options, especially the default option 1, autodial is not possible.*

Autodialing

In the autodial mode, a phone number is dialed periodically and a call is set up to the mobile phone (see also section *GSM Mobile Drivers*).

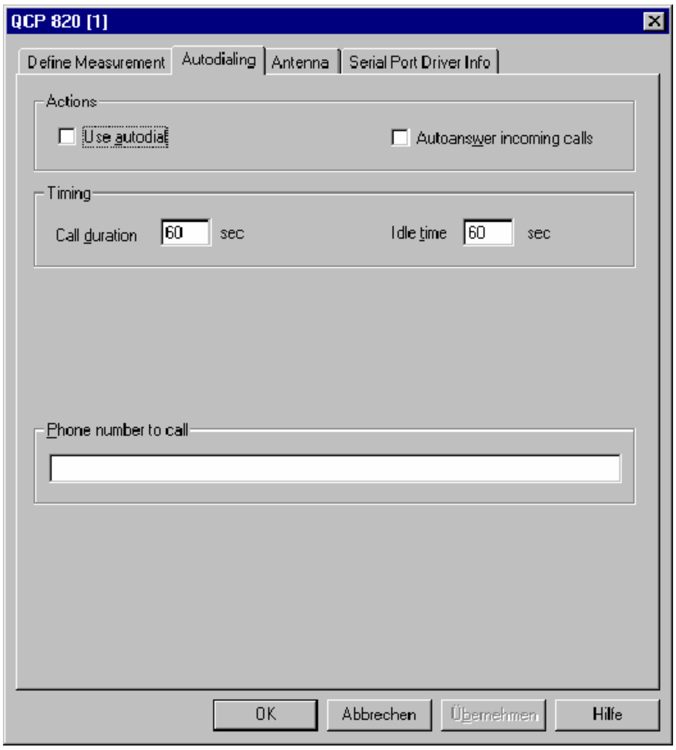


Fig. 6-65 CDMA driver configuration – Autodialing

Use autodial If checked, the box activates the autodial mode. By default, the autodial mode is not active.

Autoanswer incoming calls If checked, the box activates the autoanswer mode where after a certain number of rings, the call will be automatically accepted by the mobile phone. By default, the autoanswer mode is not active.

Timing Defines the periodicity of the autodial process.

Call duration	Time between start of a call and hang up in the range between 15 s (default) and 86400 s. For some mobiles it may be necessary to set the Call duration time higher than 15 s to get a Good Call, e.g. to 25 s. Therefore check the call statistics in the CDMA NQA View before starting the measurement tour.
Idle time	Time between hang up and dialing for the next call in the range between 15 s (default) and 86400 s.

Phone number to call A phone number can be entered via the keyboard and the input field.

Antenna

The *Antenna* tab sets RF parameters such as the cable loss caused by the test setup, the type and gain of an antenna used. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

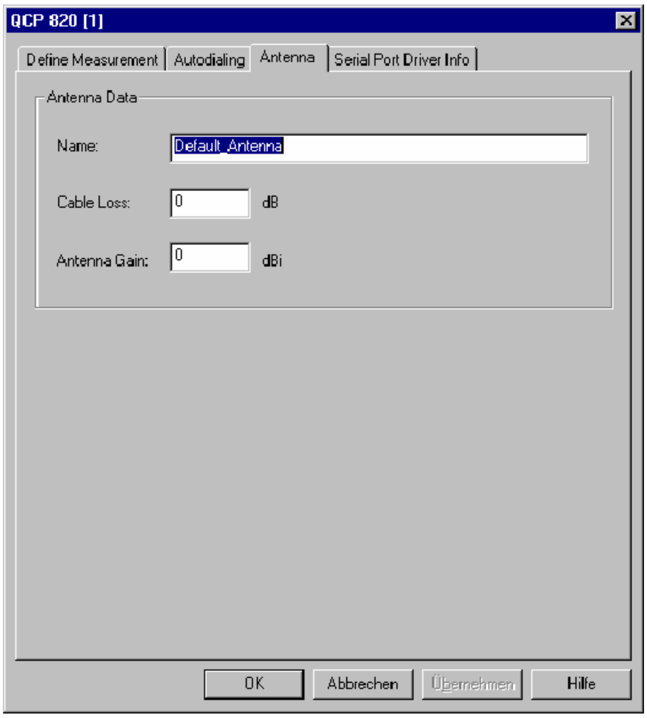


Fig. 6-66 CDMA driver configuration – Antenna

Serial Port Driver Info

The *Serial Port Driver Info* tab of the configuration menu displays information about the file version of the current driver, the product name, and the manufacturer. In addition, it shows the serial port assigned to the driver and the transmission parameters.

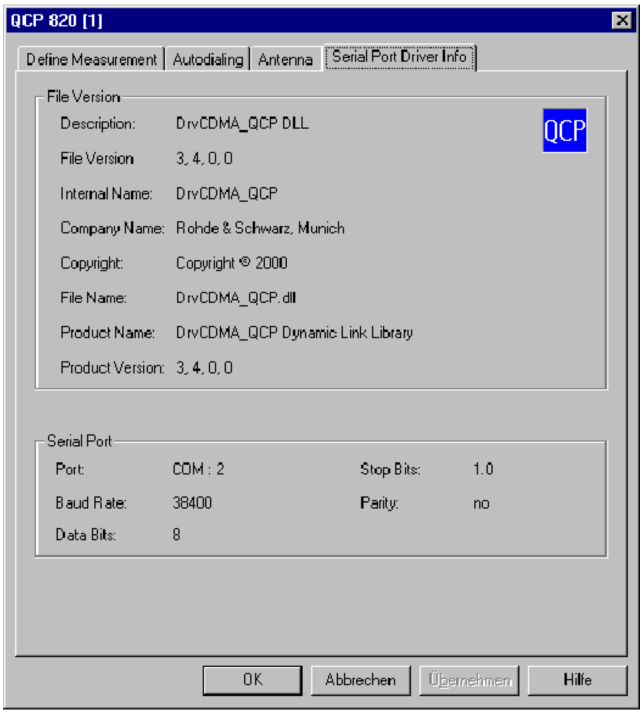


Fig. 6-67 CDMA driver configuration – Serial Port Driver Info

ETACS Mobile Driver

The ETACS mobile driver provided with the measurement system supports the Philips Fizz ETACS mobile. The ETACS driver is installed by selecting *ETACS* in the *Hardware Drivers* window (see *Fig. 6-1* on page 6.1). It is possible to load up to three ETACS mobile drivers at the same time. The configuration menus and additional settings are explained below.

Configuration Menu

The *FIZZ Configuration* menu contains two tabs configuring the measurement *(FIZZ CONFIG)* and the *RF Parameters* of the connected antenna.

The *Driver Configuration* menu is opened by clicking the *Driver* command line in the *Configuration* menu which is available as soon as a receiver driver is loaded. Besides, it is opened automatically whenever a driver for a mobile which does not conform to the default configuration settings is loaded, i.e. on confirming the driver selection and port assignment made in the *Hardware Drivers* menu (see *Fig. 6-1* on page 6.1).

FIZZ Configuration

The *FIZZ Configuration* tab controls the mobile mode, the autodialing and scanner settings.

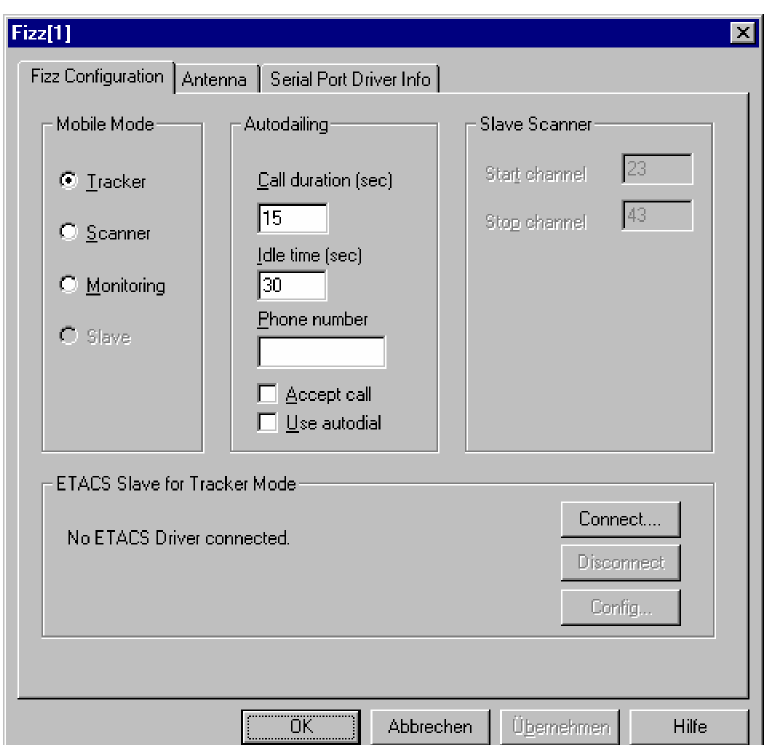


Fig. 6-68 ETACS driver configuration – FIZZ Configuration

Mobile Mode

The *Mobile Mode* panel specifies how the ETACS mobile is to be operated within the test setup:

Tracker The mobile behaves like an ordinary mobile phone.

Scanner The mobile scans a range of channels defined in the Scanner panel and detects the received signal level expressed in dimensionless RSSI units or in dBm

Slave If two ETACS mobiles are used, the first one may operate in Tracker mode (as a “Master“). If the Scan adjacent channels function is active (see below), the second mobile must run in Slave mode. The system will check if this second mobile running in Slave mode is available, if not you will get an error message.

The COM port to which the ETACS mobile is assigned is indicated below the *Mobile Mode* panel.

Autodialing

In the *Autodialing* mode, a phone number is dialed periodically and a call is set up to the mobile phone (see also section *GSM Mobile Drivers*).

Call duration Time between the start of a call and hang up in the range between 1 s ... **15 s** (default) ... 60000 s.

Idle time (sec) Time between hang up and the next call in the range between 1 s ... **30 s** (default) ... 3600 s.

Phone number Phone number to dial.

Use autodial If checked, the box activates the auto dial mode. By default, auto dial is off.

Slave Scanner

Start channel and *Stop channel* defining the channel range to be measured if the mobile is in *Scanner* mode.

Antenna

The *Antenna* tab reports the cable loss caused by the test setup, the type and gain of an antenna used. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

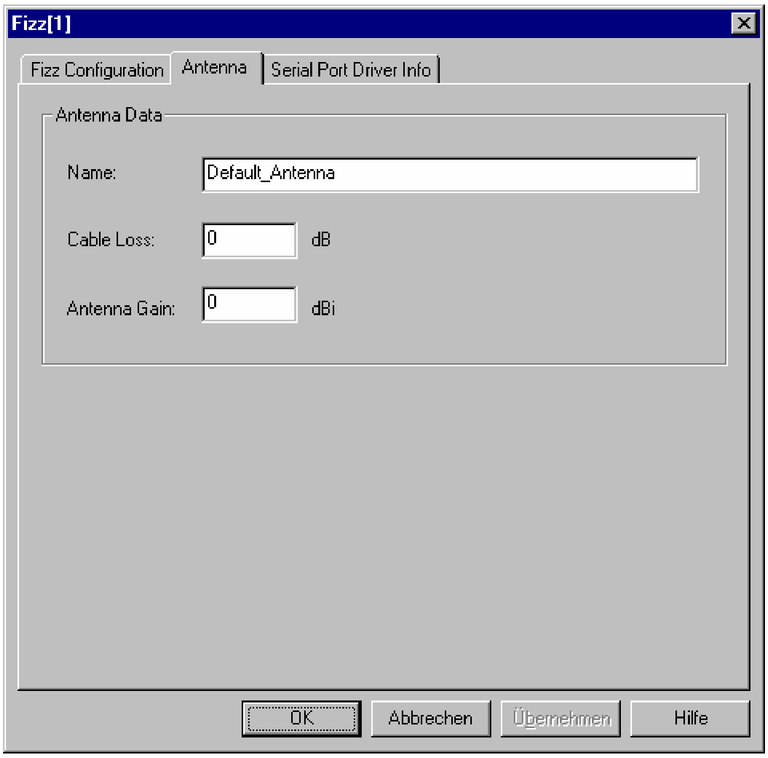


Fig. 6-69 ETACS driver configuration – Antenna parameters

Serial Port Driver Info

The *Serial Port Driver Info* tab of the configuration menu displays information about the file version of the current driver, the product name, and the manufacturer. In addition, it shows the serial port assigned to the driver and the transmission parameters.

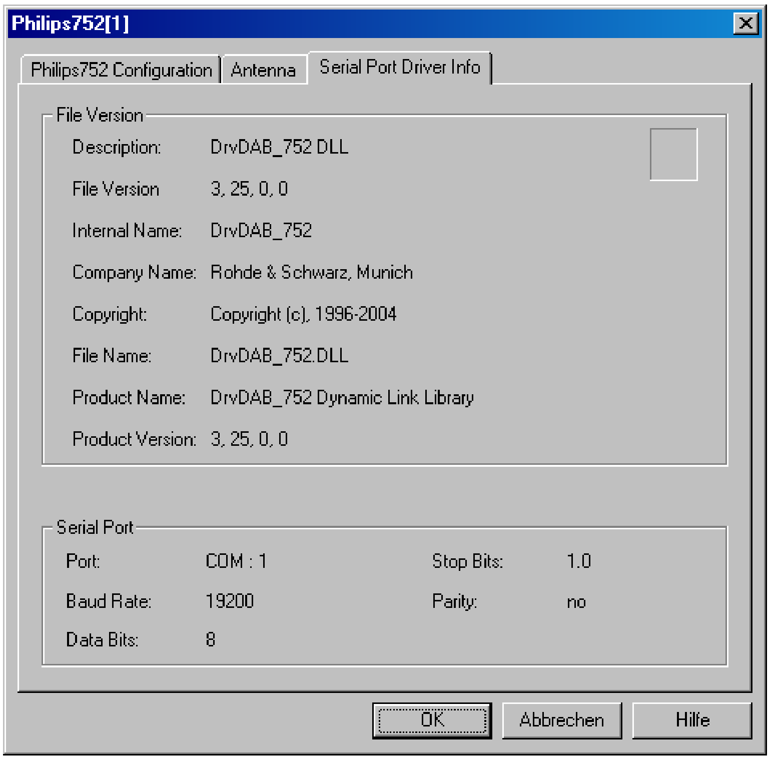


Fig. 6-70 ETACS driver configuration – Serial Port Driver Info

Action Menu

The *Action* menu opens popup boxes used to dial to the mobile phone and monitors the channels measured when the mobile is in *Receiver* mode. It is added to the menu bar as soon as a mobile driver has been successfully installed (see section *Driver Installation* on page 6.1 ff). If several mobiles are connected, separate command lines are displayed for each of them.

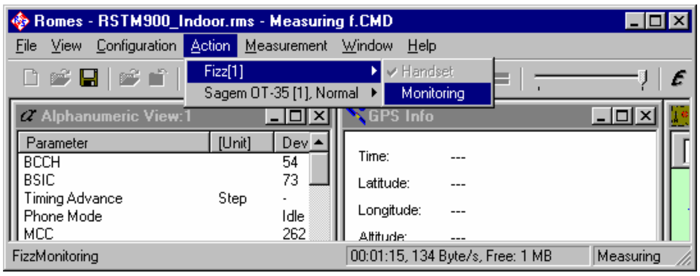
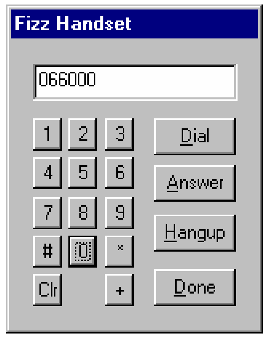


Fig. 6-71 Action menu (ETACS driver)

Handset

Activates the entry of a number to dial, sets up and terminates a call:

The *Handset* command opens the *Fizz Handset* dialog box:

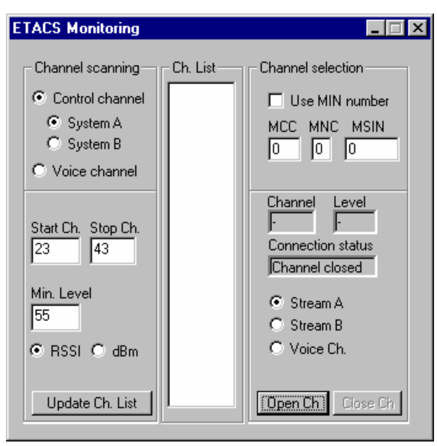


Dialed number	The number to be dialed can be entered either via the keyboard and the input field or by clicking the on-screen keypad.
Done	Closes the window without any further action.
Dial	Starts dialing the number entered before.
Answer	Picks up the phone.
Hangup	Drops the line.

Monitoring

Monitors the channels measured when the mobile is in *Receiver* mode.

Monitoring opens the following dialog.



Channel Scanning

Selection of the channel type to be monitored (control channel for system A or B or voice channel).

Below, a channel range and minimum received input power is defined:

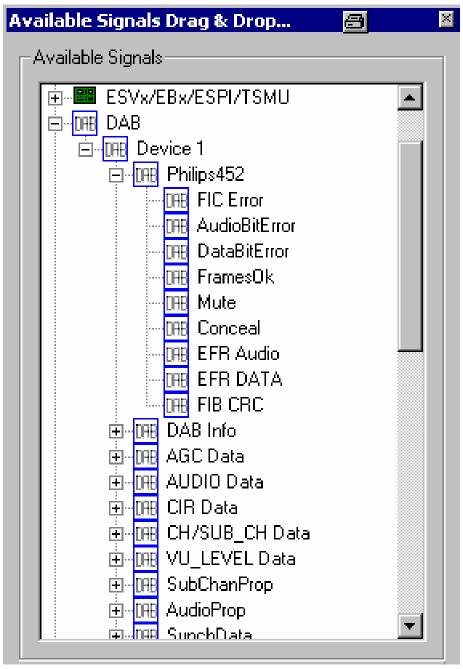
Start channel	Lower limit of the channel range to be monitored
Stop channel	Upper limit of the channel range to be monitored
Min. Level	Lower limit of the received input power, expressed in dimensionless RSSI units or in dBm: only channels with a signal level larger than or equal to the *min Level* are shown in the channel list *(Ch. List)*
Update Ch. List	Deletes and updates the channel list *(Ch. List)*

Ch List Indicates the numbers of the measured channels which fulfill the conditions set in the *ETACS Monitoring* dialog.

DAB752 Driver

The DAB driver provided with the measurement system supports the Philips752 DAB test receiver. An earlier type, the Philips452 DAB test receiver, is supported by ROMES versions V2.xx, however, measurement data recorded with this receiver can also be replayed and evaluated in ROMES 3.xx. The DAB driver is installed by selecting *DAB* in the *Hardware Drivers* window (see *Fig. 6-1* on page 6.1).

Note:
In the data tree, data recorded by the Philips452 receiver appears in a separate data structure. In particular the Philips452 signals are not overwritten by Philips752 DAB test receiver data.



The DAB receiver provides a wealth of data that can be viewed in all *Basic Views* (see chapter 3). The configuration menus and additional settings are explained below.

Configuration Menu

The configuration menu contains two tabs to configure the measurement *(Philips752 Configuration)* and define the characteristics of the antenna used *(Antenna)*.

The *Driver Configuration* menu is opened by clicking the *Driver* command line in the *Configuration* menu which is available as soon as a receiver driver is loaded. Besides, it is opened automatically whenever a driver for a receiver which does not conform to the default configuration settings is loaded, i.e. on confirming the driver selection and port assignment made in the *Hardware Drivers* menu (see *Fig. 6-1* on page 6.1).

Philips752 Configuration

The *Philips752 Configuration* tab controls the receiver frequency, the sampling rate *(Measurement Period)*, and further test receiver parameters.

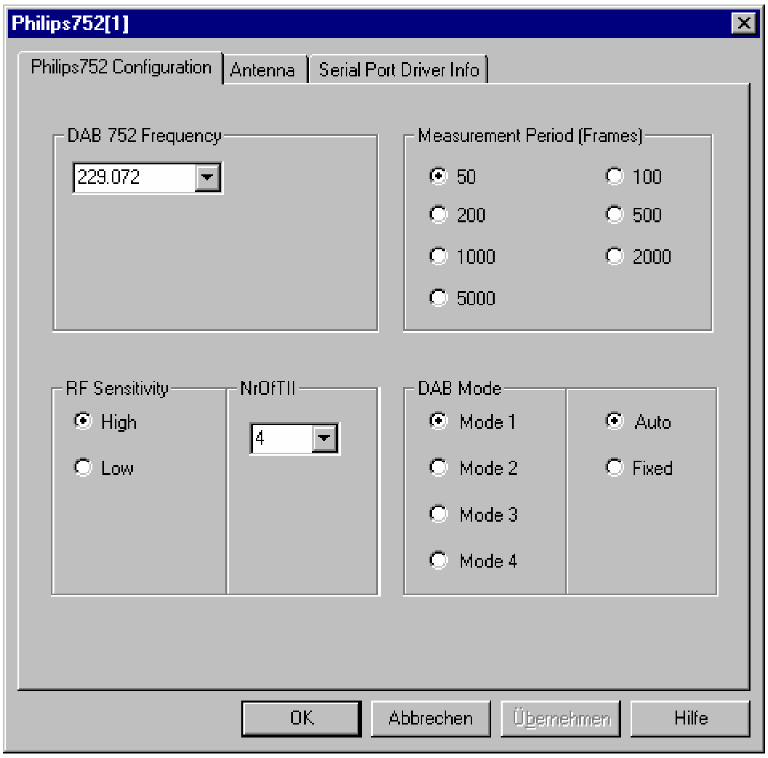


Fig. 6-72 Philips752 driver configuration – Measurement settings

DAB 752 Frequency The *DAB 752 Frequency* panel contains an input field to specify the frequency the receiver is tuned to. The frequency entered determines the ensemble tested; see section *Action Menu* on page 6.118.

Measurement Period The *Measurement Period* specifies the number of logical frames that are processed to produce a measurement summary of the monitored DAB signal. The measurement speed is 1.2 s per 50 frames. A longer measurement period reduces the data rate.

RF Sensitivity The *RF Sensitivity* radio buttons switch the receiver between high (min. –95 dBm, typ. –98 dBm) and low sensitivity (typ. –45 dBm). The default setting is *High*. *Low* RF sensitivity is recommended for very strong received signals (e.g. due to a direct connection of the receiver via test cable or a measurement in the vicinity of the BTS). In addition, it avoids detection of weak unwanted signals when the DAB signal disappears.

NrOfTII Number of TII signals generated in the measurement file in the range 1 to 8. The number can be reduced to accelerate the measurement.

DAB Mode One of four *DAB Modes* can be selected *(Fixed* setting). Alternatively, the mode is set by the system according to the test conditions *(Auto* setting).

Antenna

The *Antenna* tab sets RF parameters such as the cable loss caused by the test setup, the type and gain of an antenna used. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

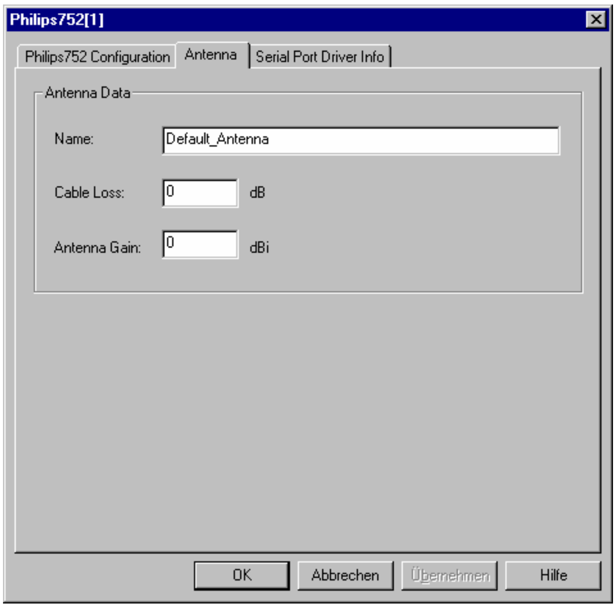


Fig. 6-73 Philips752 driver configuration – Antenna

Serial Port Driver Info

The *Serial Port Driver Info* tab of the configuration menu displays information about the file version of the current driver, the product name, and the manufacturer. In addition, it shows the serial port assigned to the driver and the transmission parameters.

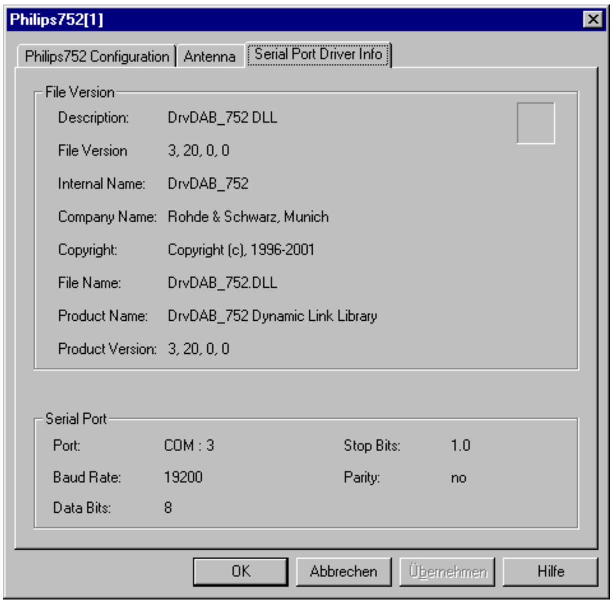


Fig. 6-74 Philips752 driver configuration – Serial Port Driver Info

Action Menu

The *Action* menu opens a popup box used to select the service and displaying information on the DAB connection. It is added to the menu bar as soon as a mobile driver has been successfully installed (see section *Driver Installation* on page 6.1 ff). If several mobiles are connected, a separate command line is displayed for each of them.

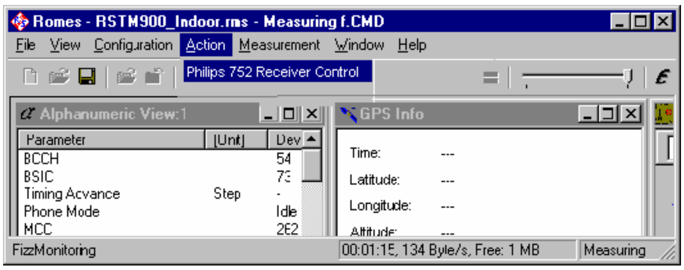
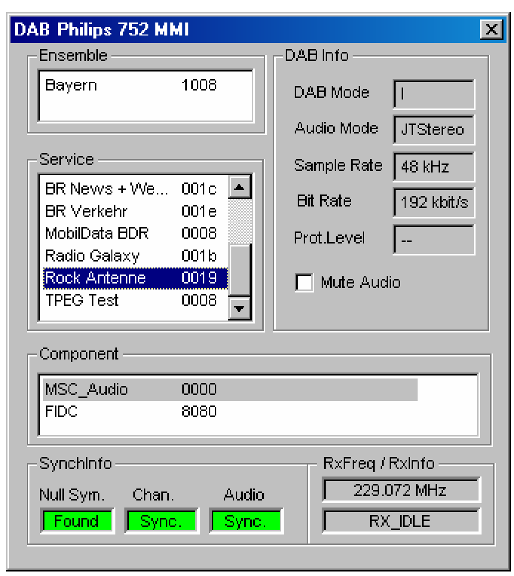


Fig. 6-75 Action menu (DAB driver)

Receiver Control

Selects the service and displays information on the connection.

The *Receiver Control* command opens the *DAB Philips 752 MMI* dialog box:



Ensemble	Indicates the DAB ensemble determined by the DAB 752 Frequency selected in the Philips 752 Configuration tab
Service	List to select among several DAB services
DAB Info	Indicates several transmission parameters of the DAB receiver
Component	List to select among several DAB service components (click the arrow buttons)

SynchInfo	Indicates the synchronization of different system components. Synchronization is complete when all output fields are green; otherwise, an output field is red and an appropriate message is displayed.
RXFreq/ RXInfo	Indicates the received carrier frequency (identical with the DAB 752 Frequency selected in the Philips 752 Configuration tab) and the receiver state.

DVB Drivers

The DVB (Digital Video Broadcasting) drivers provided with the measurement system support the BARCO Atlas MK II receiver, the CAS3173 receiver by Comatlas, as well as the R&S DVMD analyzer, the R&S EFA-T receiver, the R&S DVQ analyzer, and the R&S TSM-DVB diversity test receiver by Rohde & Schwarz. The DVB drivers are installed by selecting *DVB...* in the *Hardware Drivers* window (see *Fig. 6-1* on page 6.1).

The DVB receivers and analyzers provide a wealth of data that can be viewed in the three special *DVB Views* and in all *Basic Views* (see chapter 3). The configuration menus and additional settings are explained below.

Configuration Menu

The configuration menu contains several tabs configuring the measurement. It can be opened by clicking the *Driver* command line in the *Configuration* menu which is available as soon as a analyzer or receiver driver is loaded. Besides, it is opened automatically whenever a driver for a analyzer or receiver which does not conform to the default configuration settings is loaded, i.e. on confirming the driver selection and port assignment made in the *Hardware Drivers* menu (see *Fig. 6-1* on page 6.1).

The configuration settings vary depending on the analyzer or receiver type.

Barco Atlas Configuration

The *Barco Atlas* driver configuration menu configures the BARCO Atlas MK II receiver. The menu is divided into several tabs.

Note:
The BARCO Atlas MK II DVB receiver driver requires a Windows 2000 or Windows XP operating system. A replay of measurement data is possible on any operating system supported by ROMES.

Atlas Measurements

The *Atlas Measurements* tab defines general control parameters of the BARCO Atlas MK II receiver.

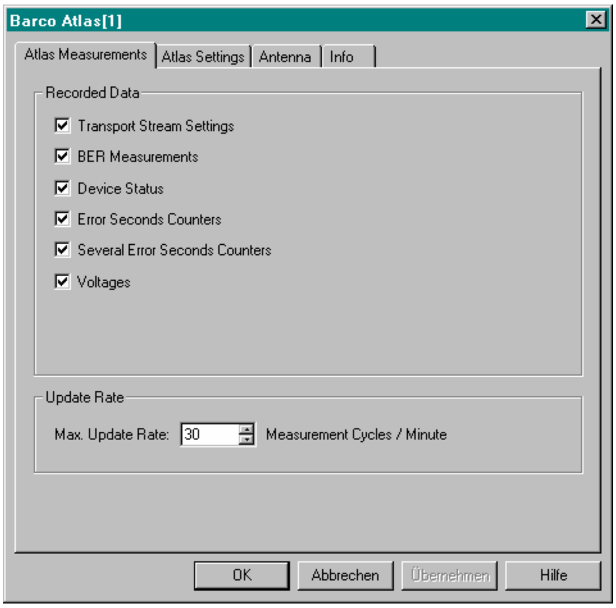


Fig. 6-76 Atlas Measurements - Measurement Settings

Recorded Data The *Recorded Data* panel selects the information to be recorded during an *Atlas MK II* measurement. The following data are recorded if the boxes are checked:

Transport Stream Settings	OFDM parameters of the received DVB signal to be indicated in the Transport Stream Settings panel of the DVB Atlas View.
BER Measurements	Several BER measurement results to be indicated in the Measurement panel of the DVB Atlas View.
Device Status	Status parameters to be indicated in the Status panel of the DVB Atlas View.
Errored Seconds Counters	One errored second is a one second period with one or more errored blocks. A second is considered to be errored if one or more uncorrected Reed Solomon errors have occurred.
Severely Errored Seconds Counters	One severely errored second is a one second period with 30% or more errored blocks or at least one sync loss or loss of signal.
Voltages	The receiver regularly checks its internal test voltages for compliance with the specifications.

Update Rate The *Update Rate* panel defines how frequently the measurement is performed.

Atlas Settings

The *Atlas Settings* tab defines the received frequency range and selects the OFDM parameter of the received DVB signal.

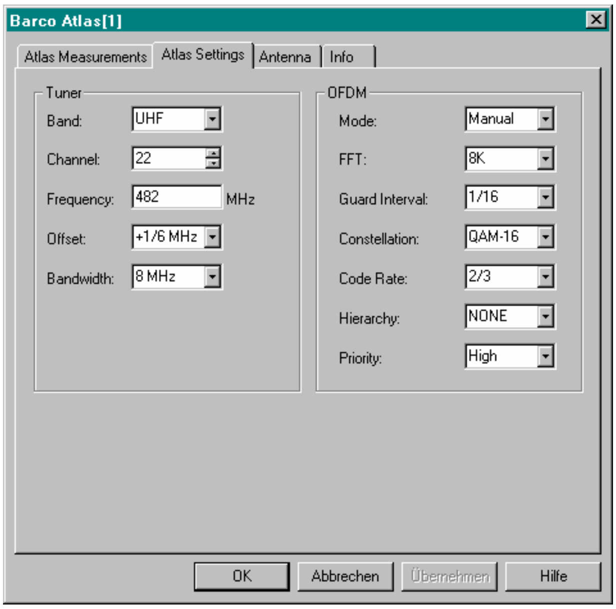


Fig. 6-77 Atlas Settings

Tuner The *Tuner* panel provides settings for the received frequency range.

Band Spectral band: Ultra High Frequency (UHF) or Very High Frequency (VHF)

Channel Input UHF channel number. The DVB-T signal may be transmitted on UHF channels 21 to 69. The channel and the frequency are related parameters. The relation between the frequency and the channel is given by:

Frequency = (Channel * 8 MHz) + 306 MHz

Changing the channel number will automatically change the frequency. The channel programming is only possible in the UHF band and if the tuner bandwidth is 8 MHz.

Frequency Input frequency in MHz. The DVB-T signal can be received on VHF frequencies 170 to 230 MHz or UHF frequencies 470 to 862 MHz with a bandwidth of either 7 MHz or 8 MHz. The frequency ranges are as follows:

170 MHz to 230 MHz and

470 MHz to 862 MHz

As fixed channel numbers are only defined for UHF frequencies at 8 MHz bandwidth, changing frequencies in this range will automatically change the channel number. The relation between the channel and the frequency is given by

Channel = (Frequency – 306 MHz) / 8 MHz

Offset	Frequency offset from the nominal channel frequency quoted above. These frequency offsets are used to minimize interference from adjacent channels. The DVB-T signal may be transmitted with a frequency offset of 0 MHz, +1/6 MHz or –1/6 MHz for 8 MHz bandwidth (UHF) and with a frequency offset of 0 MHz, +1/8 MHz or –1/8 MHz for 7 MHz bandwidth (VHF).
Bandwidth	The bandwidth that is currently selected: 7 MHz or 8 MHz. In practice, a 7 MHz bandwidth is used in the VHF band, the 8 MHz bandwidth is used in the UHF band.

OFDM

The *OFDM* panel selects the Orthogonal Frequency Division Multiplexing (OFDM) parameters of the DVB signal (see also standard ETSI EN 300 744). OFDM is the transmission scheme used in the DVB system. The OFDM parameters can be acquired automatically from the input stream or can be manually set.

Mode	Manual setting of the OFDM parameters or Automatic detection from the input stream.

The following parameters can be set only if the *Manual* mode is selected.

FFT	FFT mode of OFDM processing. The 2K mode is suitable for single transmitter operation and for small Single Frequency Networks (SFN). The 8K mode can be used both for single transmitter operation and for small and large SFN networks.
Guard Interval	Type of guard interval inserted before the useful part of an OFDM frame: 1/4 or 1/8 or 1/16 or 1/32 of the period of an OFDM symbol.
Constellation	Modulation type to transmit the DVB-T signal.
Code Rate	Code rate for the Viterbi decoder.
Hierarchy	OFDM hierarchical mode: non-hierarchical (NONE) or hierarchical (one high-priority plus one low-priority bit stream) with QAM constellation ratio α = 1, 2 or 4. If non-hierarchical is selected, the Priority is set to HIGH.
Priority	Priority of the stream (HIGH or LOW) when in hierarchical mode.

Atlas: Antenna

The *Antenna* tab sets RF parameters such as the cable loss caused by the test setup, the type and gain of an antenna used. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

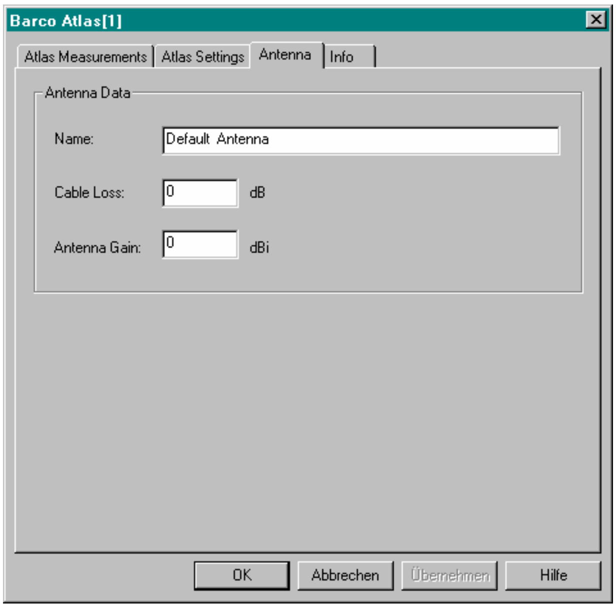


Fig. 6-78 Barco Atlas driver configuration – Antenna

CAS3173 Configuration

The *CAS3173 CONFIG* tab defines the receive frequency, the bit stream for hierarchical or non-hierarchical transmission, and the properties of the measurement output for a CAS3173 receiver.

Note:
To be recognized by the driver, The CAS3173 receiver must be set to REMOTE mode at its user interface.

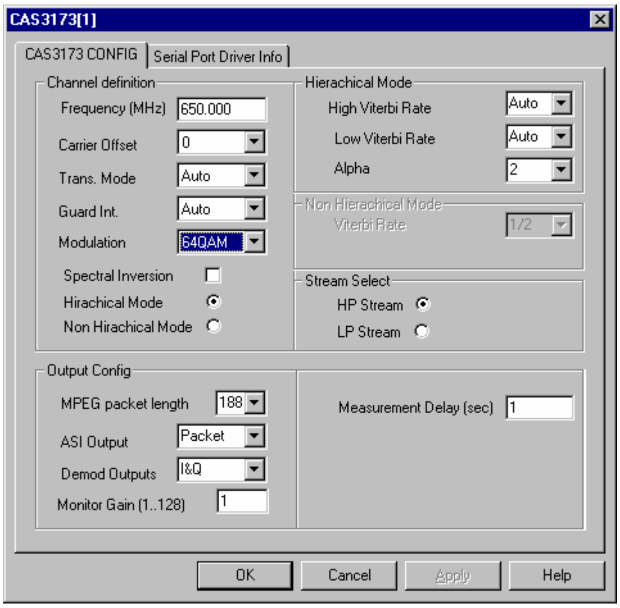


Fig. 6-79 CAS3173 CONFIG

Channel definition

The *Channel definition* panel contains several input fields and controls to specify the OFDM transmission parameters and the channel of the received signal. In the *Auto* settings the parameters are acquired automatically from the input stream.

Frequency (MHz)	Nominal carrier frequency in the range 470 MHz to 858 MHz
Carrier Offset	Offset of the receive frequency from the nominal carrier frequency: 0 (kHz) or +167 kHz or –167 kHz
Trans. Mode	Transmission mode: FFT 2K or FFT 8K or Auto.
Guard Int.	Type of guard interval inserted before the useful part of an OFDM frame: Auto or 1/4 or 1/8 or 1/16 or 1/32 of the period of an OFDM symbol.
Modulation	Modulation type: Auto, 16QAM, 64QAM or QPSK.
Spectral inversion	Allow/exclude spectral inversion
Hierarchical Mode	Selection of either hierarchical transmission (one high-priority plus one low-priority bit stream) or non-hierarchical transmission. In hierarchical mode, it is possible to set the symbol rate for both bit streams and the constellation ratio (see *Hierarchical Mode* panel below) and to select the bit stream to be measured *(Stream Select)*.

Hierarchical Mode/ Non-Hierarchical Mode

The *Hierarchical Mode* or *Non-Hierarchical Mode* panels configure the bit stream for the transmission mode *(Hierarchical Mode* or *Non-Hierarchical Mode)* selected in the *Channel Definition* panel:

Viterbi Rate	Code rate after Viterbi decoding in the receiver. In hierarchical mode, the Viterbi rate for the low-priority and the high-priority bit stream can be defined separately: Possible values are Auto, 1/2, 2/3, 3/4, 5/6, 7/8.
Alpha	Constellation ratio which determines the QAM constellation for the modulation for hierarchical transmission: 1 or 2, 3 or 4. For non-hierarchical transmission, alpha is always equal to 1.

Stream Select

The *Stream Select* panel contains two alternative radio buttons to select either the high-priority bit stream or the low-priority bit stream for the measurement. It is enabled if *Hierarchical Mode* is selected in the *Channel Definition* panel.

Output Config

The *Output Config*. panel sets the following output parameters:

MPEG packet l.	Length of the MPEG-2 multiplex transport packets in bytes and in the range 188 to 204
Monitor Gain	Gain factor in the range 1 to 128.
ASI Output	Output format of the Asynchronous Serial Interface (ASI): data packets, data bursts, or test.
Demod. Outputs	Output of the demodulator: I&Q and clock, linear spectral response, logarithmic spectral response, impulse response, data and clock.
Measurement P.	Duration of the measurement in the range 0 s to 10 s.
Monitor Gain	Gain factor in the range 1 to 128.

Serial Port Driver Info

The *Serial Port Driver Info* tab of the configuration menu displays information about the file version of the current driver, the product name, and the manufacturer. In addition, it shows the serial port assigned to the driver and the transmission parameters.

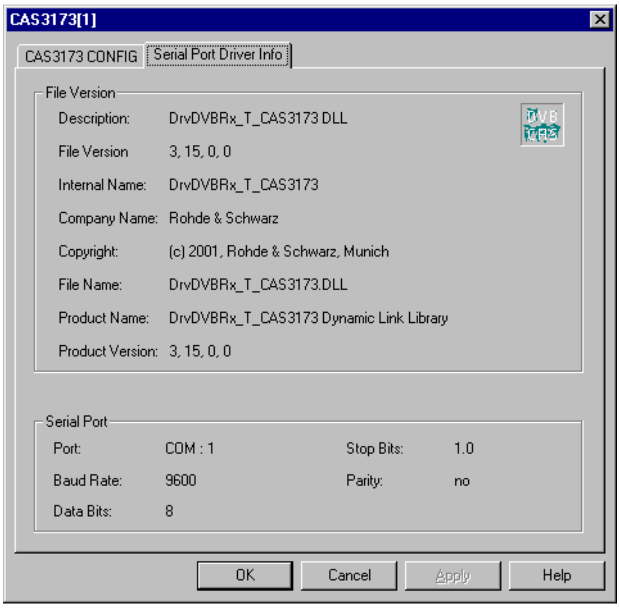


Fig. 6-80 CAS3173 – Serial Port Driver Info

DVMD Configuration

The DVMD driver configuration menu is divided into several tabs.

DVMD: Settings

The *Settings* tab defines general control parameters of the DVMD analyzer.

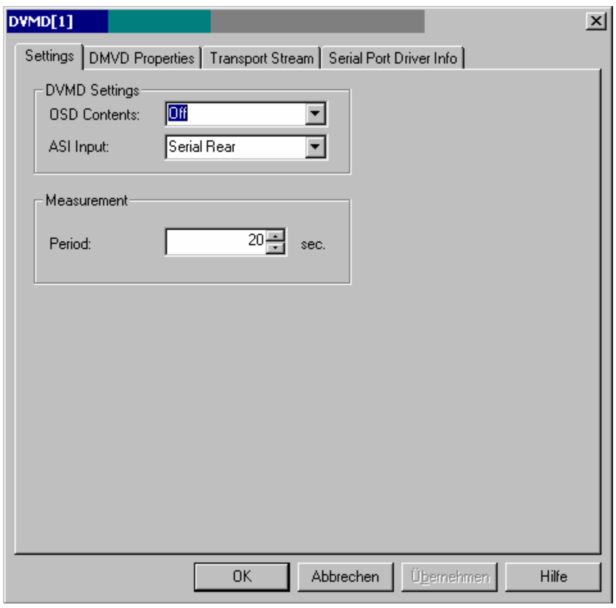


Fig. 6-81 DVMD Settings

DVMD Settings The *DVMD Settings* panel configures the OSD and the ASI:

OSD Contents	On Screen Display on or off
ASI Input	Input of the Asynchronous Serial Interface: *Serial Rear, Serial Front* or *Parallel Front*

Measurement The *Period* input field in the *Measurement* panel defines the measurement time in seconds.

DVMD Properties

The *DVMD Properties* tab defines time limits for the measured parameters and timeouts for the transport stream synchronization loss and lock.

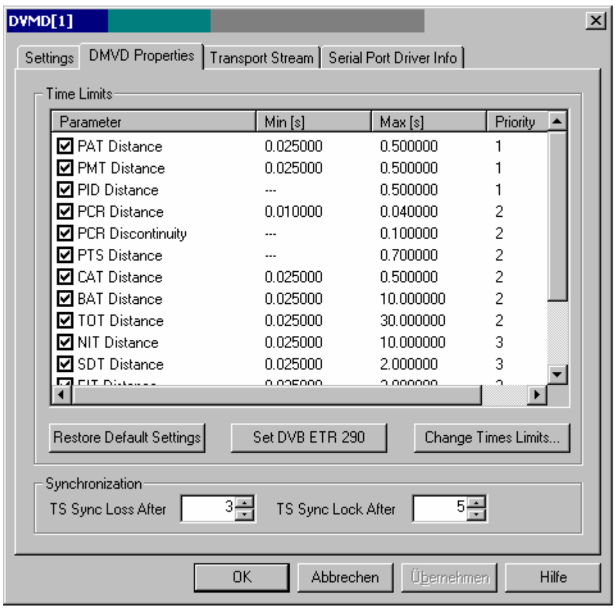
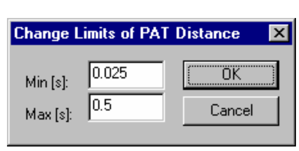


Fig. 6-82 DVMD Properties

Time Limits

The *DVMD Settings* panel defines time limits for the measured parameters. Only the parameters checked in the *Parameter* column of the *Time Limits* table will be measured and recorded.

Restore Def. S.	Restores the default values of all entries in the *Time Limits* table
Set DVB ETR 290	Sets the time limits recommended in DVB ETR 290
Change Times L.	Open a configuration window to change the time limits



Synchronization

The *Synchronization* panel contains two input fields to define the timeouts for transport stream synchronization loss and lock.

DVMD: Transport Stream

The *Transport Stream* tab selects the contents of the transport stream. The transport stream usually contains several programs consisting of several elementary streams (video, audio, data).

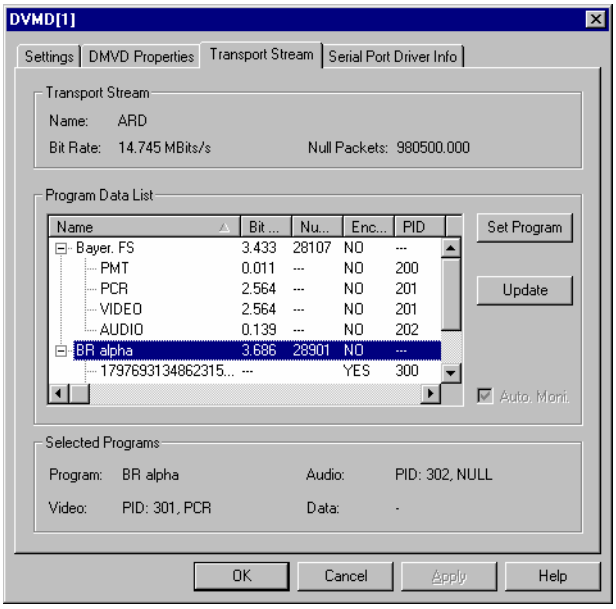


Fig. 6-83 Transport Stream

The selected program is available on the video and audio output of the DVMD.

DVQ Configuration

The *DVQ Settings* tab defines the input routing, the measurement parameters, update rates and the program selection (transport stream) of the DVQ analyzer.

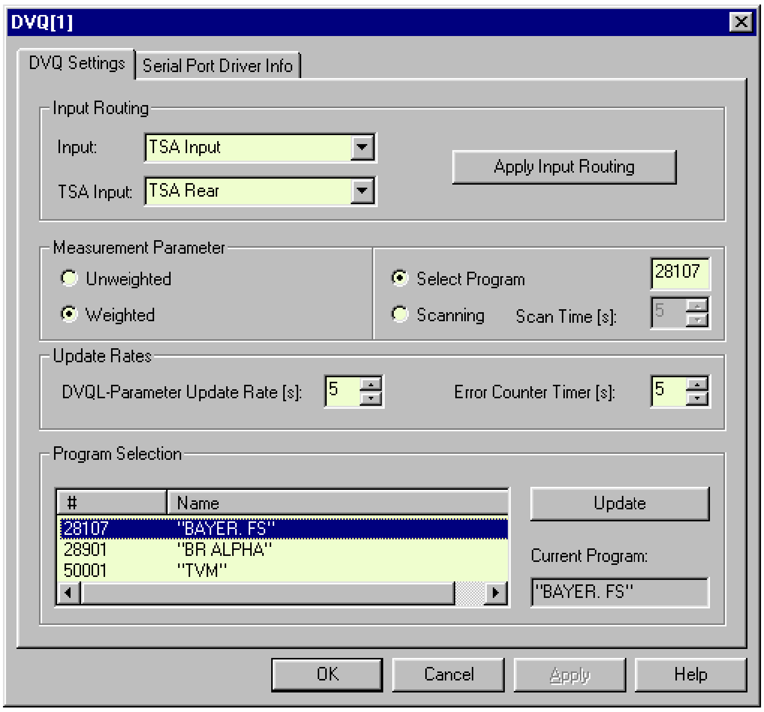


Fig. 6-84 DVQ Settings

Input Routing

The *Input Routing* panel contains two pull-down lists to select the signal input (transport stream) for the DVQ analyzer.

Input Type of input connector: *TSA Input* or *TS* parallel

TSA Input Position of the TSA input connector (only if *TSA Input* is selected as *Input*): *TSA Front* or *TSA Rear*

The selections made are applied by pressing the *Apply Input Routing* button.

Measurement Parameter

The *Measurement Parameter* panel contains two pairs of alternative radio buttons selecting the type of measurement parameters and the transport stream.

Unweighted/Weighted The alternative radio buttons select either the unweighted or weighted Digital Video Quality Level (DVQL) to be measured. Both parameter types can not be measured simultaneously. Therefore, the setting made here must be compatible to the parameter selection in the different views.

Select Program Select a program from the Program Selection table displayed below. The program number must be entered in the input field on the right side.

Scanning	Automatic and cyclic decoder switchover between all programs in the transport stream (Decoder Scan mode). The time between two consecutive swichovers can be selected in the Scan Time field.

For more information on all measurement parameters refer to the DVQ operating manual.

Update Rates

The *Update Rates* panel defines how frequently the measurement is done and the error counter is updated.

Program Selection

The *Program Selection* panel contains a table listing the programs that may be selected for the transport stream; see *Select Program* and *Scanning* above. The *Update* button updates the table contents. The selected program appears in the *Current Program* field and is available on the video and audio output of the DVQ.

EFA-T Configuration

The EFA-T driver configuration menu is divided into several tabs.

EFA-T Mode Settings

The *EFA-T Mode Settings* tab defines the input path *(Receiver)*, selects a digital or analog receiver mode and gives access to the configuration menu for the selected mode.

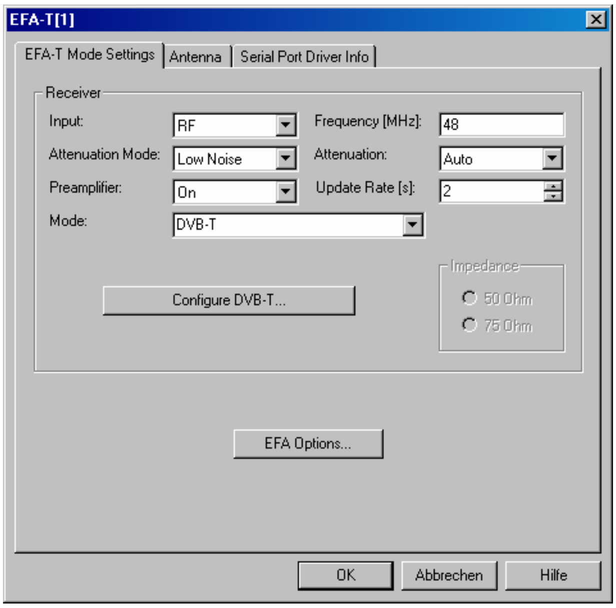


Fig. 6-85 EFA-T Mode Settings

For detailed information on all EFA-T settings please refer to the EFA manual.

Receiver

The *Receiver* panel configures the input signal path of the EFA-T receiver: It selects the *Input* connector *(RF* or *IF)*, the *Attenuation Mode (Low Noise* or *Low Distortion),* switches the *Preamplifier On* or *Off,* defines the input *Frequency* in MHz, selects an *Attenuation* factor (0 dB, 5 dB, 10 dB or autoranging, according to the received signal level) and the time in seconds after which ROMES acquires and stores new measurement data from the test receiver *(Update Rate)*.

TIP The configuration menu may not always provide the full range of parameters (e.g. for the Attenuation). You can refine your selection using the configuration menus of the EFA receiver.

Mode Configures the EFA as a receiver for digital signals *(DVB-T* for model R&S EFA 40, *ATSC* for model R&S EFA 50) or analog TV signals *(Nyquist Demod. FM Sound, Nyquist Demod. FM Sound Mono, Nyquist Demod. NICAM Sound, NTSC).* The *Configure…* button and its menus change depending on the selected mode.

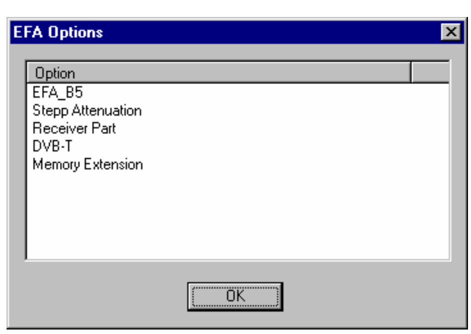
Configure DVB-T / Configure Analog TV

Opens a submenu to specify further parameters for the selected measurement *Mode:*

- In the digital modes *DVB-T* mode *(DVB-T* for model R&S EFA 40, *ATSC* for model R&S EFA 50) the *DVB-T/ATSC Configuration* menu is opened; see section *DVB-T / ATSC Measurement Configuration* on p. 6.134 and the following sections.
- In the analog modes (Nyquist Demod…., NTSC) the Analog TV Configuration menu is opened; see section Analog TV Configuration on p. 6.133.

EFA Options

The *EFA Options* button opens a window showing all options that are currently installed on your EFA-T.



Analog TV Configuration

The *Analog TV Configuration* tab provides analog receiver settings for the EFA. It is opened by the *Configure Analog TV...* button in the *EFA-T Mode Settings* tab (see Fig. 6-85 on p. 6.131) if an analog receiver mode is set.

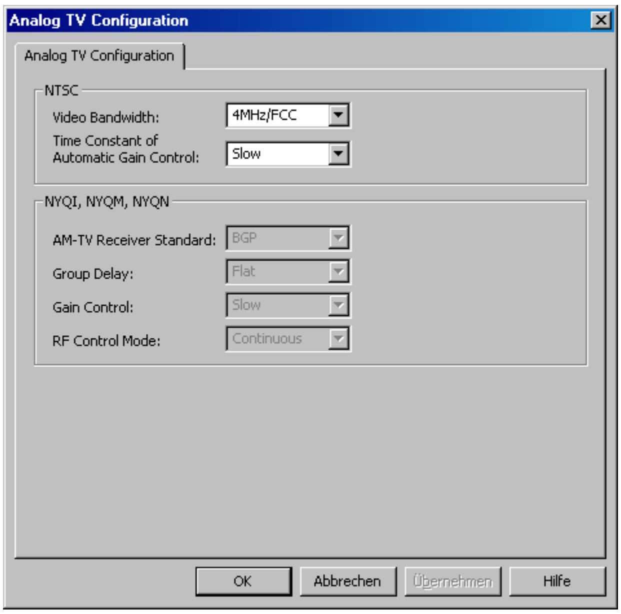


Fig. 6-86 Analog TV Configuration

The tab provide two alternative panels to configure the *NTSC* and the *Nyquist Demod…* analog receiver modes, respectively.

NTSC Provides the *Video Bandwidth* (either *4 MHz FCC*, *4 MHz FLAT, 5 MHz FCC, 4 MHz FLAT)* and *Automatic Gain Control (Slow* or *Fast)* settings to be used in NTSC receiver mode.

The NTSC settings are provided in the *NTSC/BTSC STATUS* configuration menu of the EFA receiver.

NYQI, NYQM, NYQN Selects the *AM-TV Receiver Standard* and defines various receiver settings for the selected Nyquist demodulation mode.

The settings are provided in the *NYQU … STATUS* configuration menus of the EFA receiver.

DVB-T / ATSC Measurement Configuration

The *DVB-T / ATSC Measurement Configuration* tabs define which type of measurement is performed and which parameters are displayed in the EFA-T views. It is opened by the *Configure DVB-T...* or *Configure ATSC...*buttons in the *EFA-T Mode Settings* tab (see Fig. 6-85 on p. 6.131) if one of the two digital receiver modes is set.

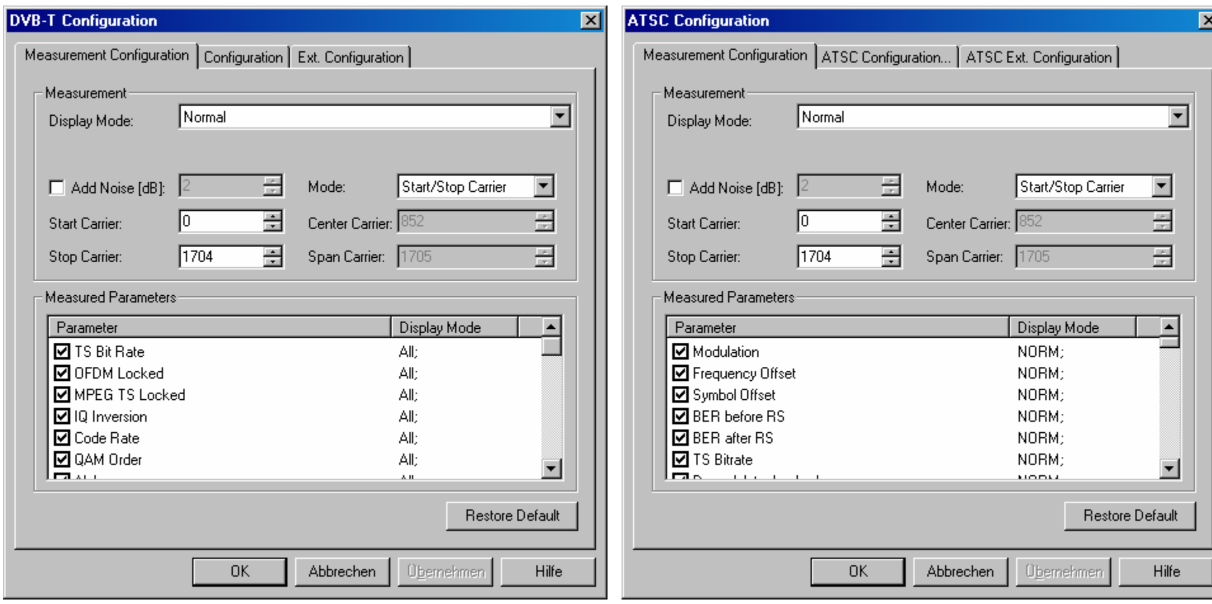


Fig. 6-87 DVB-T / ATSC Measurement Configuration

Measurement The *Measurement* panel selects the Display Mode to define which type of measurement is performed and which parameters can be measured and viewed. The available display modes depend on the receiver mode; refer to the two tables below.

Table 6-12 DVB-T display modes, parameters and views

Display Mode	Parameters available	Views
Normal	DVB-T Frequency offset, DVB-T Bit Rate Offset, BER ahead of Viterbi, BER ahead of Reed Solomon, BER after Reed Solomon	
CCDF (Complementary Cumulative Distribution Function)	Crest Margin, Crest Max, Crest current, Crest Acquisition	DVB EFA-T CCDF (different views for CCDF (RF) and CCDF (ENV))
Amplitude Distribution	Crest Margin, Crest Max, Crest current, Crest Acquisition	DVB EFA-T Amplitude Distribution
Impulse Response	CIR Peaks	DVB EFA-T CIR
OFDM Parameters	Central Carrier excluded, I/Q Imbalance, I/Q Phase Error, Carrier Suppression, Carrier Suppression Angle, Jitter, S/N Ratio, RMS Modulation Error, Peak Modulation Error, Average Progress	
Spectrum Detector	Lower Shoulder, Upper Shoulder	

Display Mode	Parameters available	Views
For all modes	RF Level, Signal OK, TS Bit Rate, OFDM locked, MPEG locked, IQ Inversion, Code Rate, QAM Order, Alpha, Guard Interval, FFT Mode, TPS Code Rate, TPS QAM Order, TPS Alpha, TPS Guard Interval, TPS FFT Mode	DVB EFA-T Status

Table 6-13 ATSC display modes, parameters and views

Display Mode	Parameters available	Views
Normal		
CCDF (Complementary Cumulative Distribution Function)		DVB EFA-T CCDF (different views for CCDF (RF) and CCDF (ENV))
Amplitude Distribution		DVB EFA-T Amplitude Distribution
Spectrum Detector (MIN / RMS / MAX)		
Amplitude/Phase		
Amplitude/Group Delay		
Phase Jitter		
For all modes		DVB EFA-T Status

In the remaining fields of the *Measurement* panel, an additional noise signal can be added to the analyzed signal *(Add Noise).* The frequency range is defined by means of a *Start Carrier* and a *Stop Carrier* (if *Start/Stop Carrier* mode is selected) or by means of a *Center Carrier* and a *Span Carrier* (if *Center/Span Carrier* mode is selected).

The *Mode* itself is only indicated in the *Measurement Configuration* tab; it must be changed on the EFA.

Measured Parameters The *Measured Parameters* list shows all parameters that can be measured. Only the parameters checked in the *Parameter* column table will be measured and recorded. The display mode(s) required to measure a parameter (see table above) is indicated in the *Display Mode* column.

Restore Default The *Restore Default* button restores the default settings of the *Measurement Configuration* tab.

DVB-T / ATSC Configuration

The *DVB-T / ATSC Configuration* tabs give access to the settings in the *STATUS* and *OFDM/CODE RATE* menus of the EFA receiver and defines the input attenuation.

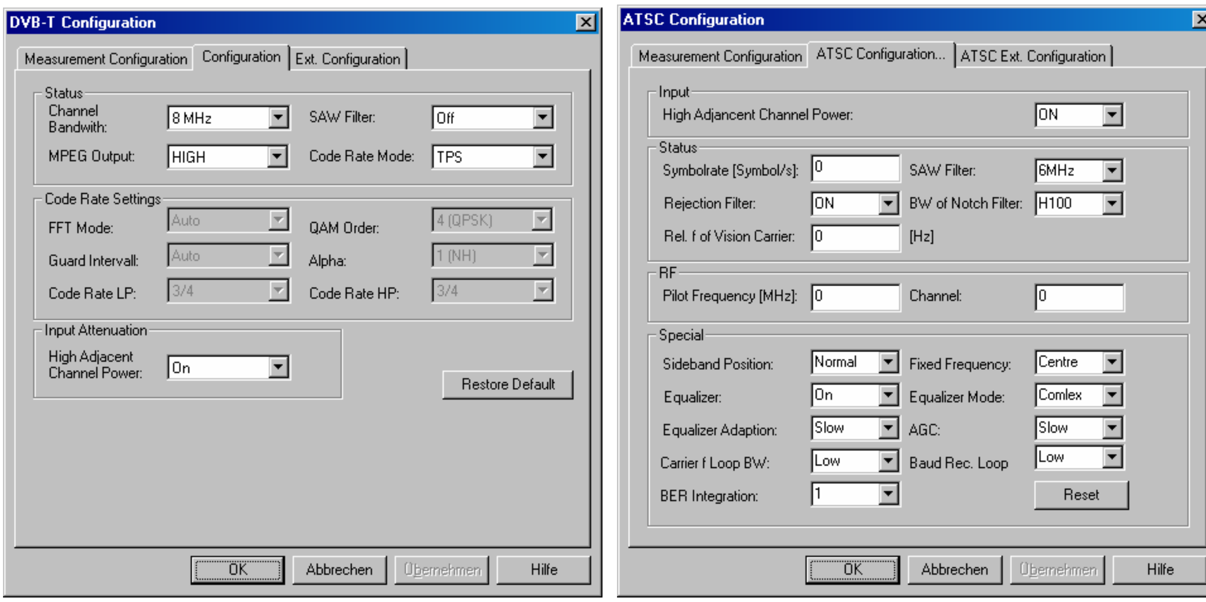


Fig. 6-88 DVB-T / ATSC Configuration

Status

The *Status* panel provides the essential settings of the *STATUS* menus of the EFA receiver:

In the *DVT-T* receiver mode, the settings include the *Channel Bandwidth* of the demodulator (7 MHz or 8 MHz), the *MPEG Output (High* or *Low)*, the bandwidth of the *SAW Filter* (6 MHz, 7 MHz, 8 MHz or Off), and the *Code Rate Mode (TPS, Auto, Manual)*.

In the *ATSC* receiver mode, the settings include the *Symbol Rate* (determining the bandwidth), the bandwidth of the *SAW Filter* (according to the available EFA options), and the status of the *Rejection Filter* used to suppress NTSC co-channels *(On* or *Off)*. The rejection filter is formed by three notch filters that are to be tuned to the vision carrier, the sound carrier and the color subcarrier of the NTSC signal received in the same channel. The notch filter bandwidth *(BW of Notch Filter)* and the spacing between the channel center frequency and the vision carrier frequency *(Rel. f. of Vision Carrier)* can be set as well.

Code Rate Settings

In the *DVT-T* receiver mode, the *Code Rate Settings* panel provides the main settings of the *OFDM/CODE RATE SETTINGS* menu of the EFA-T receiver: the *FFT Mode* (2K-FFT with 1705 carriers or 8K-FFT with 6817 carriers, or *Auto)*, the length of the *Guard Interval* inserted before the useful part of an OFDM frame, defined as a fraction of the period of an OFDM symbol (Auto, 1/4, 1/8, 1/16, 1/32)*,* the order of the Quadrature Amplitude Modulation *(QAM Order)* of the OFDM signal (QPSK, 16QAM or 64QAM), the constellation ratio *Alpha* (1 (NH), 1, 2, 4), the high priority *(HP)* and low priority *(LP) Code Rate* (2/3, 3/4, 5/6, 3/8, 1/2).

Input Attenuation

The *Input Attenuation* panel switches the function *High Adjacent Channel Power* on or off.

RF

In the *ATSC* receiver mode, the *RF* panel provides the essential settings of the *ATSC/VSB RF* menu of the EFA-T receiver: It is possible to set the pilot frequency in MHz and select the channel number of the received ATSC signal.

Special

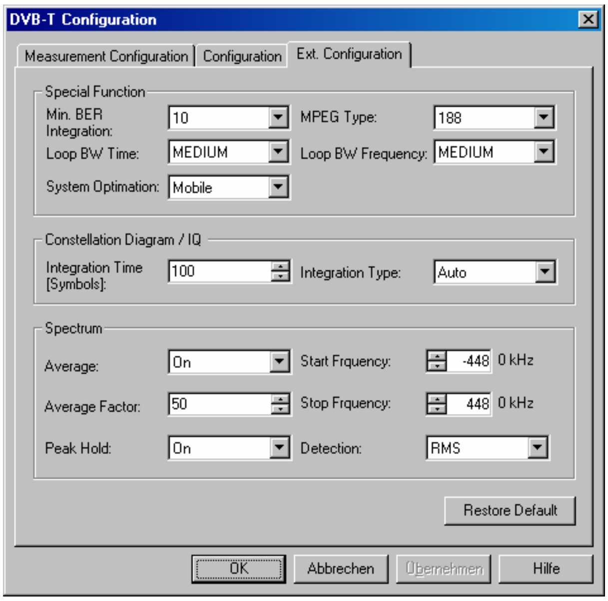
In the *ATSC* receiver mode, the *Special* panel provides the essential settings of the *ATSC/VSB SPECIAL FUNCTIONS* menu of the EFA-T receiver. More *Special Function* settings are provided in the *ATSC Ext. Configuration* tab described below.

Restore Default / Reset

The *Restore Default / Reset* buttons restore the default settings of the *DVB-T / ATSC Configuration* tabs.

DVB-T / ATSC Ext. Configuration

The *DVB-T / ATSC Ext. Configuration* (extended configuration) tab defines the *Special Function* settings, configures the *Constellation Diagram / IQ* and the *Spectrum* measurements and displays a list of available options *(EFA Options)* of the EFA-T receiver.



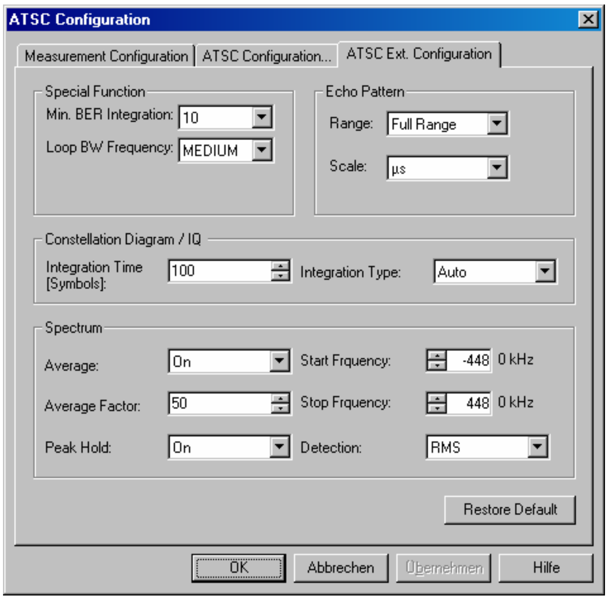


Fig. 6-89 DVB-T / ATSC Ext. Configuration

Special Function

The *Special Function* panel provides important settings of the *SPECIAL FUNCTION* menus of the EFA-T receiver.

In *DVB-T* receiver mode, a *Min BER Integration* value used to optimize the BER measurement (1 or 10 or 100 or 1000), the *Loop Bandwidth* time and frequency for carrier recovery *(High or Medium or Low)*, the *MPEG Type* (188 or 204), and a *System Optimization* parameter *(Mobile, stationary fast, stationary slow)* can be set.

In *ATSC* receiver mode, the *Special Function* settings complement the settings in the *ATSC Configuration* tab.

Echo Pattern

In *ATSC* receiver mode, the *Echo Pattern* settings configure the *Ghost Pattern* measurement. The settings have an impact on the *DVB EFA-T Echo Pattern View* described in chapter 4.

Constellation Diagram/IQ

The *Constellation Diagram/IQ* panel selects the *Integration Time* and the *Integration Type (Auto, Hold, Norm)* for generating the constellation diagram.

Spectrum

The *Spectrum* panel configures the *Spectrum* measurement of the EFA-T receiver, including the frequency range, averaging rules and receiver settings.

Restore Default

The *Restore Default* button restores the default settings of the *Measurement Configuration* tab.

EFA-T Antenna

The *Antenna* tab sets RF parameters such as the cable loss caused by the test setup, the type and gain of an antenna used. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

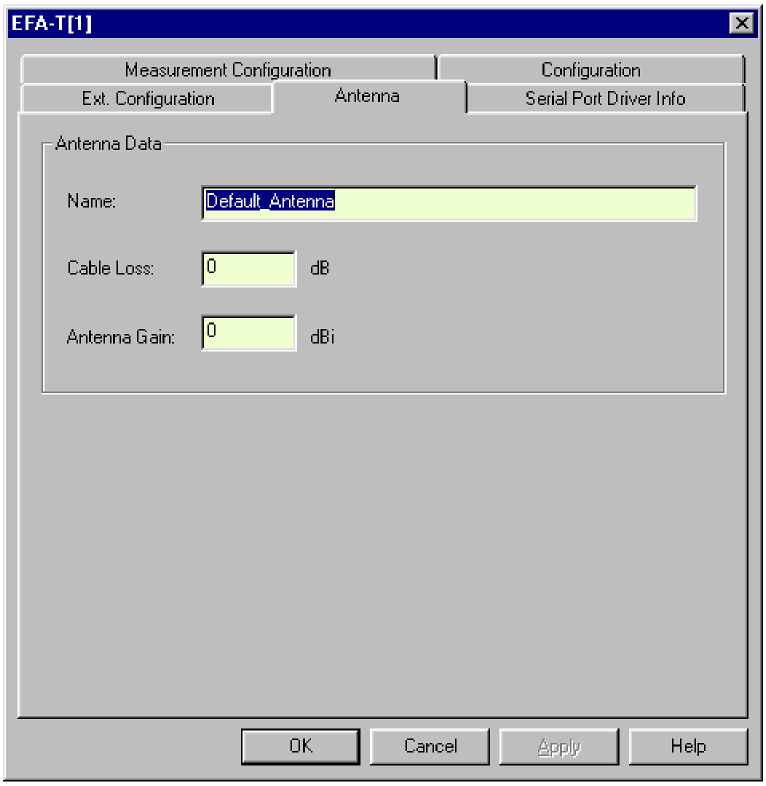


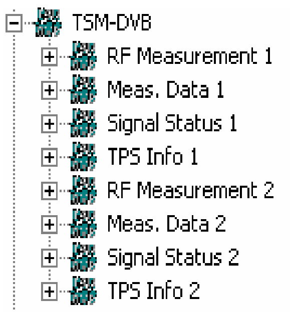
Fig. 6-90 EFA-T driver configuration: Antenna

TSM-DVB Configuration

The DVB-T diversity test receiver TSM-DVB is controlled by the TSM-DVB driver (option ROMES-D7). The TSM-DVB is equipped with two independent antenna connectors RF IN 1 and RF IN 2. An RS-232 interface is used for the communication with the controller; see also Fig. 6-92 on p. 6.142.

The driver configuration menu is divided into several tabs.

The TSM-DVB data is not displayed in the DVB Views. To analyze TSM-DVB data select the TSM-DVB signals in the data tree (Configuration – Settings – Available Signals) and use the basic views (Alphanumeric View, 2D Chart View…). The following information is available for channel 1 and 2:



RF level

Modulation Error Rate (MER)

BER after Reed Solomon error correction

Packet Error Rate (PER, MPEG packets per second)

Carrier-to-Noise-plus-Interference Ratio C/(N + i)

Various status indicator signals

Various transport signal (TPS) information signals

TSM-DVB: Configuration

The *Configuration* tab selects the operating mode of the TSM-DVB diversity test receiver and configures both RF channels.

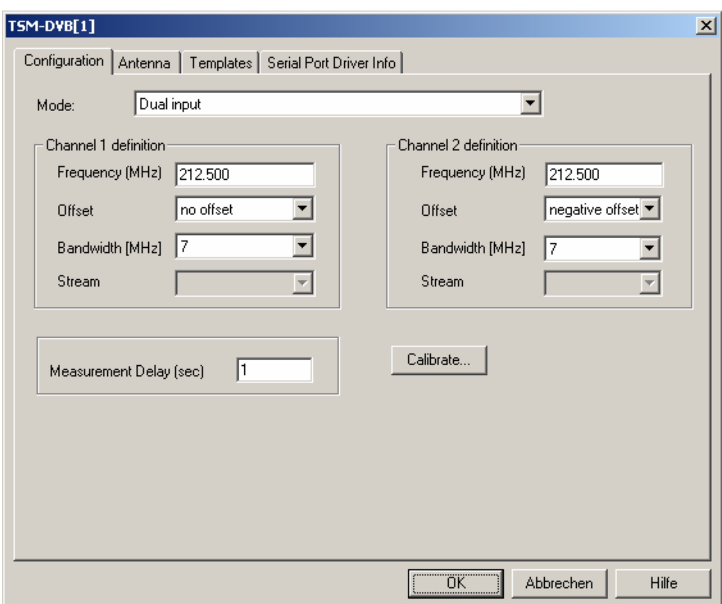


Fig. 6-91 TSM-DVB Configuration

Mode

Selects the operating mode of the diversity test receiver. The TSM-DVB receiver has two antenna inputs (input connectors RF IN 1 and RF IN 2 at the rear panel) for two independent demodulation channels, providing two separate MPEG transport streams (MPEG-TS). The MPEG-TS are converted to ASI format in accordance with the DVB-ASI recommendation and fed to the output connectors ASI 1 and ASI 2. The operating mode controls the switching between the two MPEG-TS.

Diversity The two demodulator channels have the same frequency, offset and bandwidth. The MPEG-TS are switched internally; no stream priority is defined. The ASI output stream is available at both ASI outputs

Dual input	The two demodulator channels are independent and can be configured with different parameters. Each MPEG-TS has its own ASI output (RF IN 1 – > ASI 1 and RF IN 2 – > ASI 2). This mode can be used for redundant input with external switching.
Hierarchical	The two demodulator channels differ by their stream priority settings. The frequency, offset, and bandwidth settings can be the same or different. Each MPEG-TS has its own ASI output (RF IN 1 – > ASI 1 and RF IN 2 – > ASI 2).
Redundant Manual Switch Input 1/2	The two demodulator channels are independent; internal automatic switching is disabled. The same output stream is available on both ASI outputs.
Redundant Sync failed Input 1/2	The two demodulator channels are independent and switched internally whenever synchronization is lost at input RF IN 1 or RF IN 2. The same output stream is available on both ASI outputs.
Redundant DRS failed Input 1/2	The two demodulator channels are independent and switched internally whenever an uncorrected packet (remaining error Data packet after Reed Solomon, DRS) is detected at input RF IN 1 or RF IN 2. The same output stream is available on both ASI outputs.

Channel 1 / 2 definition

The TSM-DVB provides the same receiver settings for the two input channels 1 and 2. Some parameters might be unavailable, depending on the operating mode.

Frequency	Nominal RF carrier frequency in MHz. The DVB-T signal can be received on VHF frequencies 170 to 230 MHz or UHF frequencies 470 to 862 MHz. The frequency ranges are as follows: 170 MHz to 230 MHz and 470 MHz to 862 MHz
Offset	These frequency offsets are used to minimize interference from adjacent channels. The DVB-T signal may be transmitted with a frequency offset of 0 MHz *(no offset)*, +1/6 MHz or –1/6 MHz for 8 MHz bandwidth (UHF) and with a frequency offset of 0 MHz, +1/8 MHz or –1/8 MHz for 7 MHz bandwidth (VHF) *(negative offset* or *positive offset)*.
Bandwidth [MHz]	Bandwidth of the DVB-T channel: 6 MHz, 7 MHz or 8 MHz. A 7 MHz bandwidth is used in the VHF band, the 8 MHz bandwidth is used in the UHF band.
Stream	Priority setting for *Hierarchical* mode: high or low priority.

Measurement Delay

Delay between consecutive measurements.

Calibrate…

Opens a submenu for an RF input level calibration of the TSM-DVB using an external signal generator R&S SFQ. The signal generator provides an RF input signal for the TSM-DVB that is varied over its entire input power and frequency range. The known input power is used for a correction of the TSM-DVB *RF Level* reading.

The R&S SFQ must be connected to the local PC using the GPIB (IEEE) bus connector. The entire calibration procedure is controlled automatically via GPIB bus; no additional settings at the R&S SFQ are required. The TSM-DVB also provides a calibration verification procedure that can serve as a quick check whether a new complete calibration is necessary.

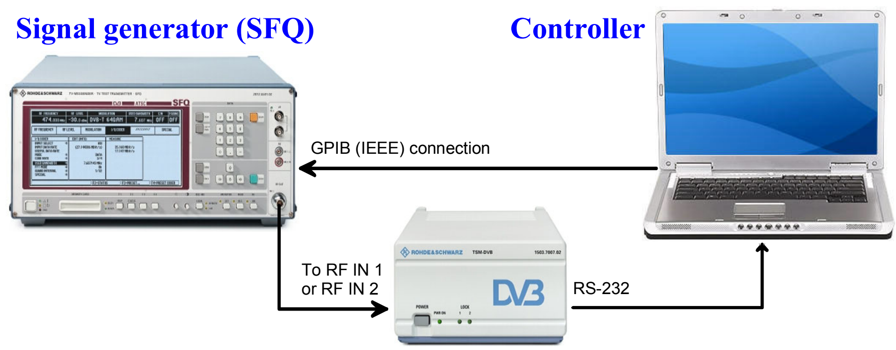


Fig. 6-92 TSM-DVB calibration – test setup

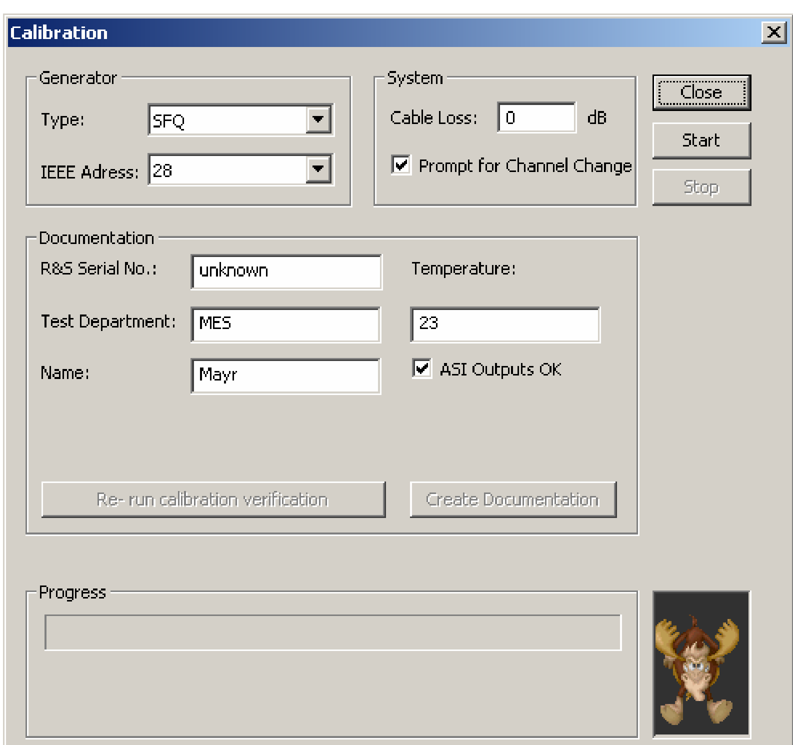


Fig. 6-93 TSM-DVB Configuration – Calibration

Generator

Generator type (SFQ) and GPIB/IEEEE address of the signal generator in the test system.

System

ROMES can take into account a known cable loss between the generator output and the TSM-DVB RF input. The R&S SFQ RF signal must be applied to both RF inputs of the TSM-DVB. This can be done in two different ways:

- If *Prompt for Channel Change* is selected, then the inputs are calibrated one after another. A message indicates the RF input to be connected to the R&S SFQ RF output connector.
- If *Prompt for Channel Change* is cleared, then the inputs are calibrated simultaneously. A power splitter is used to feed the generated RF signal to both RF inputs.

Documentation

Input of user information to be included in the calibration documentation. In addition to the user information the documentation file contains the calibration verification data acquired in an automatic verification procedure after the end of the calibration.

The documentation is stored in a file named *TC_xxxx.RTF* where *xxxx* denotes the Teamcast serial no. of the receiver module. This file is stored in the *Driver* subdirectory of the ROMES program directory. The *Documentation* panel provides the following additional control elements:

- *ASI Outputs OK* can be written to the documentation file after a manual change of the TSM-DVB ASI outputs.
- *Re-run Calibration Verification* initiates a new verification procedure (duration: approx. 3 minutes). The verification information indicates whether a new calibration is needed.
- *Create Documentation* updates the documentation file using the current user and verification information.

Start / Stop / Progress

The calibration can be started after completing the test setup and performing the necessary settings at the signal generator. The progress is monitored in the *Calibration* dialog. The complete calibration takes approx. 80 minutes.

TSM-DVB: Antenna

The *Antenna* tab sets RF parameters such as the cable loss caused by the test setup, the type and gain of the antenna(s) used. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

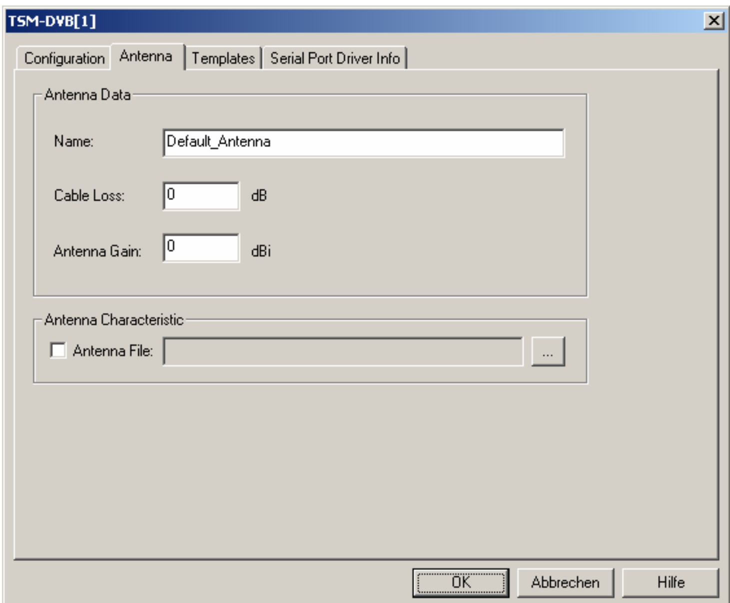


Fig. 6-94 TSM-DVB driver configuration: Antenna

Antenna Characteristic

If the checkbox to use an antenna file is activated, an antenna frequency response file can be imported, e.g. in order to calculate the RF power in basic views.

The antenna file is in .csv format (Comma Separated Values)

```
f1 [MHz], Delta Level 1 [dB]
f2 [MHz], Delta Level 2 [dB]
f3 [MHz], Delta Level 3 [dB]
...
fn [MHz], Delta Level n [dB]
```

where n >= 2 and f is formatted as x.xx (the number of decimals does not matter, but the period is mandatory, e.g. "345" is not a valid frequency value, but "345.0" is). Values between frequency values in the list are interpolated.
Here is an example for a csv antenna file for typical TSM-DVB frequencies:

```
320.0, -1.5
345.5, -1.1
362.5, -0.65
385.0, 0.5
410.0, -0.5
455.0, -0.8
460.0, -1.15
470.0, -1.65
485.5, -2.1
492.5, -2.0
505.0, -1.5
```

TSM-DVB: Templates

The *Templates* tab stores the current driver configuration as a template, lists, loads or deletes driver templates. It is provided for many test device drivers and is identical for all of them.

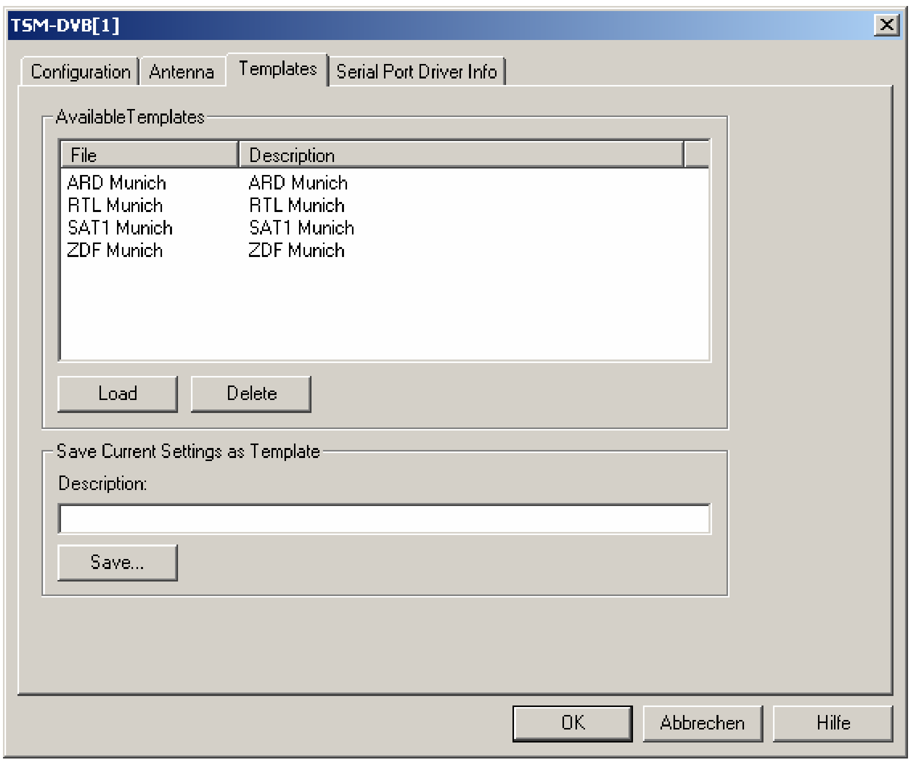


Fig. 6-95 TSM-DVB driver configuration: Templates

Serial Port Driver Info

The *Serial Port Driver Info* tab of the configuration menu displays information about the file version of the current driver, the product name, and the manufacturer. In addition, it shows the serial port assigned to the driver and the transmission parameters.

Action Menu

The *Action* menu opens a popup box used to select the service and obtain information on the DVB connection. It is added to the menu bar as soon as a mobile driver has been successfully installed (see section *Driver Installation* on page 6.1 ff.). If several DVB receivers or analyzers are connected, a separate command line is displayed for each of them.

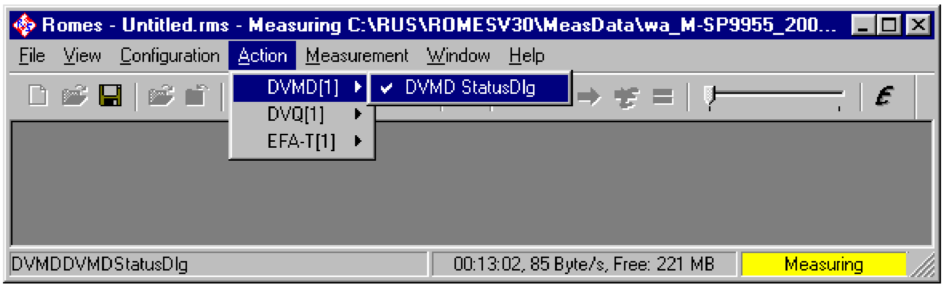
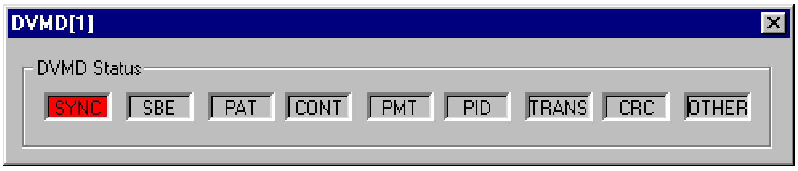


Fig. 6-96 Action menu (DVB drivers)

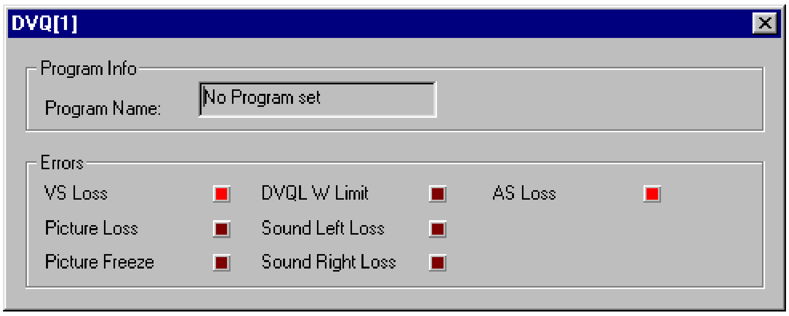
DVMD StatusDlg

Displays information on the current status of the DVMD analyzer.



DVQ StatusDlg

Displays information on the current status of the DVQ analyzer.



Reset BER

Resets a BER measurement performed by the EFA-T receiver.

Test Receiver Drivers

The measurement system offers five different test receiver drivers to be used with the test receivers from Rohde & Schwarz (R&S EB200/ESMB, R&S ESPI, R&S ESVx, the single board receiver R&S SBR and its successor R&S TS55-R2, R&S TSMU/TSML-CW), or with the dti SeeGull test receiver, respectively.

ROMES offers drivers for all types of test receivers. Installation of the drivers is explained in section *Driver Installation* on page 6.1; their configuration is explained below. The test receiver data can be viewed in all *Basic Views* (see chapter 3).

Supported Devices

The ESVx driver supports the receivers of the ESxx family by Rohde & Schwarz listed in the following table.

Table 6-14 Test receiver family ESxx

Receiver type	Bandwidths supported by ROMES / kHz	Detectors available
ESVD	10, 120, 300, 1000	Peak, Average
ESVB	10, 120, 300, 1500	Peak, Average, RMS
ESVB12	10, 120, 300, 8000	Peak, Average, RMS
ESVS10	10, 120	Peak, Average
ESVS20	10, 120	Peak, Average
ESVS30	10, 120, 300, 1000	Peak, Average
ESN	1, 3, 9, 15, 120, 250	Peak, Average, RMS
ESVN20	1, 3, 9, 15, 120, 250	Peak, Average, RMS
ESVN30	1, 3, 9, 15, 120, 250	Peak, Average, RMS
ESVN40	1, 3, 9, 15, 120, 250	Peak, Average, RMS
ESPC	10, 120	Peak, Average

- The EB200 driver supports the EB200 Miniport Receiver and the ESMB Monitoring Receiver from Rohde & Schwarz.
- The ESPI driver supports the ESPI test receiver from Rohde & Schwarz.
- The dti SeeGull driver supports the SeeGull test receiver from dti.
- The SBR driver supports the SBR 3 ms receiver (3 ms denotes the minimum delay between two consecutive trigger signals). The TS55-R2 driver supports the TS55-R2 single-board receiver and is similar to the SBR driver.
- The TSMx driver supports the TSMU/TSML-CW test receivers. For ROMES as of V3.25 SP4, a TSMU/TSML-CW firmware version V10.xx or higher is required.

Note:
In the data tree (see chapter 1) the TS55-R2 results appear under the SBR (Single Board Receiver) technology node.

Resources Configuration

The test receiver drivers are installed by selecting *CW Receiver* in the *ROMES Hardware Configuration* window (see *Fig. 6-1* on page 6.1). The resources needed differ according to the test receiver. The installation of all test receiver drivers is described in section *Test Receiver Drivers* on p. 6.7 ff.

ESVx Driver

The ESVx driver requires:

- The IEC/IEEE bus interface (here: GPIB7210) with the corresponding driver. GPIB7210 driver versions for different operating systems are located on the hard disk after ROMES installation, see subdirectory Install\IEEE Interface of the program directory.
- The trigger unit. In older systems, the *IMC Board* (a slot card in the controller that is no longer supported by ROMES 3; only by TS55-K1 V2.x) serves as trigger unit; all other systems – including the current ROMES version – use the *Trigger Box.*

EB200 Driver

The EB200 driver requires:

- Either the serial RS232 interface or LAN interface with the corresponding driver. Both interfaces are optional; at least one of them is provided on each unit.
- The Trigger Box which serves as an external trigger unit.
- Firmware version 2.50 or higher in EB200 and 1.50 or higher in ESMB. It is recommended to install the latest firmware version, which can be found on the ROMES CD in the *Firmware & Drivers* directory.
- Software option EB200CM (Coverage Measurement) for EB200, if the EB200 test receiver is used.

SBR Driver and TS55-R2 Driver

The single-board receiver drivers require:

- A COM port for the receiver
- A COM port for the external trigger unit (*Trigger Box)*

For ROMES V3.15 and higher the SBR and TS55-R2 receivers can also be used without the Trigger Box *(Internal Trigger* option, time trigger).

dti SeeGull Driver

The dti SeeGull driver requires a COM port for the receiver.

A maximum of two SeeGull receivers can be operated at the same time. A Trigger Box is not required.

ESPI Driver

The ESPI driver requires:

- Either the IEC/IEEE bus interface (GPIB7210) or LAN interface with the corresponding driver. The LAN interface is provided as an option (option FSP-B16). GPIB7210 driver versions for different operating systems are located on the hard disk after ROMES installation, see subdirectory Install\IEEE Interface of the program directory.
- The Trigger Box which serves as an external trigger unit.

The ESPI receiver can also be used without the Trigger Box *(Internal Trigger* option).

TSMx Driver

The EB200/ESMB receivers can also be used without the Trigger Box *(Internal Trigger* option).

The TSMx driver requires:

- An IEEE 1394 Firewire interface, controlled by means of the Rohde & Schwarz Firewire driver.

The Trigger Box cannot be used together with the TSMU/TSML-CW units, because these have a built-in triggering unit.

The *Trigger Box* is connected to a COM port as described in section *Test Receiver Drivers* on p. 6.7 ff., no additional driver is necessary.

Configuration Menus

ROMES provides configuration menus for the test receiver drivers and for the Trigger Box. Both configuration menus are accessed by clicking the corresponding *Driver...* command lines in the *Configuration* menu that are available as soon as the drivers are loaded.

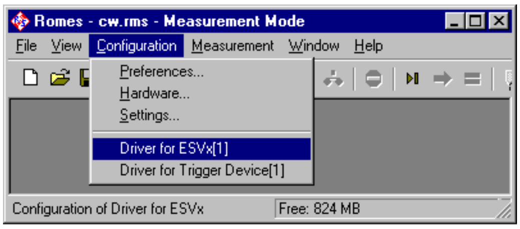


Fig. 6-97 Accessing the test receiver driver configurations

Note:
The number of test receiver signals that are displayed in the data trees can be limited in the Configuration of Software Modules menu; see section TEC for CW Devices in chapter 2.

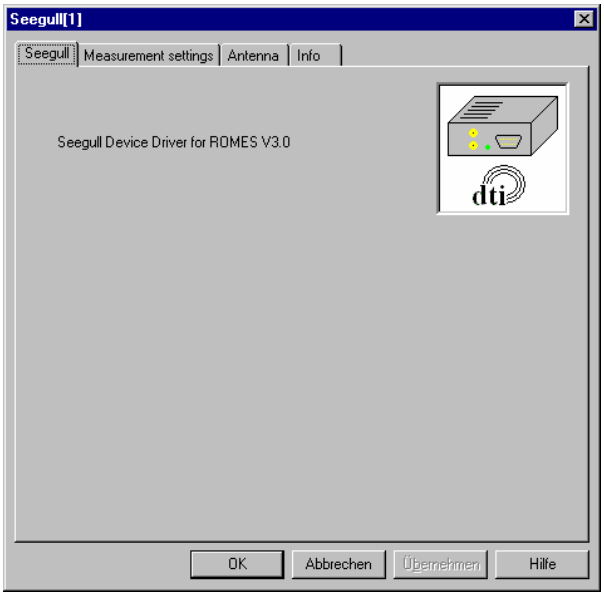
Test Receiver Configuration

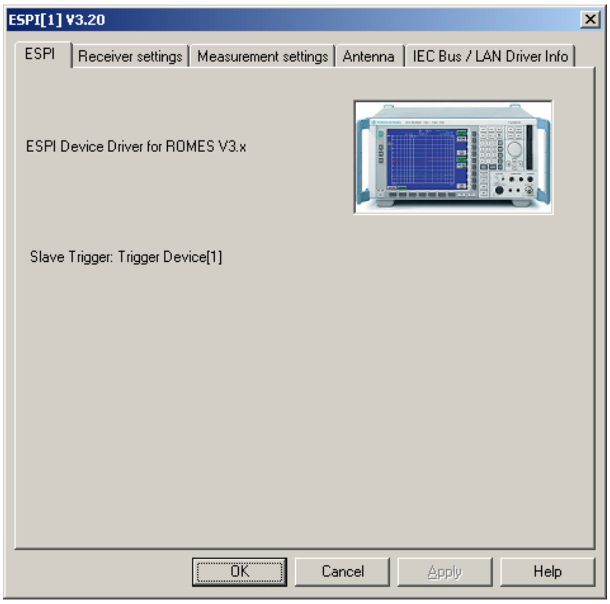
The test receiver configuration menus contain several tabs to display information on the test receiver driver and configure the *Receiver settings*, the *Measurement settings* (channel selection and trigger), and the *Antenna* parameters.

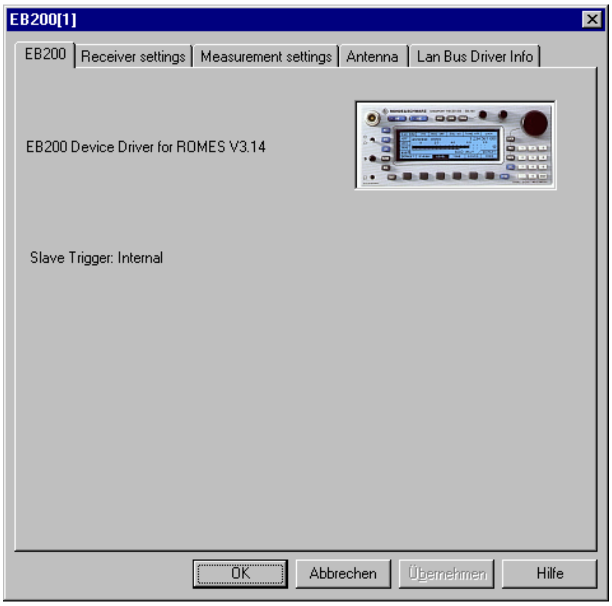
The *Driver Configuration* menus are opened by clicking the *Driver…* command lines in the *Configuration* menu which are available as soon as a receiver driver is loaded (see *Fig. 6-97*). Besides, they are opened automatically whenever a driver for a receiver which does not conform to the default configuration settings is loaded, i.e. on confirming the driver selection and port assignment made in the *Hardware Drivers* menu (see *Fig. 6-1* on page 6.1).

ESVx/Seegull/ESPI/EB200/TSMx

The *ESVx/Seegull/ESPI/EB200/TSMx* tabs indicate the driver version and the slave trigger.







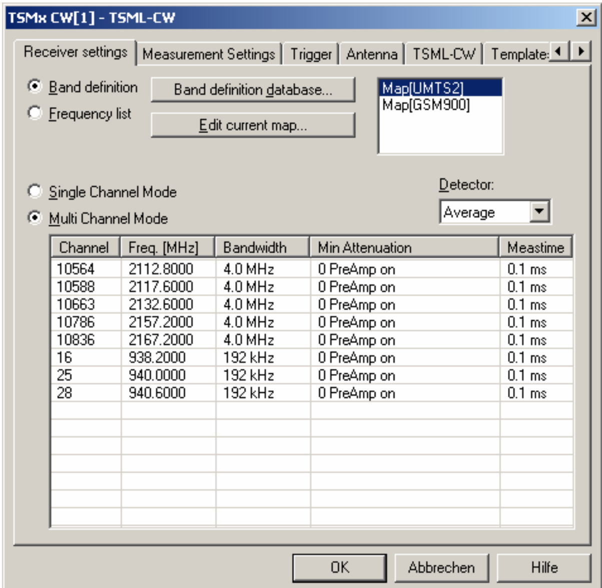


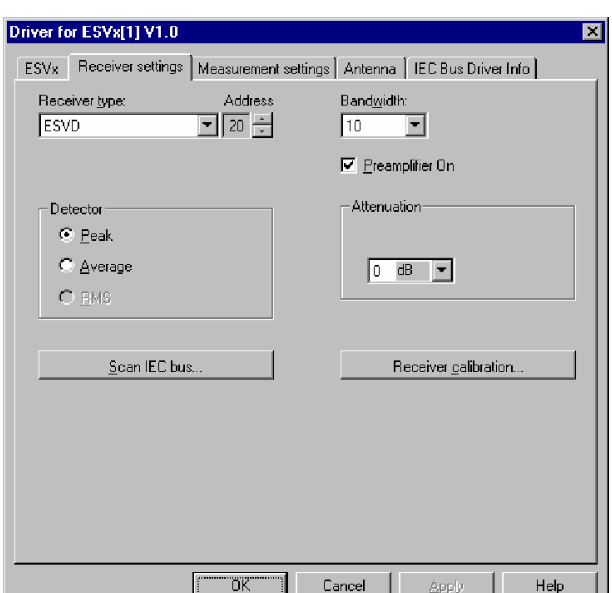
Fig. 6-98 Test receiver driver configuration – ESVx/Seegull/ESPI/EB200/TSMx

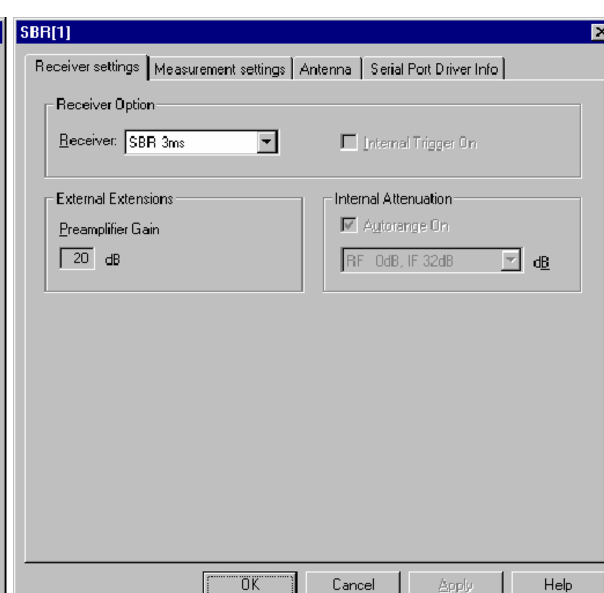
The TSMx properties and available options are also displayed in the *Device Chooser* described on p. 6.21.

Receiver settings

The *Receiver Settings* tab selects the receiver type and receiver parameters. All settings are explained in more detail in the test receiver manuals.

If the settings in the *Receiver Settings* tab do not comply with the connected test receiver, the tab is opened automatically while the driver is installed; see section *Test Receiver Drivers* on p. 6.7 ff.





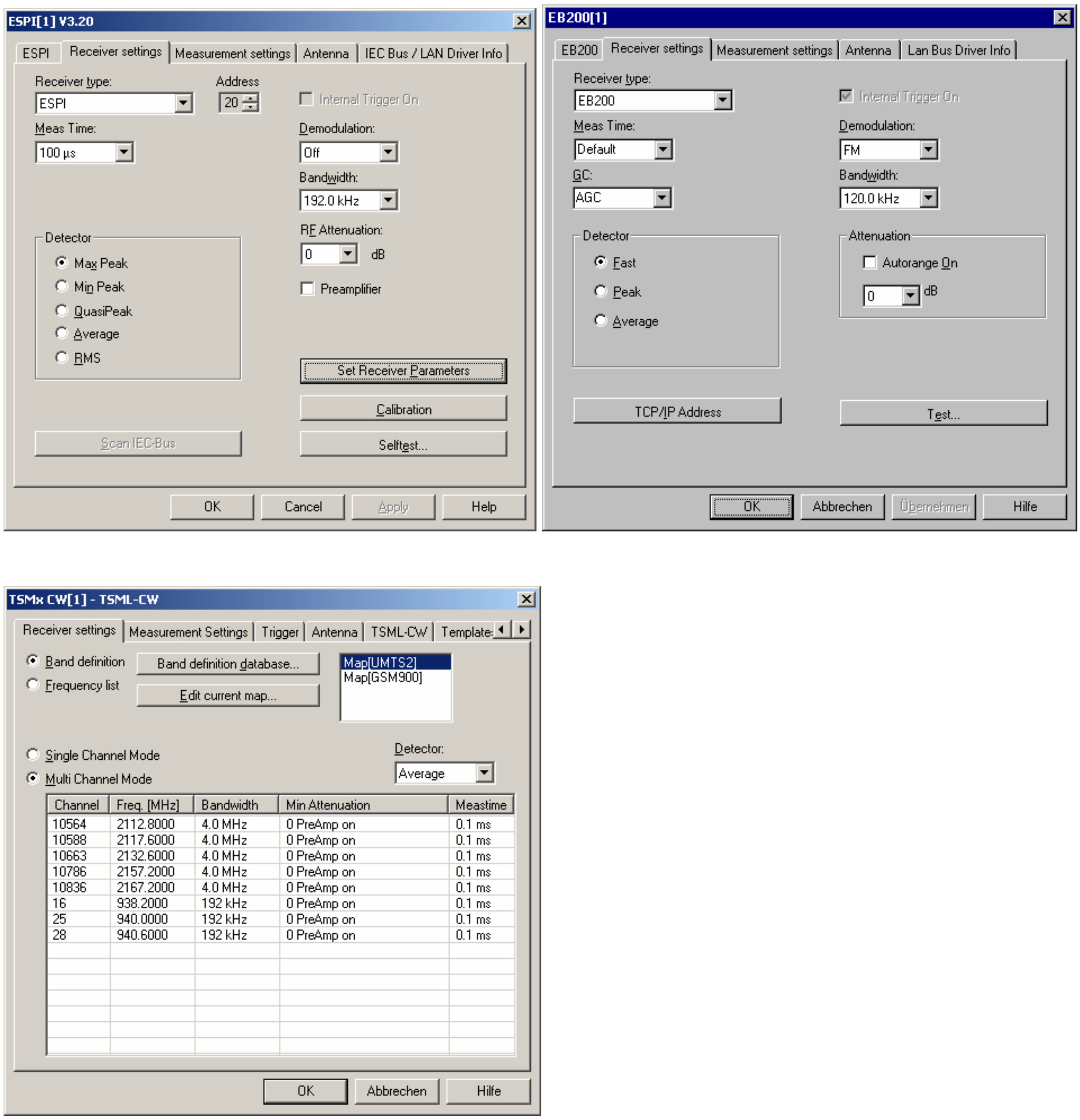


Fig. 6-99 Test receiver driver configuration – Receiver settings

Receiver type/ Receiver Option

The *Receiver (type)* pull-down list indicates all receiver types supported by the driver (see section *Supported Devices* on page 6.147). The used receiver can be selected from the list.

The SBR, TS55-R2, EB200 and ESPI driver configuration menus also indicate whether an internal trigger is used. With internal trigger, no Trigger Box is used and the measurement must be triggered by time (see p. 6.161).

Address
TCP/IP Address

The *Address* input field sets the IEC/IEEE bus address of a test receiver that is connected via IEC/IEEE bus interface, see paragraph entitled *Allocating a valid IP address* on p. 6.9. This input field is available for ESVx and ESPI drivers only. If the ESPI driver is assigned to a LAN interface (see section *Test Receiver Drivers* on p. 6.7 ff.) the IEC/IEEE bus address is ignored.

The *TCP/IP Address* button sets the TCP/IP address of the test receiver. This input field is available for EB200 drivers only.

Attenuation

In the input path of the SBR and TS55-R2 receiver an attenuation factor can be set either automatically or explicitly:

Autorange On	If the function is active (box checked), the attenuation is automatically adjusted according to the input level received during the measurement
dB	Selection of an explicit attenuation factor or mode from a pull-down list.

For ESVx and ESPI receivers, autoranging is always switched off.

Preamplifier

The internal preamplifier of the ESVD and ESPI can be switched on (box checked) or off.

With the SBR or TS55-R2, the preamplifier gain is important in configurations using a one-to-three power splitter in conjunction with a ultra low-noise preamplifier. The gain value compensates for the loss of the splitter and the gain of the preamplifier. This value will be taken into account for the measurement.

The following settings are not provided for the SBR and TS55-R2 driver:

Bandwidth

Pull-down list of all available receiver bandwidth settings (in kHz) for the selected receiver type. For CW measurements in GSM networks, where the channel spacing is 200 kHz, a bandwidth of 300 kHz is sufficient. A bandwidth of 120 kHz should be used if the neighbor channels are at high signal power.

Note:
A small bandwidth reduces the measurement speed when more than one channel is used.

Detector

The *Detector* panel selects a method of weighting the received signal levels and deriving the measurement curve from the entire set of measurement results. The test receivers provide different detectors described in the receiver manuals.

Demodulation

The *Demodulation* field provides a pull-down list to select the type of demodulation or switch off the demodulation completely. The test receivers provide different demodulation types described in the receiver manuals.

Meas. Time

The *Meas. Time* field provides a pull-down list to select the time during which the test receiver acquires the measurement points that its detector weights and processes together; see receiver manuals.

GC

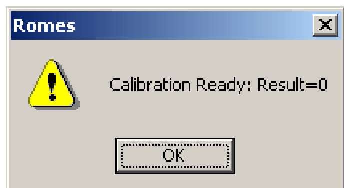
Selects a gain control factor to control the sensitivity of the receiver. In the AGC (Automatic Gain Control) setting the GC factor is automatically adapted to the input signal level; see receiver manual.

Scan IEC bus...

The *Scan IEC bus* button detects all connected devices and their IEC(IEEE)-bus addresses, see receiver manuals.

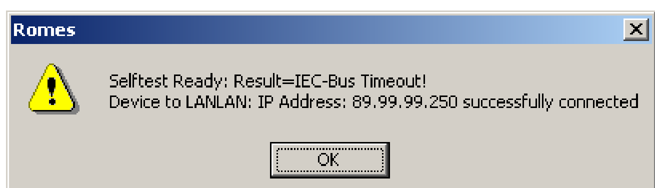
Receiver calibration.../ Calibration

The *Receiver calibration* or *Calibration* buttons start the short receiver calibration, see receiver manual and section *R&S Test Receiver Calibration* on p. 6.174 ff. A message indicates the end of the calibration:



Selftest.../ Test

The *Selftest* or *Test* buttons initiate a selftest of the test receiver. In the case of the ESPI receiver, ROMES displays the following report when the selftest is terminated:



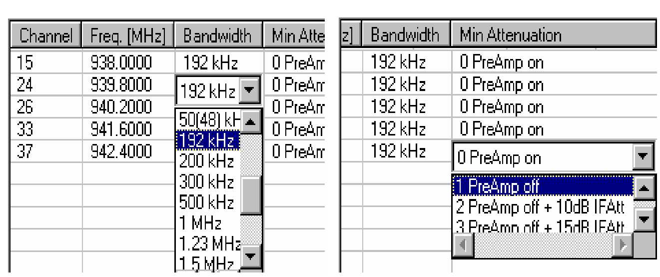
Channel selection (TSMx)

The channels selection for the TSMx is analogous to the other test receivers. For a description of the *Band definition* and *Frequency list* refer to the *Channel selection* paragraph on p. 6.157.

The TSMx provides the most flexible receiver settings of all test receivers:

Several bands (GSM900/GSM-P, GSM-E, GSM-R, GSM1800 etc.) and even several technologies (GSM, UMTS,…) can be measured simultaneously.

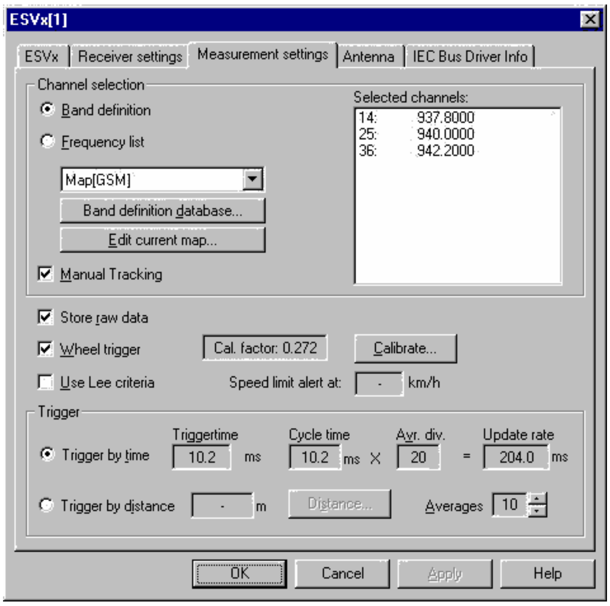
The *Bandwidth* and the *Min. Attenuation* can be selected individually for each channel. A click on the cells in the channel list opens pull-down menus, e.g.:

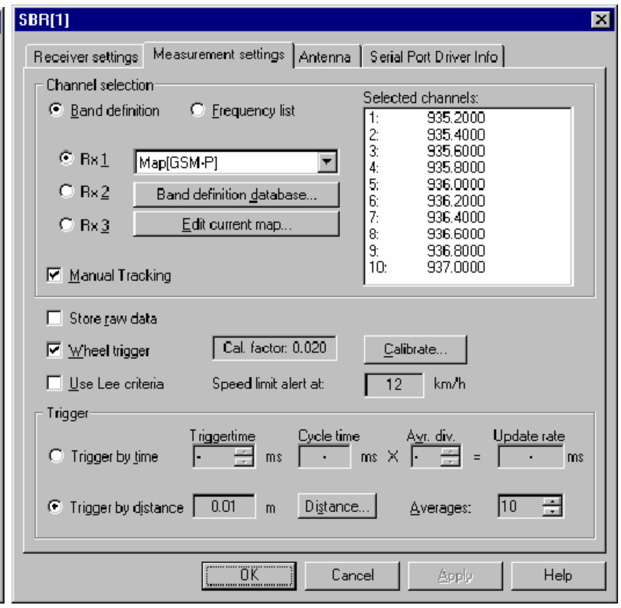


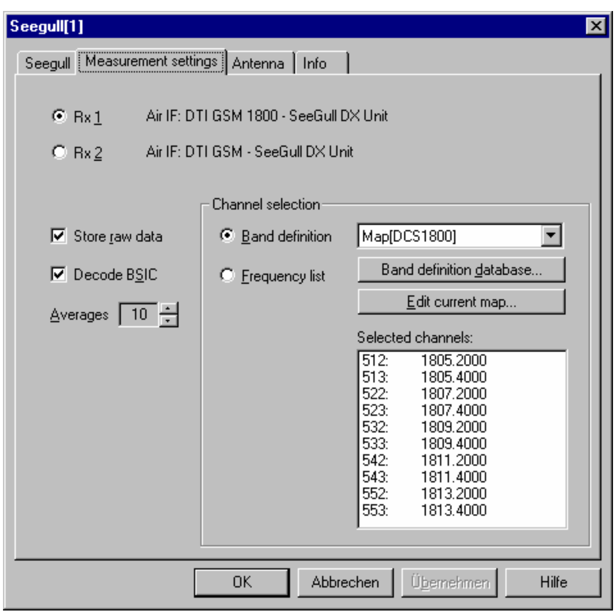
For more information refer to the Technical Information for the TSMU CW Driver *ROMES-AS6*.

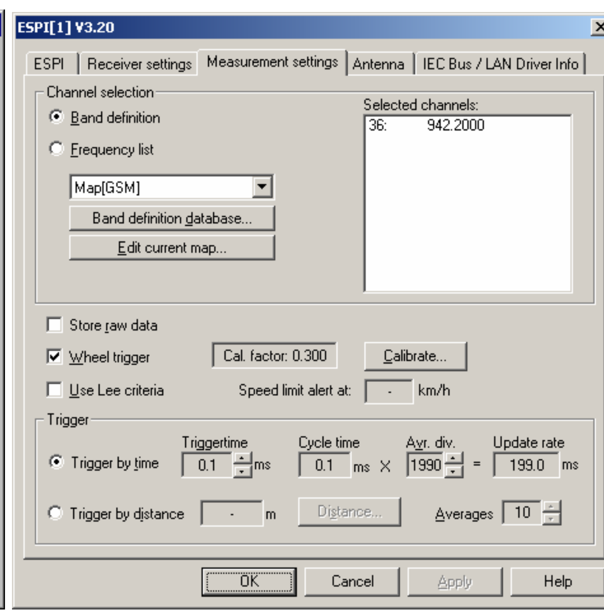
Measurement settings

The *Measurement Settings* tab controls the channel selection, data storage, and provides a variety of trigger options.









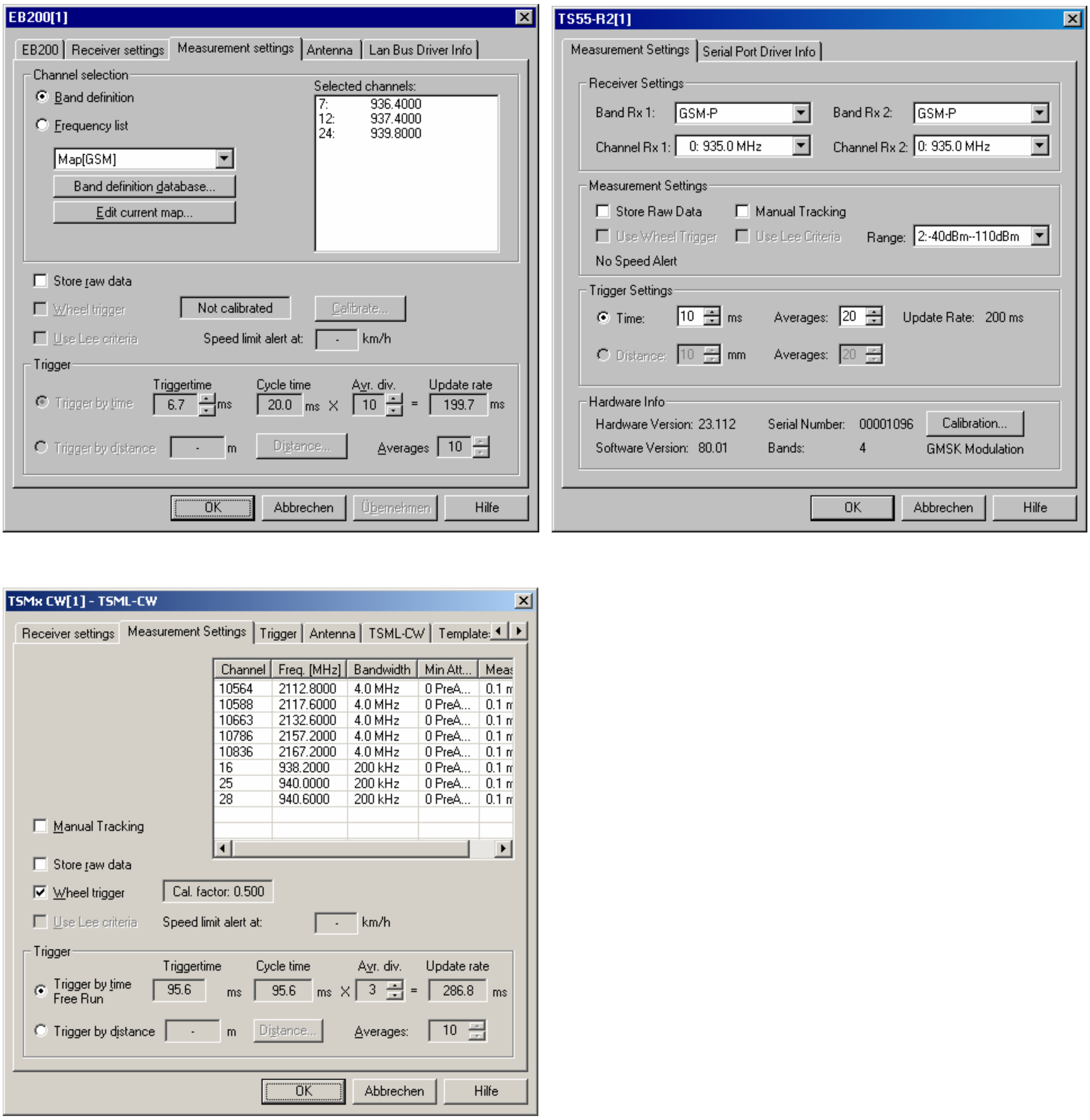


Fig. 6-100 Test receiver driver configuration – Measurement settings

Receiver selection (SBR)

The SBR device accommodates 3 independent receivers, each with its own connectors, providing 3 independent measurement channels. The receivers can be configured independently and operated at the same time:

Rx 1/2/3 Number of test receiver. Note that only one frequency channel can be selected per receiver. The frequency channels must be distinct from each other.

Receiver selection (SeeGull)

The SeeGull device provides up to two independent receivers.

Rx 1 / Rx 2 Number of test receiver. Up to 255 channels can be selected per receiver.

If not all receivers are connected, the corresponding radio buttons are grayed.

Receiver Settings (TS55-R2)

The TS55-R2 device accommodates two independent receivers, each with its own connectors, and is thus capable of measuring two channels – even in two different GSM bands – at the same time. The GSM bands *(GSM-P, GSM-1800/DCS* or *GSM-1900/PCS, GSM-R/GSM-E,* see channel tables in chapter 8) and channel numbers/frequencies for both receivers can be selected in the *Receiver Settings* panel.

The maximum sampling rate of the TS55-R2 test receiver depends on the trigger source:

With internal trigger	1 sample / 2 ms
With Trigger Box	1 sample / 1 ms

Channel selection

The *Channel selection* panel specifies the radio channels to be measured. The channels can be selected in two alternative ways:

Band definition	Channels are selected from a band, i.e. a continuous range of channels with constant spacing. This method is appropriate for radio networks with equidistant channels such as GSM.
Frequency list	Channels are selected from a list of specific frequencies. This method is appropriate for radio networks with non-equidistant channels such as DAB.

The panel provides further controls and output fields:

Selection window	Pull-down list showing all available *Band definition* and *Frequency list* channel maps.
Selected channels	Channel numbers and frequencies in the map shown in the selection window.

Note on TSMx:
The selected channels are shown in the Measurement Settings *tab, however, the selection is made in the* Receiver Settings *tab.*

Manual Tracking

If the box is checked, the ESVx, ESPI, SBR, TS55-R2 or TSMx test receiver is set to manual tracking mode. In this mode, a channel list is defined using the *Band definition* or *Frequency list* options, however, the receiver measures on only one channel that can be selected or changed manually. To change the channel, the *Action* menu must be used; see section *Action Menu* on p. 6.172 ff. The current measurement frequency can be viewed in the *CW Tracking Info View;* see chapter 3.

Note on SBR:
If Manual Tracking is disabled the SBR receiver can measure on only one channel. If more than one channel is selected in the Channel selection map, ROMES generates a warning:

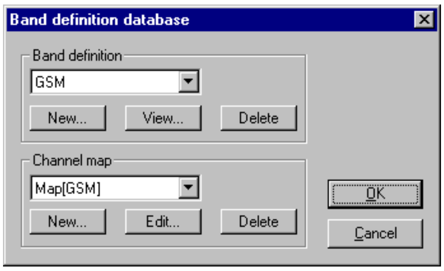
Note on EB200:

The EB200 can measure a maximum of 50 channels. If more than 50 channels are selected, ROMES generates a warning Too many channels selected! see above.

The buttons below the selection window depend on the way the channels are selected:

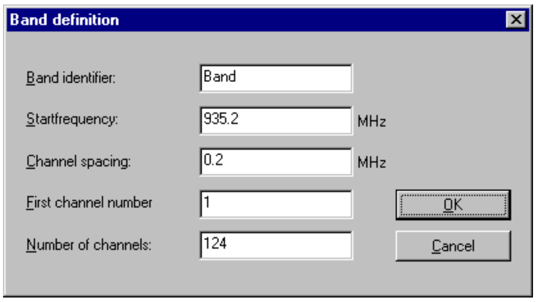
Band definition

Opens the menu for editing the database containing allchannel selections created via *Band definition*.



In the *Band definition database* dialog, the existing *Band definitions* and corresponding *Channel maps* are shown in the pull-down lists of two analogous panels. The three buttons below create a new element of the list *(New...),* view without editing *(View...), Edit,* or delete *(Delete...)* the selected element.

The *New...* button in the *Band definition* panel opens the *Band definition* dialog:

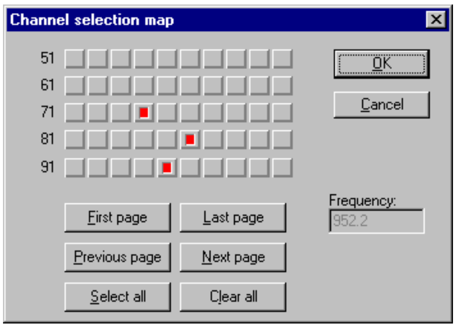


A band is specified by a *Start frequency* (f_{init}) with corresponding *First channel number* (n_{init}), a constant *Channel spacing* (Δf), and the *Number of channels* (n). For n_{init} through n_{init} + n, the channel frequencies f_i are determined according to the linear equation:

$$f_i = f_{init} + (i - n_{init})\Delta f \ ; \quad i = n_{init} ... n_{init} + n$$

The *Band identifier* is a user-defined name which allows to distinguish between different bands. Note that, in contrast to the channel map, the band definition can not be modified after it is stored via the *OK* button.

The *New...* button in the *Channel map* panel opens the *Channel selection map* dialog:



The *Channel selection map* dialog shows all channels defined in the current band, represented by small square buttons arranged in several rows. If necessary, the diagram consists of several pages that can be scrolled using the *First page, Last page, Previous page*, and *Next page* buttons. An individual channel can be selected via mouse-click; moreover, it is possible to select all channels or clear the current selection. If a channel is selected, the corresponding frequency is shown in the *Frequency* field.

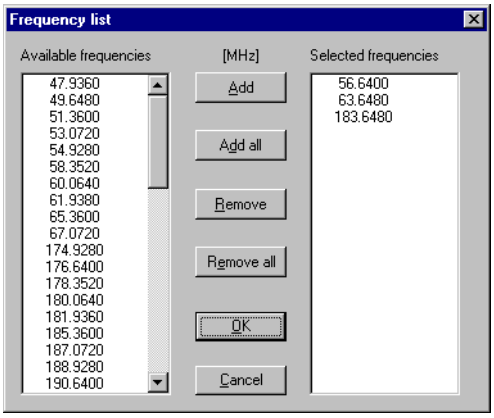
An existing channel map can be modified via the *Edit..* button of the *Band definition* database dialog or via the *Edit current map...* button of the *Measurement Settings* tab. It can be renamed in the *Channel map* entry field of the *Band definition database* window.

After quitting the *Channel selection map* with *OK*, the selected channels will be shown in the *Selected channels* field of the *Driver Configuration* menu.

Frequency list

Opens the menu for editing the database containing all channel selections created via *Frequency list*.

In the *Frequency list* dialog, the frequencies to be measured can be selected from a list of *Available frequencies*.



Measurement speed of SeeGull receiver

The measurement time depends on the number of channels selected:

- In a 1-channel measurement, the minimum time offset between two consecutive trigger events is >120 s.
- In a multi-channel measurement, the minimum time offset between two consecutive trigger events is >200 s.

Range (TS55-R2)

It is possible to specify the dynamic measurement range for the TS55-R2 receiver.

Note:
In the data tree (see chapter 1) the TS55-R2 results appear under the SBR technology node. The signals RF Input – RF Channel 1 and RF Input – RF Channel 2 indicate whether the measured input power is within (OK), below (Low) or above (High) the dynamic measurement range of the receiver.

Store raw data

If the *Store raw data* box is checked the raw data, i.e. all measurement data taken by the test receiver, are saved with the measurement file. Otherwise, only the averaged data is saved.

Decode BSIC

If the *Decode BSIC* box (for Seegull driver only) is checked, the BTS Identity Code is decoded from the selected channels. This increases the measurement time.

(Use) Wheel Trigger

If the *Wheel trigger* box (not for SeeGull driver) is checked, a wheel trigger is used to monitor the distance driven with the measurement vehicle.

Calibrate...

A *calibration factor* (equal to the distance driven per trigger pulse) can be determined to convert the trigger pulse scale into a length scale. Calibration of the wheel trigger is also accessible from the *Trigger Box* configuration menu; for more information see section *Trigger Box Configuration* on p. 6.168 ff.

Use Lee criteria (not for SeeGull driver)

If the *Use Lee criteria* checkbox is checked a speed limit alert message will be issued when the vehicle drives faster than the Lee speed. When distance trigger is in use (see below), the trigger distance will be corrected at the same time.

The Lee speed is indicated in the output field to the right of the *Use Lee criteria* checkbox.

The Lee criteria are derived from a statistical model describing the geographical distribution of the field strength in mobile communication networks and its variation in time. The model provides an averaging procedure for the field strength in typical coverage situations, where random, non-reproducible variations are smoothed out but the relevant information (e.g. the attenuation of the field strength due to long-term fading) is preserved in the averaged data.

Lee's averaging model:

According to Lee, the field strength should be averaged over a length of approx. $L = 40\lambda$ (where λ denotes the carrier wavelength of the network); a reasonable number of test points is $N = 50$ for each radio channel measured. Assuming an average measurement time for a single test point of $T = 2.5$ ms and n different channels, this yields a maximum speed of the test vehicle (Lee speed) of

$$V_{Lee} = \frac{L}{NnT} = \frac{40 \times 10^3}{n \times 50 \times 2.5s} \lambda \approx \frac{360}{n} \frac{\text{km}}{\text{h}} \quad \text{for GSM900} \qquad \textit{(Equation 1)}$$

The Lee speed decreases as λ gets smaller (e.g. for GSM1800) or as the number of test points N is increased for the sake of accuracy. It also decreases if the number of channels or the measurement time of the test receiver increases, e.g. due to a reduction of the resolution bandwidth.

Trigger

The *Trigger* panel specifies how the measurement is triggered. This can be done in two alternative ways:

Trigger by time	The time between two measurements (trigger time) is specified.
Trigger by distance	The distance driven between two measurements (trigger distance) is specified.

All controls of the *Trigger* panel depend on the trigger mode.

Trigger by time:

The *trigger time* is the time between two consecutive measurement data sets containing the data for all selected channels. The default trigger time corresponds to the fastest trigger rate (minimum measurement time) of the used test receiver, i.e. to the quantity nNT in *(Equation 1)*.

Enlarging the trigger time reduces the amount of raw data generated such that a doubled trigger time results in about half as large a data file. The LEE speed limit decreases according to *(Equation 1)*.

The following parameters configure the time trigger:

Trigger time	Time between two measurements (see above), to be adapted to the expected maximum speed of the test vehicle.
Averages	Number of samples (measurements) taken per fixed distance for each channel (i.e. the quantity N in *(Equation 1)* in the range of 1 to 100. In the Trigger by time mode, this value can also be changed to modify the Lee speed limit. A low value increases the Lee speed limit at the expense of accuracy.
Cycle Time	Measurement time for all selected channels (fixed). This is roughly equal to the step width (i.e. minimum trigger time for one channel) multiplied by the number of selected channels. The step width is 1 ms for the SBR receiver.
Average divider	Number of data collected for averaging (different from the quantity N in *(Equation 1*, adjustable). The minimum value is automatically set such that the Update rate (see below) is not below 100 ms. This parameter does not depend on the raw data and has therefore no impact on the Lee criterion.
Update rate	Time needed to collect an averaged measurement data set for all selected channels (fixed). The update rate must not fall below 100 ms, otherwise the average divider is increased.

Trigger by distance:

The *trigger distance* is the distance between two measurement sets containing the data for all selected channels. The default setting is the maximum distance according to Lee.

The following parameters configure the distance trigger:

Distance... Trigger distance, can be modified if no Lee trigger criterion is used (the *Use Lee criteria* checkbox is unchecked). With the Lee criterion, the trigger distance is calculated as a function the *Averages* value set, see below.

Averages Number of samples (measurements) taken per fixed distance for each channel (i.e. the quantity N in *(Equation 1)* in the range of 1 to 100. If the Lee criterion is applied, a higher *Averages* value reduces both the trigger distance and the Lee speed limit.

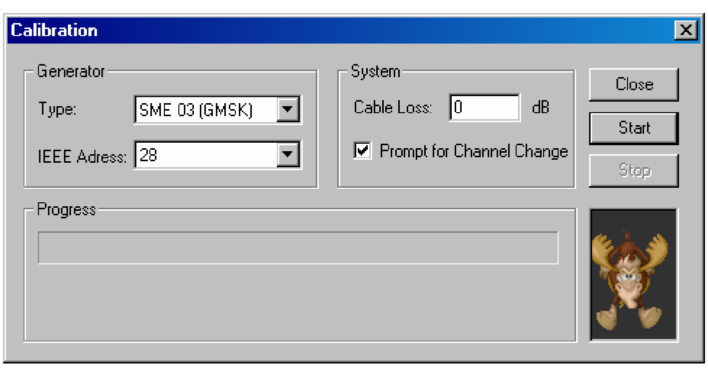
The maximum speed according to Lee is always shown in the *Speed limit alert at: ...* field, see above. Before starting the measurement tour, check whether the speed limit is sufficiently high. E.g. a limit of 20 km/h is far too low for reasonable driving. In this case

- ➢ Increase the receiver bandwidth (a larger bandwidth reduces the measurement time T and thus enhances the speed limit), if possible
- ➢ Reduce the number n of channels
- ➢ Reduce the number N of samples *(Averages,* in *Trigger by Distance* mode only)

The distance trigger is not available for the TSMU.

Calibrate... (TS55-R2)

In the *TS55-R2* driver configuration menu, the *Calibrate…* button opens a menu to configure and start a receiver calibration:



The receiver calibration consists of measuring a known test signal with variable frequency and power and calculate a correction table that is stored in a *.cal file. The test signal settings are automatically controlled to cover the entire frequency and dynamic range of the receiver.

Generator Type Type of signal generator providing the test signal; R&S SMHU (CW) or R&S SME 03 (GMSK). GMSK modulation must be set explicitly at the SMHU; this improves the accuracy of GSM signal measurements. For CW signal measurements (e.g. if a CW test transmitter is used), it is recommended to use a SMHU generator providing a CW signal.

IEEE Address IEEE address of the generator in the measurement

	system
Cable Loss	Entry of a known cable loss between the signal generator and the input of the receiver
Prompt for...	If the box is checked, the ROMES prompts with a message before changing the receiver/measurement channel; otherwise the calibration is performed without interruption. This option should be selected when calibrating both receivers Rx 1 and Rx 2, in particular if the test setup requires a change of the connectors.
Start	Start the calibration. The relative progress is indicated with a progress bar.
Stop	Stop a running calibration.
Close	Close the *Calibration* menu.

The generated calibration file, named C2_xxxxxxxx.cal (where xxxxxxxx denotes the serial no. of TS55-R2), is stored in the *Driver* subdirectory of the ROMES program directory.

Note:
The CW level calibration is mandatory when the TS55-R2 device driver for CW measurements is used for the first time (i.e. if no calibration file is found when the driver is loaded). For an overview of test receiver calibration see section R&S Test Receiver Calibration on p. 6.174 ff.

It is recommended to create a backup of the calibration file and store it to a separate directory.

Antenna

The *Antenna* tab defines *Antenna Name, Antenna Gain* and *Cable Loss*. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

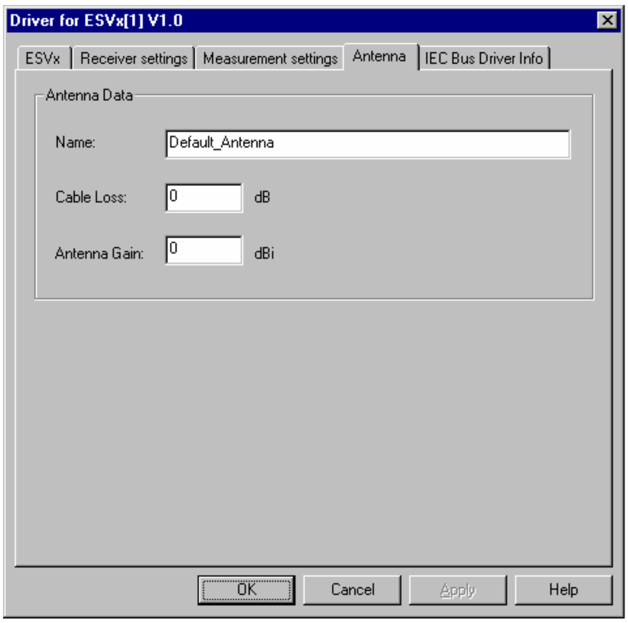


Fig. 6-101 Test receiver driver configuration – Antenna

Templates (TSMx)

The *Templates* tab stores the current TSMx driver configuration as a template, lists, loads or deletes driver templates.

Note:

When a driver is loaded using Configuration – Preferences – Hardware (see section Driver Installation on p. 6.1 ff.) ROMES checks whether or not a driver template is stored in the Driver Templates directory and its subdirectories (see below). The driver can be loaded with default settings or with the settings stored in any of the templates found.

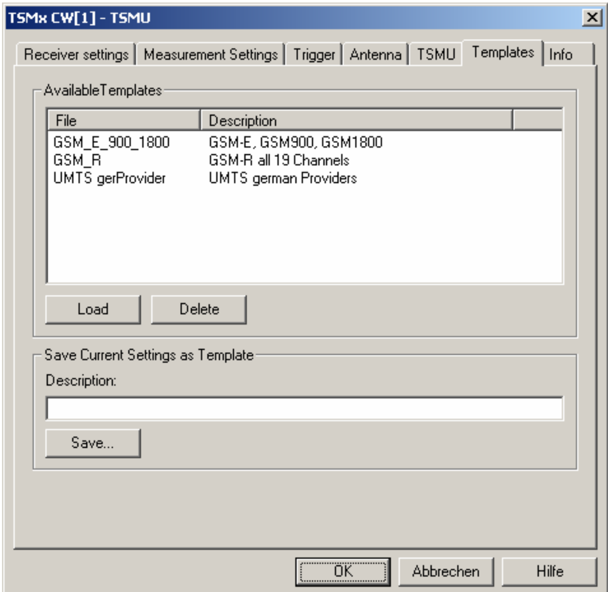
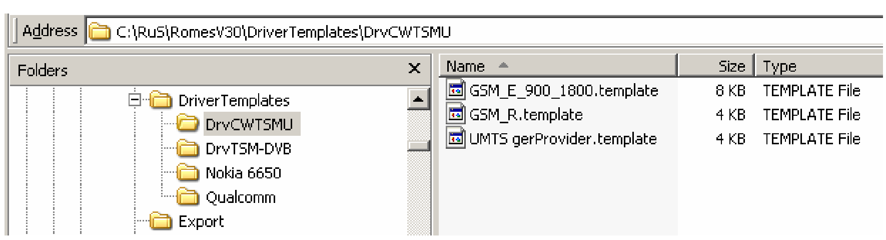


Fig. 6-102 Test receiver driver configuration – Templates

Load/Delete

Loads a driver template or deletes a template displayed in the list of *Available Templates*. Template files are ASCII files with the extension *.template. The template definition is independent of the workspace. A selection of template files for the TSMx is supplied with the ROMES installation:

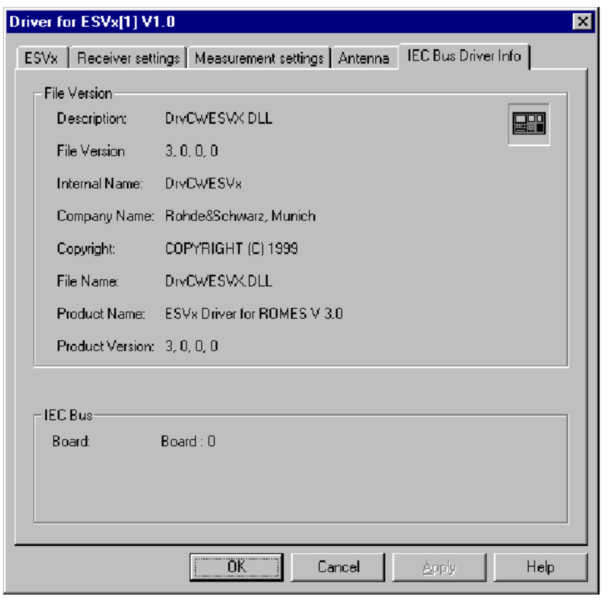


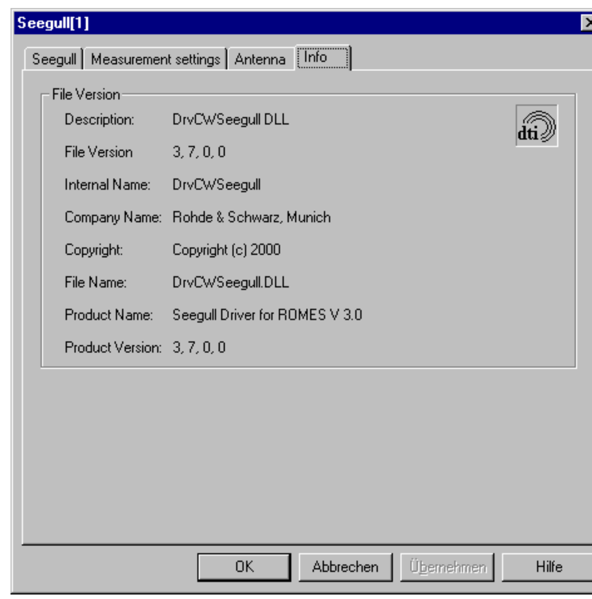
Save

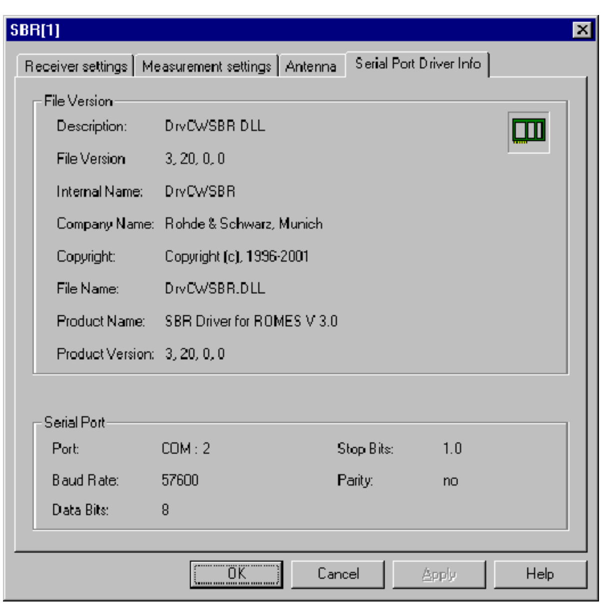
Saves the current driver settings together with the *Description* to a selected template file.

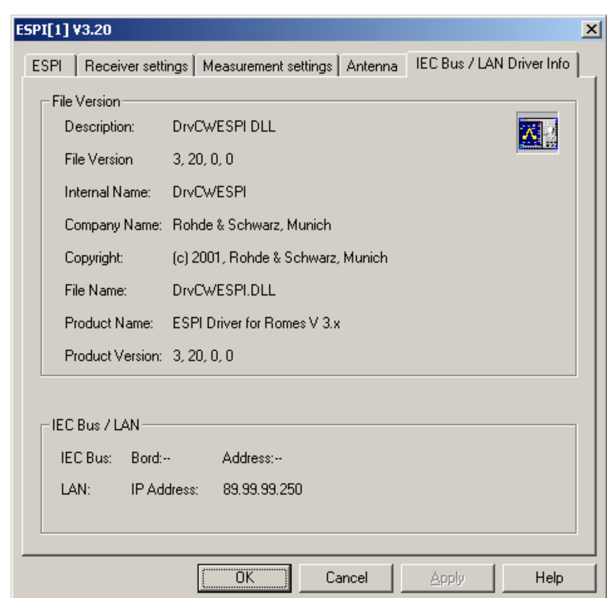
Info

The *Info* tabs display information on the software versions of the different drivers and the different types of connections. The SeeGull and TSMx drivers display no connection information. The ESVx driver shows the IEC/IEEE bus board number. The SBR and TS55-R2 drivers show the serial port assigned to the driver and the transmission parameters. The ESPI driver shows IEC/IEEE bus or IP address, depending on the selected connection type. The EB200 driver shows the parameters of the TCP/IP Interface.









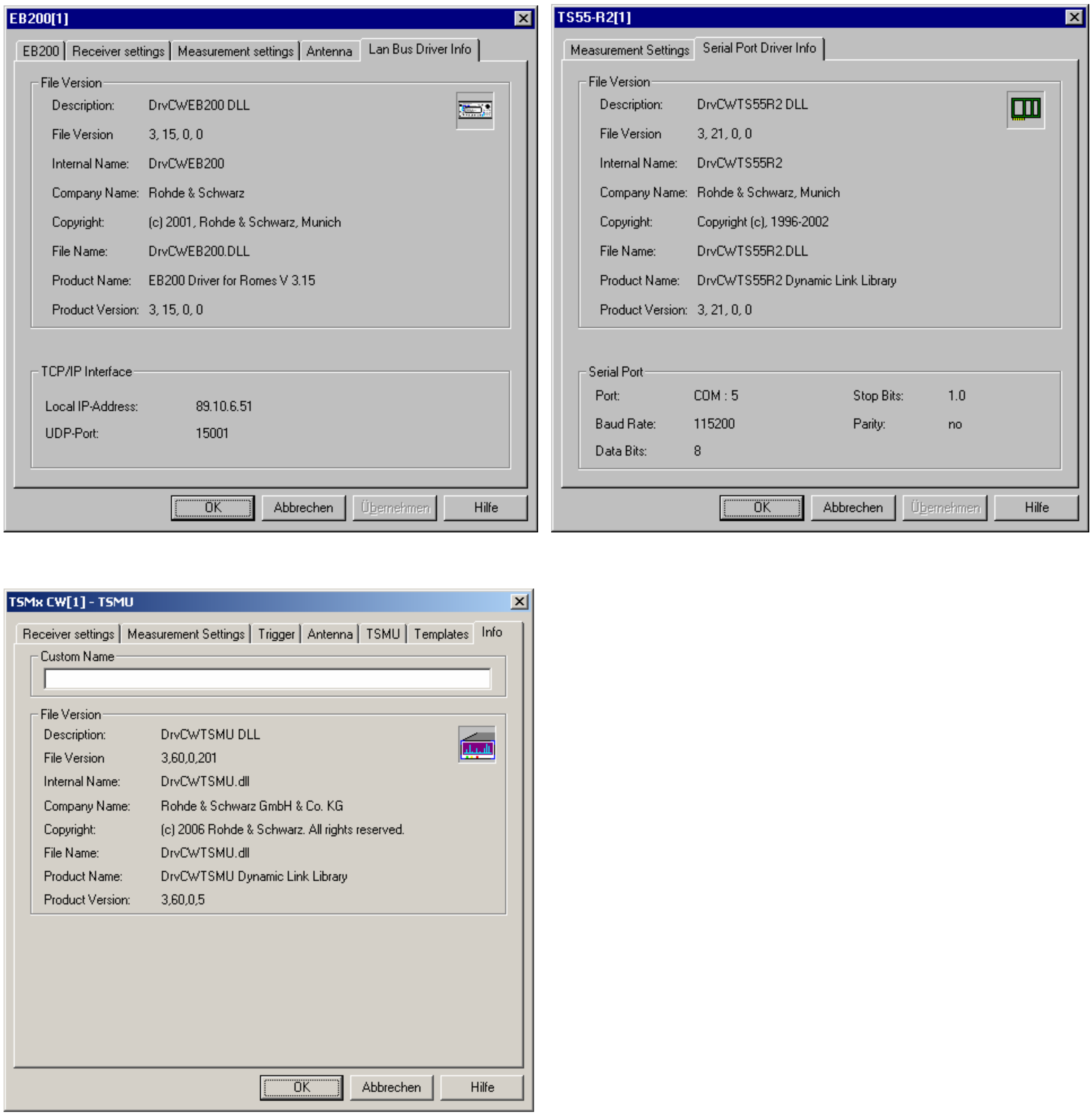


Fig. 6-103 Test receiver driver configuration – driver Info

OK Saves all settings made in the test receiver driver configuration menu and closes the menu.

Cancel Discards all settings made in the test receiver driver configuration menu and closes the menu.

Trigger Box Configuration

The *Trigger Device* configuration menus are equal for the ESVx, EB200, ESPI, SBR and TS55-R2 drivers. They contain two tabs to define the calibration factor and user distance and to display information on the trigger driver.

The *Driver Configuration* menu is opened by clicking the *Driver* command line in the *Configuration* menu which is available as soon as a receiver driver is loaded (see Fig. 6-97).

Note:

For ESVx, EB200, ESPI, SBR and TS55-R2 devices, the trigger box is a separate externally connected unit. This configuration is described with the menus in the following section.
These devices all support external triggering by loading the trigger box driver as a slave.

The TSMx devices have an integrated triggering unit, which are configured as described in section Trigger Box (TSMx, internal) *on p. 6.171.*

Triggerbox (external)

The *Triggerbox* tab defines the calibration factor for the wheel trigger and a user distance signal.

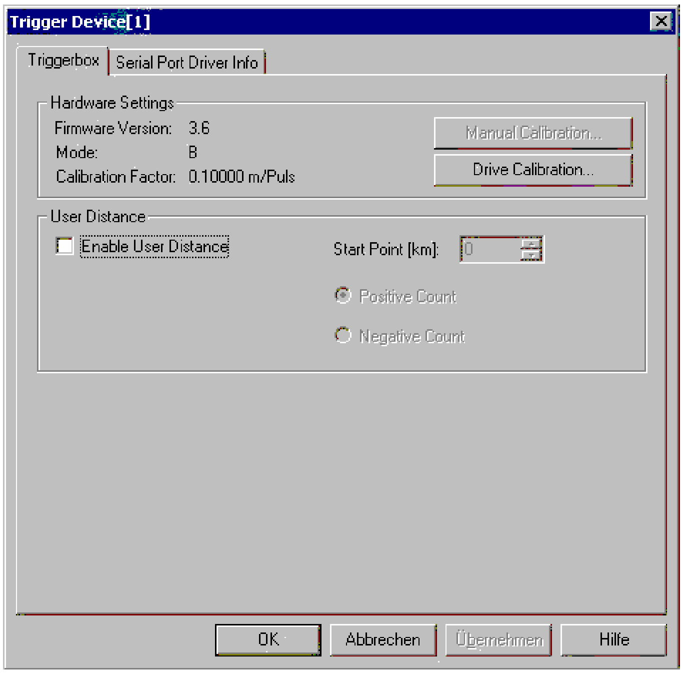
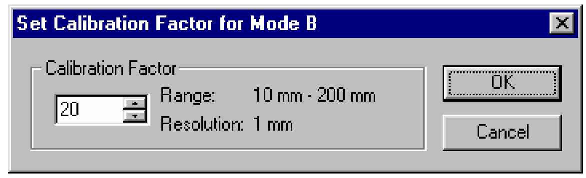


Fig. 6-104 Trigger Box driver configuration (for the R&S external trigger box)

Hardware Settings The *Hardware Settings* panel indicates the current ROMES *Firmware Version,* the *Mode* (B or C; both modes are equivalent as far as their function for ROMES is concerned; not to be changed by the user because new measurement systems are delivered with optimized settings), and the current *Calibration Factor*. A calibration factor is needed to convert the trigger pulse scale into a length/distance scale if a *Wheel trigger* is used (see p. 6.160). The calibration factor can be defined in two different ways:

Manual Calibrat.

For Trigger Box firmware versions ≥V3.7: The calibration factor (distance driven in mm per trigger pulse) is entered manually. This option is suitable if the calibration factor is known; otherwise a *Drive Calibration* must be performed.



Drive Calibration

The calibration factor (distance driven in mm per trigger pulse) is determined experimentally by driving a particular distance while counting the number of trigger pulses.

The procedure is identical with the calibration from the *Measurement Settings* tab of the driver configuration menu. The calibration factor is entered into the Trigger Box and the registry, therefore it is valid for all (ESVx, EB200, ESPI, SBR and TS55-R2) drivers. A calibration must be carried out only once with either the ESVx, the SBR or the TS55-R2 test receiver driver.

User distance

If *User Distance* is enabled, a new marker point can be defined during the measurement where the *Start Point* (reference) and the direction *(Positive/Negative Count)* of the user distance may change. The same settings are provided in the *Action* menu; see p. 6.172 ff.

Serial Port Driver Info

The *Serial Port Driver Info* tab displays information on the file version of the Trigger Device driver, the serial port assigned to it, and the transmission parameters.

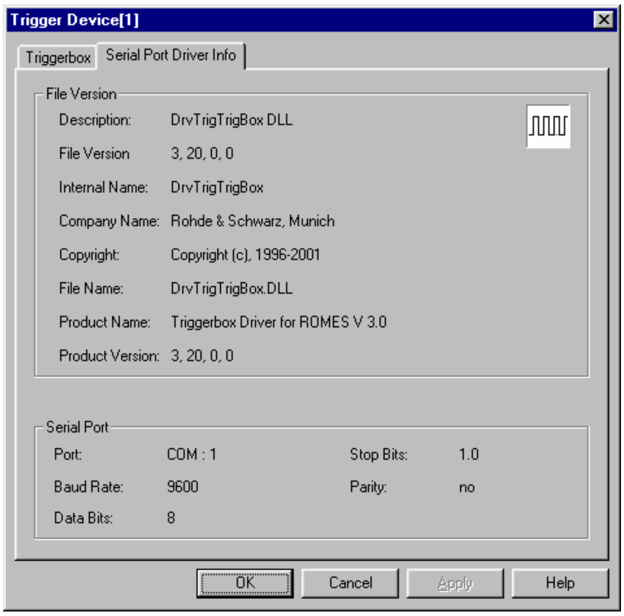


Fig. 6-105 Trigger Box configuration – Serial Port Driver Info

OK Saves all settings made in the *Driver for Trigger Device* configuration menu and closes the menu.

Cancel Discards all settings made in the *Driver for Trigger Device* configuration menu and closes the menu.

Trigger Box (TSMx, internal)

The *Triggerbox* tab defines the calibration factor for the wheel trigger. The user distance signal is provided automatically in TSMx devices.

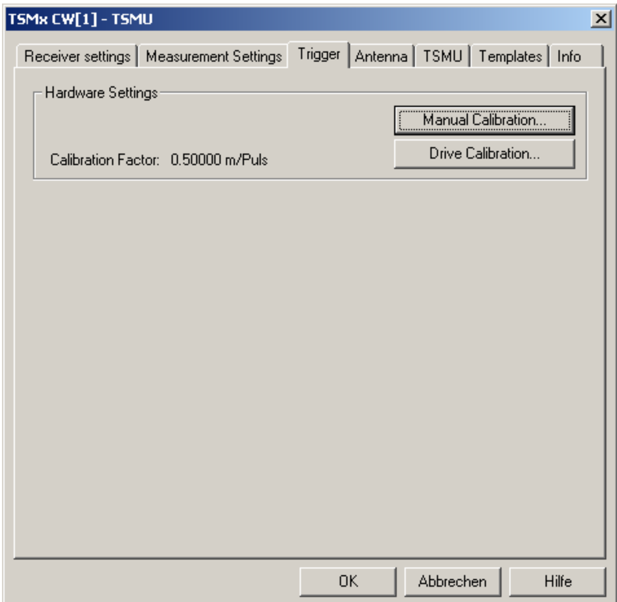
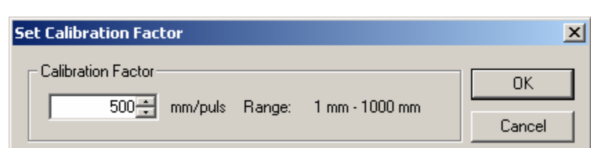


Fig. 6-106 Trigger Box driver configuration (for TSMx-CW with internal triggering)

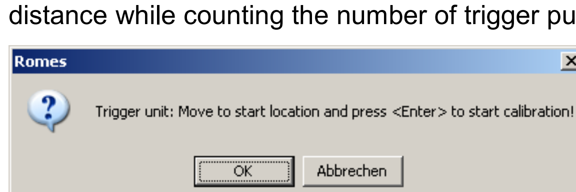
Hardware Settings

The *Hardware Settings* panel indicates the current *Calibration Factor*. The calibration factor is needed to convert the trigger pulse scale into a length/distance scale for *Wheel triggers* (see p. 6.160).
The calibration factor can be defined in two different ways:

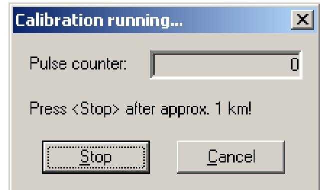
Manual Calibration The calibration factor (distance driven in mm per trigger pulse) is entered manually. This option is suitable if the calibration factor is known; otherwise a *Drive Calibration* must be performed.



Drive Calibration The calibration factor (distance driven in mm per trigger pulse) is determined experimentally by driving a particular distance while counting the number of trigger pulses.



The procedure is identical with the calibration from the *Measurement Settings* tab of the driver configuration menu.



The running *Drive Calibration* pulse counter is shown during the actual calibration. The pressing of the *Stop* button determines the applicable calibration factor.

Action Menu

The *Action* menu controls the *Manual Tracking* mode (for ESVx, SBR or TS55-R2 receivers) and configures the *Trigger Device*. It is added to the menu bar as soon as a mobile driver has been successfully installed (see section *Driver Installation* on page 6.1 ff.). If several test receivers are connected, a separate command line is displayed for each of them.

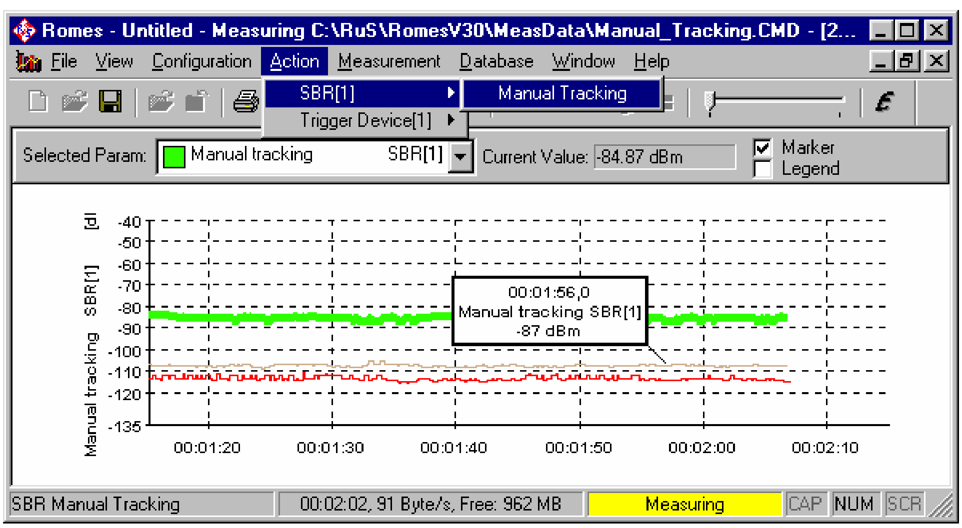


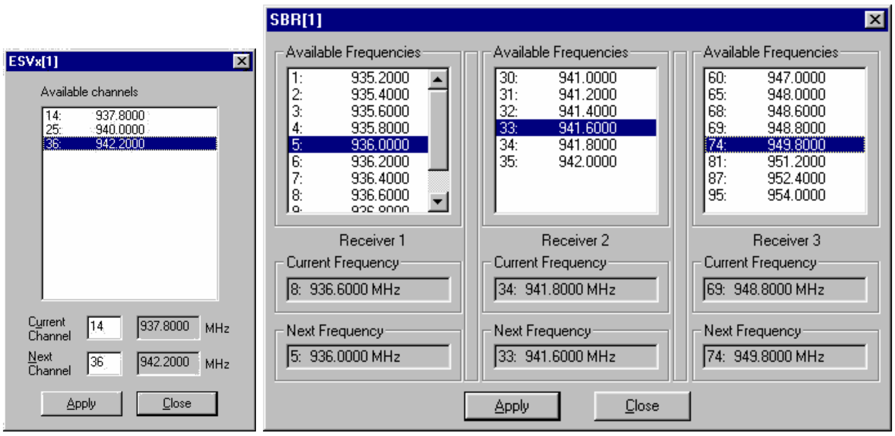
Fig. 6-107 Action menu (test receiver drivers)

Manual Tracking

Controls the *Manual Tracking* mode for ESVx, ESPI, SBR, TS55-R2 or TSMx receivers.

Manual Tracking is a test mode where the receiver can change between several measurement channels listed in a frequency/channel list (see p. 6.157). *Manual Tracking* must be activated in the *Measurement Settings* tab of the driver configuration menu where also a channel list can be defined.

The *Manual Tracking* command in the *Action* menu opens then a menu to change the current measurement channel:



Below the list of *Available Channels/Frequencies*, the *Current Channel/Frequency* and the selected channel (that is to become the *Next Channel/Frequency)* is indicated. The measurement is continued on the *Next Channel* after the *Apply* button is pressed.

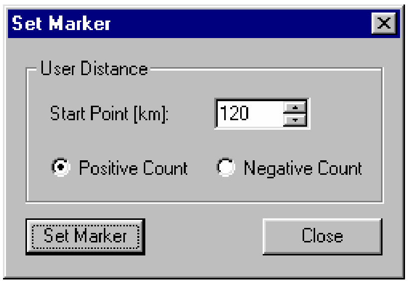
A message in the *General Status View* indicates when the channel was changed. The current measurement frequency can be viewed in the *CW Tracking Info View*. Moreover, *Manual tracking* is indicated in the list of available signals within the *2D Chart View* and *Alphanumeric View* configuration menus. The figure Fig. 6-18 above shows an example for displaying a *Manual tracking* signal in a *2D Chart View.*

Trigger Device – Set Marker

Changes the reference point *(Start Point)* or direction of the user distance.

The *User Distance* is a generalized distance signal with a finite number of marker points where the distance values may jump and/or change their direction. Unlike the real distance the *User Distance* is a composite signal that globally does not have to follow a continuous and monotonic ascending or descending curve. However, in each section between two consecutive marker points, the *User Distance* is a linear (ascending or descending) function of the real distance.

The *Trigger Device – Set Marker* command opens the *Set Marker* dialog box to define a new section of the *User Distance* signal during the measurement:



Start Point [km]	Definition of a (new) reference/start point for the user distance.
Positive Count/ Negative Count	The values in the new user distance section are counted in ascending (positive)/descending (negative) order.

Set Marker Define the current position during the measurement as a marker for the *User Distance* signal and close the *Set Marker* dialog. The next section of the *User Distance* will start with the settings made in the *User Distance* panel.

Close Close the *Set Marker* dialog without defining a new marker.

R&S Test Receiver Calibration

To ensure the accuracy of CW and C/I measurements, the Rohde & Schwarz test receivers provide different calibration methods. The CW level calibration can be performed for all receiver types (ESVx, ESPI, TS55-R2 and SBR); the IF and C/I Level calibration is only used for C/I measurements and therefore not defined for the ESPI receiver.

The following section give an overview of the calibration methods.

Note:
It is recommended to create backups of the calibration files (i.e. in a separate directory), especially of the ones where a generator (SME, SMHU) is required for the calibration.

CW Level Calibration

A CW level calibration ensures the accuracy of a general CW measurement. The calibration method differs according to the Rohde & Schwarz receiver type.

ESVx/ESPI Two different calibration types are provided:

- The short calibration can be done with the ESVx and ESPI driver, see ROMES operating manual, or with the ESVx itself.
- The total calibration is only necessary if the short calibration indicates it (i.e. the message “CAL TOTAL required” at the ESVx front panel display is shown).

For more information on both calibration types see ESVx operating manual.

Calibration	**Equipment required**	**Calibration file(s)**
Short calibration	ESVx / ESPI (+ ROMES ESVx/ESPI driver)	–
Total calibration	ESVx / ESPI	–

TS55-R2 (two-channel receiver) A CW level calibration of the TS55-R2 is mandatory when the TS55-R2 device driver for CW measurements is used for the first time. The system prompts with an error message if no calibration file is found when the driver is loaded. The matching calibration file is identified by the receiver serial number in the file name; see below.

The calibration will automatically be performed for both receiver modules and all available frequency ranges. It can be started from the driver menu, see *Calibrate... (TS55-R2)* on p. 6.162.

Calibration	Equipment required	Calibration file(s)
CW level calibration	TS55-R2 + ROMES TS55-R2 driver + SME/SMHU via IEEE	\ROMES[9]\Driver**C2_xxxxxxxx.CAL** xxxxxxxx = serial no. of TS55-R2

SBR (three-channel receiver, TS55-RX) The CW level calibration of the TS55-RX is only required if the additional Sensitivity Board TS-SENS is used, as otherwise only the interference measurement is allowed.

IF and Level Calibration for C/I Measurements

IF and C/I level calibrations are only used for C/I measurements (ROMES-GS). The calibration method differs according to the Rohde & Schwarz receiver type. The ESPI cannot be used for C/I measurements.

ESVx: IF calibration With the installation of ROMES, two general purpose IF calibration files are copied to the ROMES program directory:

IF_R_E1G.PHF

IF_R_E1D.PHF

R: Receiver

E1: ESVx #1

G: GSM900 frequency band

D: DCS/GSM1800 frequency band

These calibration files will do in general, however, for maximum accuracy an additional IF calibration of the ESVx can be performed. Whenever this is desired, remove the default calibration files before starting the Transmitter Scan, and the calibration will start automatically (shown by gray instead of colored bars in the K7 Transmitter Scan view.

Calibration	Equipment required	Calibration file(s)
IF calibration	ESVx + ROMES C/I driver + PCS1/2 boards	\ROMES[9]**IF_R_E1G.PHF** \ROMES[9]**IF_R_E1D.PHF**

[9] The directory name \ROMES\ is just an alias for the ROMES program directory name defined during the setup procedure.

ESVx: C/I level calibration

The signal level is displayed in the K7 Transmitter Scan view. In general the most important information is about detected interferences, so a medium accuracy concerning the level is sufficient. However, to obtain maximum accuracy, a C/I level calibration can be performed – which is different from the CW measurement calibration.

For this calibration, an R&S SME generator is required. It will be controlled by the ROMES C/I driver via an RS232 interface. See section *Configuration Menus* on p. 6.269 ff. for more information.

After the calibration, a file is created in the ROMES program directory:

LC_R_E1.PHF

LC: Level Calibration

R: Receiver

E1: ESVx #1

This calibration file contains information for all supported GSM frequency ranges (GSM900, 1800 and 1900), depending on the used receiver.

Calibration	Equipment required	Calibration file(s)
Level Calibration LC	ESVx + ROMES C/I driver + PCS1/2 boards + SME via RS232	\ROMES[9]\ **LC_R_E1.PHF**

TS55-R2 / SBR: IF calibration

There are no default calibration files, so this calibration is mandatory. After calibration the following files will be created in the ROMES directory:

IF_R_31G.PHF

IF_R_31D.PHF

R: Receiver

31: Three Channel Receiver, Receiver #1

G: GSM900 frequency band

D: DCS/GSM1800 frequency band

Note:
The procedure is the same for both TS55-R2 and SBR, the calibration files have the same names (i.e. there is no IF_R_21G.PHF for the 2-channel receiver TS55-R2).

On both receivers TS55-R2 and SBR only the first receiver module is used for C/I measurements, so there are no calibration files for the other modules.

Calibration	Equipment required	Calibration file(s)
IF calibration	TS55-R2 / TS55-RX + ROMES C/I driver + PCS1/2 boards	\ROMES[9]\ **IF_R_31G.PHF** \ROMES[9]\ **IF_R_31D.PHF**

Conditions for IF calibration

Each GSM band must be calibrated separately. Therefore the calibration can be started only if the following conditions are met:

- A GSM900 or GSM1800 single-band BTS data base has been loaded
- A single-band channel range (1 to 124 or 512 to 885) has been selected in the C/I driver configuration menu.

Monitoring the calibration

The status of the IF calibration can be monitored in several views:

- The *Message View* displays information about the progress of the calibration.
- The bars in the *K7 Transmitter Scan View* are gray if no IF calibration has been performed. They are colored as soon as the calibration has been terminated.

TS55-R2 / SBR: C/I level calibration

The signal level is displayed in the K7 Transmitter Scan view. In general the most important information is about detected interferences, so a medium accuracy concerning the level is sufficient. However, to obtain maximum accuracy, a C/I level calibration can be performed – which is different from the CW measurement calibration.

For this calibration, an R&S SME generator is required. It will be controlled by the ROMES C/I driver via an RS232 interface. See section *Configuration Menus* on p. 6.269 ff. for more information.

After the calibration, a file is created in the ROMES program directory:

LC_R_31.PHF

LC: Level Calibration

R: Receiver

31: Three Channel Receiver, Receiver #1

This calibration file contains information for all supported GSM frequency ranges (GSM900, 1800 and 1900), depending on the used receiver.

Note:
The procedure is the same for both TS55-R2 and SBR, the calibration files have the same names (i.e. there is no IF_R_21G.PHF for the 2-channel receiver TS55-R2).

On both receivers TS55-R2 and SBR only the first receiver module is used for C/I measurements, so there are no calibration files for the other modules.

Calibration	**Equipment required**	**Calibration file(s)**
Level Calibration LC	ESVx + ROMES C/I driver + PCS1/2 boards + SME via RS232	\ROMES[9]**LC_R_E1.PHF**

UMTS PN Scanner Driver

The UMTS PNS (Pseudo Noise Scanner) driver controls a R&S FSP spectrum analyzer, a R&S ESPI test receiver, or the R&S TSMU/TSML-W radio network analyzers in order to alternate between UMTS Pseudo Noise (PN) scans and a spectrum analysis.

In an UMTS PN scan, the test devices measure and identify all UMTS downlink (Node B) signals in the air. The spectrum analysis consists of a frequency sweep over a specified range to detect arbitrary UMTS downlink and uplink signals.

Installation of the driver is explained in section *Driver Installation* on page 6.1; its configuration is explained below. The UMTS PN data can be viewed in the *UMTS PNS Views* (see chapter 3). Some measurement examples using the UMTS PN Scanner are outlined in chapter 2.

Resources Configuration

The UMTS PNS driver is installed by selecting *UMTS PN Scanner – R&S PNS* in the *ROMES Hardware Configuration* window (see *Fig. 6-1* on page 6.1).

A *Device Chooser* dialog is opened when the UMTS PNS driver is loaded. The *Device Chooser* is used to select the test device and to define the essential connection parameters, if necessary.

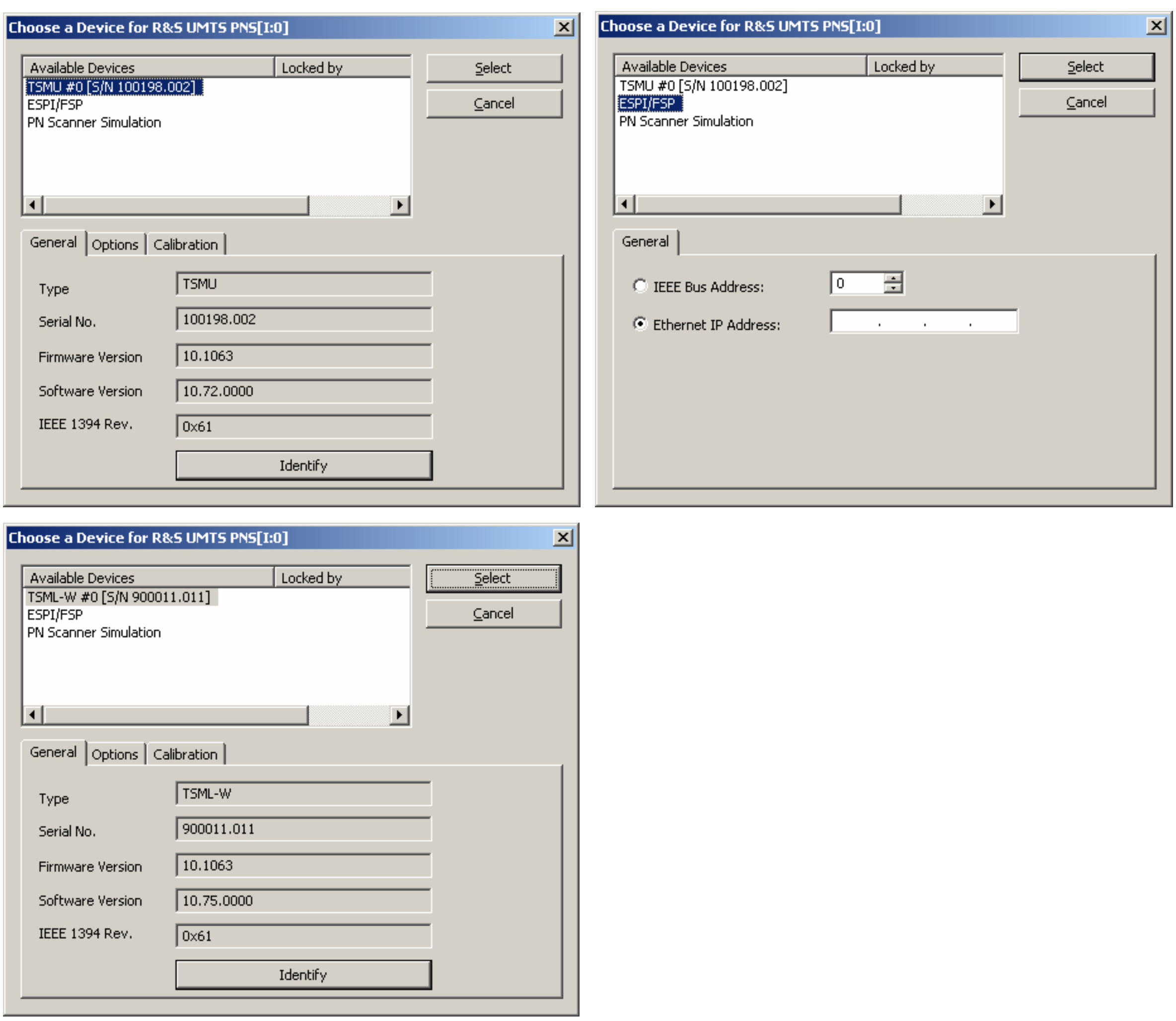
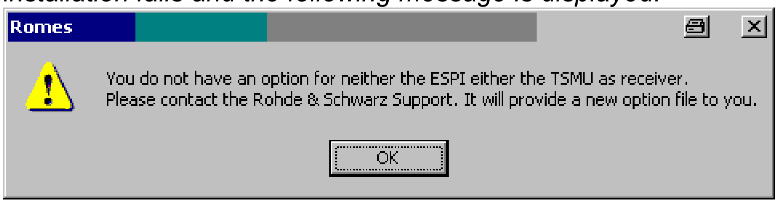


Fig. 6-108 UMTS PNS Device Chooser

The tabs on the *Device Chooser* dialog contain subsets of the receiver setting tabs described in section *Configuration Menus* below.

Note:

After an upgrade from an older version to ROMES V3.23 or higher, it is possible that the PNS driver installation fails and the following message is displayed:



To install the UMTS PNS driver, simply replace your current option.dat file by a new one provided by Rohde & Schwarz. No restart of ROMES or reinstallation is required.

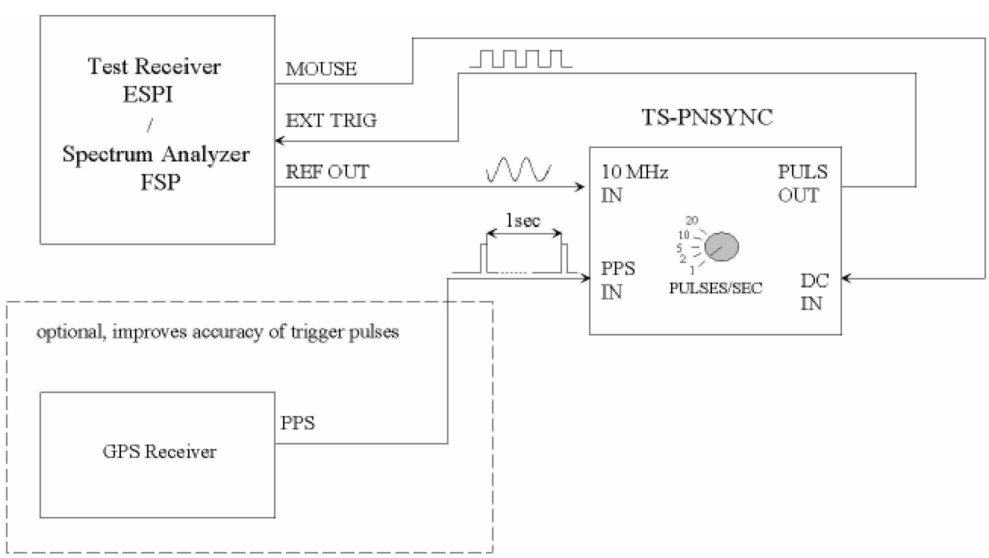
<table>
<tr>
<td>ESPI, FSP</td>
<td>
The resources needed are identical for the FSP spectrum analyzer and the ESPI test receiver; they are listed in section Resources Configuration on p. 6.148 ff. (see paragraph on ESPI Driver). No Trigger Box is needed, however, the Synchronization Unit for UMTS PN Scanner TS-PNSYNC must be used instead to provide an external trigger signal to the FSP or ESPI.
TS-PNSYNC is an external trigger device that divides and converts the 10-MHz reference frequency from the test instrument (FSP or ESPI) into a TTL trigger signal with 1, 2, 5, 10 or 20 pulses per second. The trigger signal is fed back to the external trigger input EXT TRIG of the test instrument. The trigger device can be power-supplied by the 5 V DC current from the MOUSE connector of the FSP or ESPI. The test setup is shown below.


Fig. 6-109 Test setup for UMTS PN Scanner with TS-PNSYNC
The performance and accuracy of the UMTS PN Scanner measurement can be improved by adding a high-precision PPS (pulse per second) signal from a GPS receiver (e.g. GINA, Trimble Placer).
</td>
</tr>
</table>

TSMU/TSML-W   	The TSMx devices must be connected to the controller via one of the Firewire interfaces (IEEE1394) on the rear panel. No external trigger unit is needed, however, the performance and accuracy of the UMTS PN Scanner measurement can be improved by adding a high-precision PPS (pulse per second) signal from a GPS receiver (e.g. GINA, Trimble Placer). The synchronization mode *(Time Base)* is selected in the *Measurements* tab of the driver configuration menu (*TSMx Advanced Settings)*. The PPS signal from the GPS receiver is directly fed to the BNC connector labeled *PULSE IN* at the rear panel of the TSMx. No additional synchronization unit is required. TIP *The TSMx operating manual and an installation tool for the Firewire Interface is provided on the ROMES CD-ROM. Refer to the directory Firmware & Drivers\R&S RF Receivers\TSMU. See also the paragraph about the* *Firewire Driver on p. 6.11.*

Configuration Menus

ROMES provides a configuration menu for the UMTS PNS driver that is opened by clicking the *RS UMTS PNS[1]* command line in the *Configuration* menu. The command line is available as soon as the driver has been loaded.

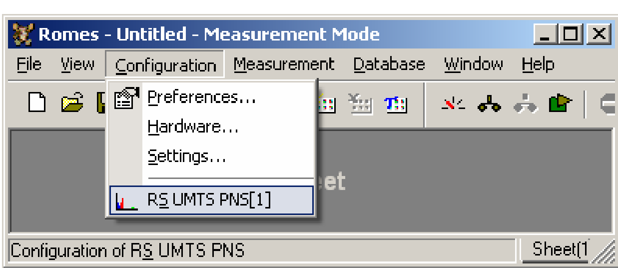


Fig. 6-110 Accessing the UMTS PNS driver configurations

The UMTS PNS driver configuration menu contains several tabs to display information on the test receiver driver *(Info),* configure the *Receiver* and the two alternate *Measurements,* define *Top N* pools to be scanned, load driver *Templates,* and specify *Antenna* settings.

Receiver settings

The *Receiver* tab selects the type of connection, the receiver address and the frequencies measured in an UMTS PN scan.

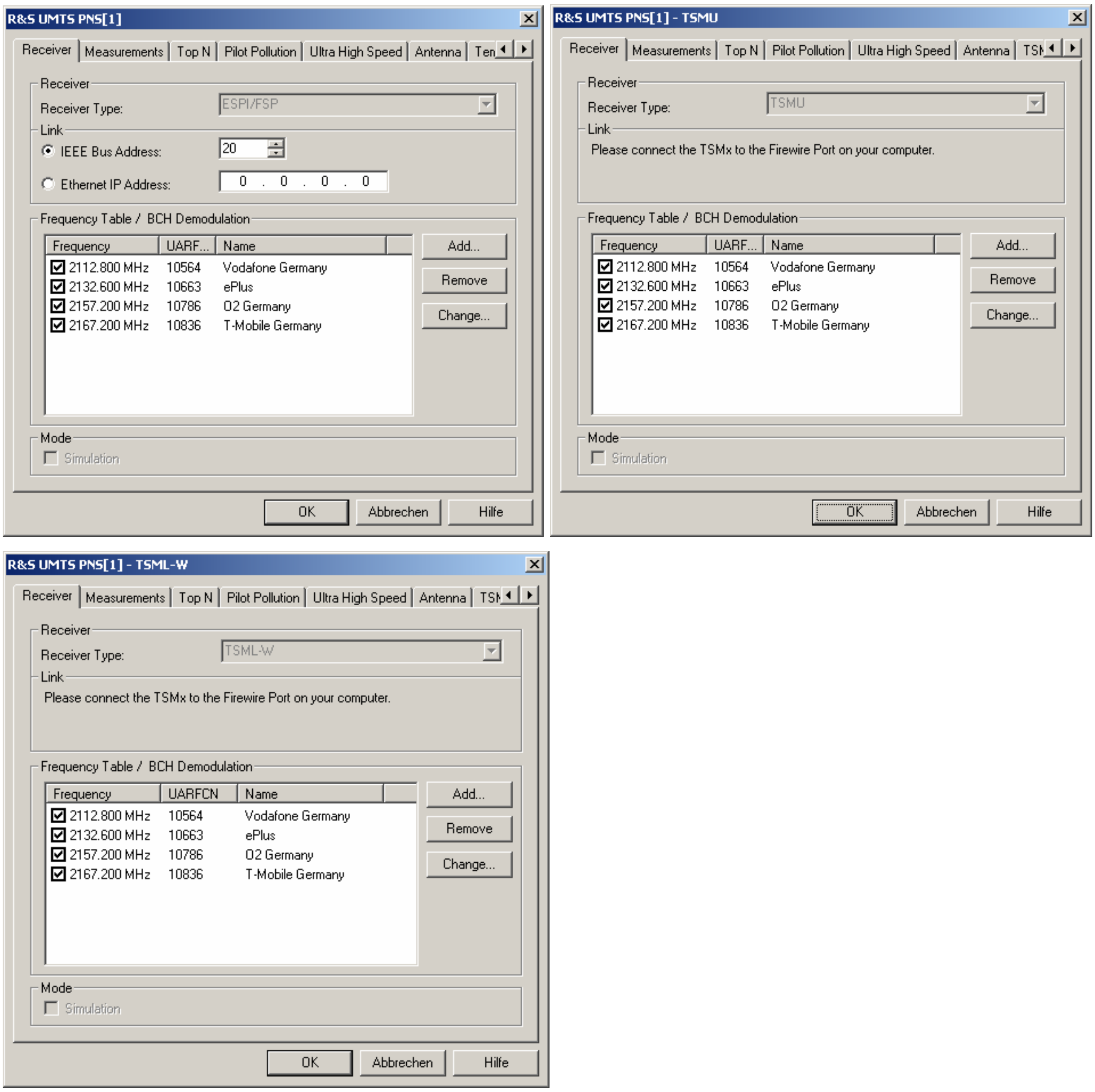


Fig. 6-111 UMTS PNS configuration – Receiver (ESPI/FSP, TSMU, and TSML-W)

Receiver type

The UMTS PNS driver depends on the test receiver type *(ESPI/FSP, TSMU, TSML-W, or Simulation* mode). The receiver type is selected in the *Device Chooser* dialog which is opened during driver installation (see p. 6.21). In the *Receiver Type* field it is only displayed for information.

The ESPI/FSP and TSMU/TSML-W driver versions differ in a few settings in the *Receiver* and *Measurements* tab; moreover the TSMU additionally provides the *Ultra High Speed* mode. Note that the TSML-W does not support the *Ultra High Speed* mode. The measurement results are equivalent for all test instruments.

Link (ESPI/FSP) The two *Link* radio buttons select the interface used for the connection of the test instrument and the IEC/IEEE bus address (for a connection via IEC/IEEE-bus interface) or IP address (for a connection via Ethernet/LAN interface; see paragraph entitled *Allocating a valid IP address* on p. 6.9). The LAN interface is provided as an option for both the FSP spectrum analyzer and the ESPI receiver (option FSP-B16, LAN Interface).

A TSMU/TSML-W analyzer is directly connected to the Firewire port of the controller; no address information is needed.

Frequency Table The *Frequency Table* displays a selection of predefined channels to be measured. The WCDMA-related channel frequencies are in the nominal UMTS downlink band, depending on the WCDMA band (1 to 9) or the channel frequency can be defined freely from 80 to 3000 MHz. The channel frequencies differ by the UMTS carrier spacing of 5 MHz:

- All WCDMA Bands (I – IX) and free configurable measurements on one TSMU

WCDMA Band	Uplink (MHz) (Spectrum)	Downlink (MHz) (Spectrum & Measurement)
I	1920 – 1980	2110 – 2170
II	1850 – 1910	1930 – 1990
III	1710 – 1785	1805 – 1880
IV	1710 – 1755	2110 – 2155
V	824 – 849	869 – 894
VI	830 – 840	875 – 885
VII	880 – 915	925 – 960
VIII	2500 – 2570	2620 – 2690
IX	1750 – 1785	1845 – 1880
Free (10 kHz Resolution)	80 – 3000	80 – 3000

Clicking a checkbox activates the measurement on the associated channel.

Add Opens a dialog for adding a new channel frequency to the table and configure the BCH demodulation (TSMx); see section *Add Frequency / BCH Demodulation* below.

Remove Removes a selected channel from the list.

Change Opens an input field to change the *Name* of the current channel or assign a new name. The *Change* dialog also allows access to the SIB Decoder Settings Menu for the current channel (see *Add Frequency / BCH Demodulation* on p. 6.183). Double-clicking a channel on the frequency table also opens the *Add Frequency / BCH Demodulation* dialog.

Simulation The *PN Scanner Simulation* represents an operating mode where ROMES generates UMTS PN Scanner data and writes it to a measurement file, if so desired. At least one frequency must be activated in the *Frequency* list to run the simulation.

The simulation mode is selected in the *Device Chooser* dialog which is opened during driver installation (see p. 6.21).

Data generation is initiated by the *Start Measurement* or *Start Recording* commands in the *Measurement* menu. The UMTS PN Scanner data can be viewed in one of the *UMTS PNS Views* while the simulated measurement is running. With *Start Recording,* the data is written to a measurement file. The *.cmd measurement file name is generated automatically if this was specified in the Measurement Info field group of the Romes Configuration - General Settings tab (see chapter 3). A comment can be added to the measurement file preamble before the simulated measurement is manually stopped.

The simulated measurement illustrates many aspects and features of the UMTS PN scanner. It can be used for test and demo purposes even if no hardware is available and no real measurement can be performed.

Add Frequency / BCH Demodulation

The *Add Frequency / BCH Demodulation* dialog adds frequencies to the frequency table in the *Receiver* tab (see above) and selects the system information to be demodulated and decoded from the UMTS Broadcast Channel (BCH). For new channels, it is opened by the *Add…* button in the *Receiver* tab of the R&S UMTS PNS driver configuration menu, for existing channels the dialog can be accessed from the *Change…* button on the same tab (or by simply double-clicking the channel on the list).

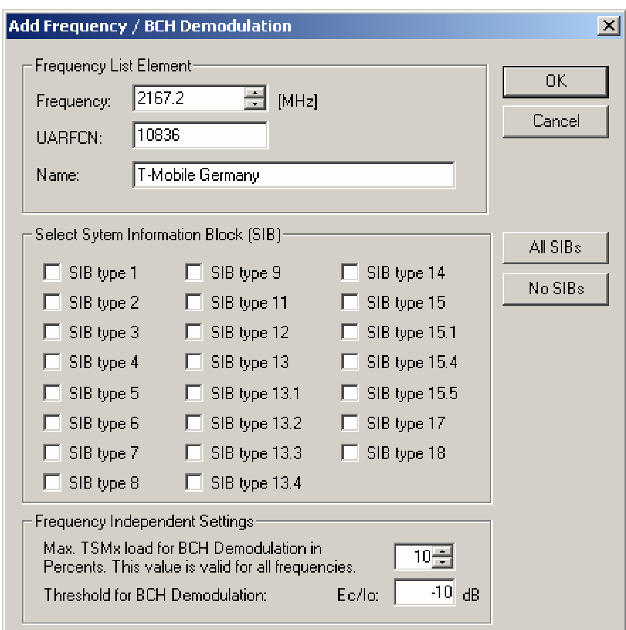


Fig. 6-112 UMTS PNS configuration – Add Frequency/BCH Demodulation

Frequency List Element

Adds frequencies to the frequency table in the *Receiver* tab. It is possible to select frequencies off the nominal UMTS downlink band, however, all frequencies must be in multiples of 0.2 MHz, corresponding to specified UARFCNs (UTRA Absolute Radio Frequency Channel Numbers).

The nominal UMTS bands are listed in chapter 8. The measured frequencies can be selected in the measurement range of the used test device.

Select SIB

The remaining panels in the *Add Frequency / BCH Demodulation* tab are only enabled for a TSMx is equipped with option TSMU-K14, *BCH Demodulation.*

The *Select System Information Block (SIB)* panel provides the SIBs to be demodulated and decoded from the UMTS BCH. Selecting at least one SIB type enables BCH demodulation. If any SIB type is selected, SIB type 3 is also enabled automatically, because it is necessary to determine the Cell Identity (CI). BCH decoding is performance critical, therefore it is recommended to restrict the selection to the SIBs of interest.

Example:
SIB type 11 and SIB type 3 is necessary (and sufficient) for the UMTS neighborhood analysis (with option ROMES-U1); see description of the *UMTS Neighborhood Analyzer View* in chapter 4.

Note:
The SIB contents can be displayed in the PNS BCH View, see chapter 4.

Frequency Independent Settings

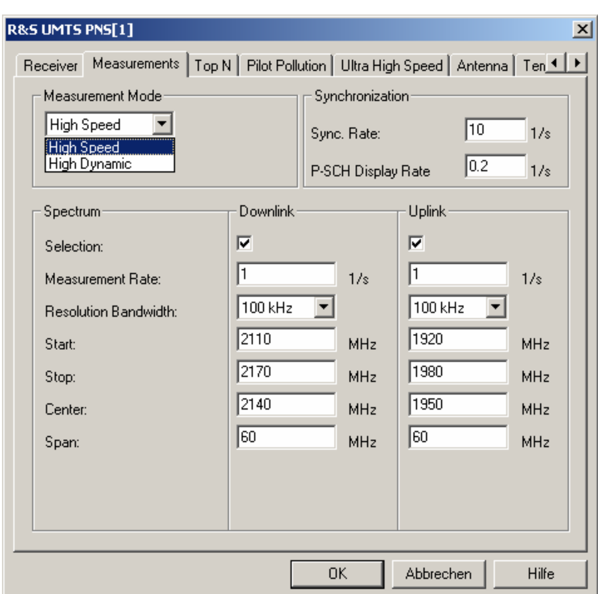
The following settings restrict the system resources reserved for BCH demodulation:

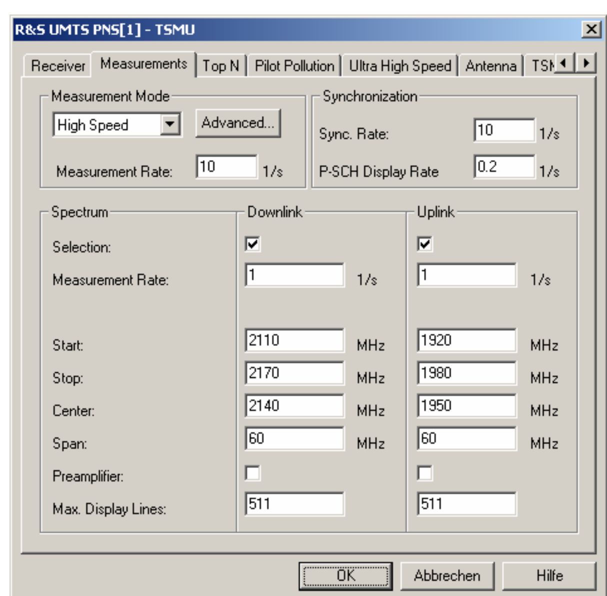
Max. TSMx load… Sets the maximum load that the TSMx reserves for BCH demodulation. The load is expressed as a percentage (between 10% and 50%) of the total TSMx performance. The performance leftover is used for PN Scanning.

Threshold… Defines a minimum signal strength E_c/I_0 for BCH demodulation. Only signals above this threshold will be decoded.

Measurements

The *Measurements* tab defines general measurement settings for the UMTS PN scan and configures the spectrum analysis.





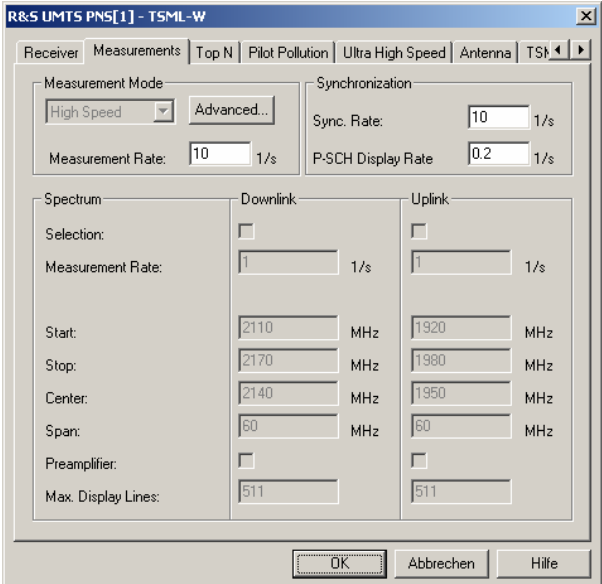


Fig. 6-113 UMTS PNS configuration – Measurements (ESPI/FSP, TSMU and TSML-W)

The test devices (ESPI/FSP and TSMU) alternate between UMTS PN scans that are continuously repeated and single frequency sweeps *(Spectrum* measurements).

- The settings in the *Measurement mode* and *Synchronization* panels are relevant for the UMTS PN scans. Results of the UMTS PN scans are displayed in all PNS views except the *PNS Spectrum View* and in the *PNS Spectrum History View.*
- The *Spectrum* settings configure the spectrum analysis for ESPI/FSP and TSMU. The results are displayed in the *PNS Spectrum View* and in the *PNS Spectrum History View.*

The supported measurement modes for the ESPI/FSP, TSMU and TSML-W test devices are shown in the table below:

	ESPI / FSP	TSML-W	TSMU
High Speed	Yes	Yes	Yes
High Dynamic	Yes	-	Yes
Ultra High Speed	-	-	Yes

Measurement Mode

The controls in the *Measurement Mode* panel define how ROMES processes the baseband (I/Q) data for an UMTS PN scan. The measurement mode has an impact on the measurement speed, the dynamic range, the synchronization procedure and the measured quantities (see also description of *UMTS PNS CPICH View* in chapter 4).

High Speed For ESPI/FSP, TSMU and TSML-W: The analysis is based on a limited amount of data and optimized for fast evaluation

High Dynamic For ESPI/FSP and TSMU: Refined analysis using a larger amount of data, slowing down the measurement but increasing its dynamic range. The SC is determined by correlation with the pilot bits of the CPICH; the *Doppler Offset* frequency is available.

Ultra High Speed For TSMU: Measurement on a single frequency with known scrambling code but with highest measurement rate (up to 333/s). The Ultra High Speed Mode is mainly intended for measuring different echoes of a single Node B signal. It is configured in a special *Ultra High Speed* tab (see p. 6.195). The results can be displayed in the *PNS Rake Finger View* and in the *PNS Rake Finger Chart View* (see chapter 4).

NOTE

In Ultra High Speed mode, the TSMU always uses UMTS Network synchronization, see below.

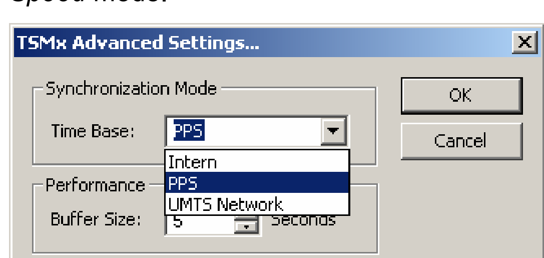
Measurement Mode (TSMU)

The following measurement mode settings are available for the TSMU analyzer only:

Measurement Rate Number of PN scans per second in the range between 0.1 and 20 (in *High Speed* mode) or 0.1 and 1.2 (High Dynamic mode). The actual measurement time is smaller than 1/20 s or 1/1.2 s for all provided test device settings so that even a large measurement rate never blocks the spectrum measurement completely.

In *Ultra High Speed* mode, the TSMU achieves measurement rates up to 333/s, corresponding to a measurement time of 3 ms. At normal vehicle speed the maximum measurement time of 10 ms usually guarantees that the TSMU rake receiver can still trace the signal. A higher measurement rate increases the measurement file.

Advanced… Opens a subdialog to configure additional measurement settings. The settings are not valid for the *Ultra High Speed* mode.



Time Base Signal source providing the time base for the TSMx measurements. The (default) PPS (pulse per second) signal from an external GPS receiver provides maximum accuracy. The time base settings are described in the shaded paragraph *TSMx Time Base* below.

Buffer Size

Time for which the raw measurement data is stored in the TSMx, should ROMES be unable to process it immediately (e.g. due to temporary low performance of the controller). If the ROMES buffer continues to be blocked after the buffer size time, the oldest data in the buffer is deleted and overwritten by new data. Data transfer starts as soon as ROMES is ready again to receive and process data.

A large buffer size increases the probability that no measurement data is lost, even though ROMES may be blocked for an extended time. On the other hand, storage and transfer of large amounts of buffer data increase the possible delay between data recording and evaluation/display in the views.

The buffer size for the *Ultra High Speed* mode can be set independently; see description of the *Ultra High Speed* tab on p. 6.195.

TSMx Time Base

The TSMx must synchronize to a reference signal at the beginning of each measurement. In the UMTS PN scan, the TSMx provides the following methods for synchronization:

PPS

Use *GSM Network* or *PPS* synchronization, if one of these signal types is available. If none of the signals is available, use *Internal* synchronization. If both signal types are available and almost synchronous to each other, use the PPS signal. If both signal types are available but not synchronous, assume that the PPS signal is inaccurate (e.g. because the GPS receiver cannot detect a sufficient number of satellites so that it must use its internal reference signal) and use the GSM signal.

The PPS (pulse per second) signal from an external GPS receiver fed to the *PULSE IN* connector at the rear panel of the TSMx (see section *Resources Configuration* on p. 6.178 ff.) provides maximum accuracy.

In the GSM network scanner driver or CDMA PNS driver, this synchronization mode is referred to as *GSM Network* | *PPS* synchronization. This mode is always used while no measurement is active.

Internal

Synchronization by means of the reference signal generated by the internal quartz oscillator of the analyzer. The internal time base is activated automatically if no PPS signal is available. While a network time base is selected, the network signals constantly correct the frequency and phase of the internal oscillator in order to compensate for a possible drift. If the network signals are affected by a systematic error (e.g. due to a Doppler shift in a moving test vehicle), *Internal* time base can be used to prevent this correction.

UMTS Network

Synchronization by means of approx. 2/3 of the received UMTS signals, discarding the signals with the strongest timing deviation and time drift. This mode remains active as long as the standard deviation of the time drift of all detected (and not discarded) UMTS signals is below 60 ns/s. If this condition is no longer met, or if no UTRAN cell is detected any more, the TSMx automatically switches to *Internal* time base. *UMTS Network* is the recommended setting if no PPS signal is available.

UMTS Network synchronization is always used while the TSMU operates in *Ultra High Speed* mode.

Synchronization

The two input fields in the *Synchronization* panel define how often the system synchronizes to the received UMTS PN signals and updates the measurement file:

Synchronization Rate	Number of synchronization processes per received channel and per second. A low synchronization rate improves the system performance, especially if ROMES receives a large number of channels, at the risk of missing Node B signals that are only received for a short time.
Update Rate for P-SCH View	Rate by which the data for the *PNS P-SCH View* is stored to the measurement file and the view itself is updated. The P-SCH data is always acquired during synchronization so that the update rate must be smaller or equal to the *Synchronization Rate.* A smaller update rate has no impact on the measurement but can considerably reduce the size of the measurement file.
Display Update Rate	Rate by which the results in the *PNS Rake Finger View* and the *PNS Rake Finger Chart View* are updated if the TSMU operates in *Ultra High Speed* mode. A high update rate prevents sudden jumps of the traces in the *PNS Rake Finger Chart View* but requires a higher system performance.

Spectrum (ESPI/FSP and TSMU)

The input fields in the *Spectrum* panel configure the single frequency sweeps for the spectrum analysis and defines how often they are repeated, interrupting the UMTS PN scan. The parameters for downlink and uplink signal measurements can be set independently; their frequency ranges may overlap.

Selection	Enables (if checked) or disables the data entry for the downlink or uplink.
Measurement Rate	Number of sweeps per second in the range between 0.1 and 20. The actual sweep time is smaller than 1/20 s for all provided test device settings so that even a large measurement rate never blocks the UMTS PN scan completely.
Resolution Bandwidth	Bandwidth of the IF resolution filter of the analyzer or receiver. Possible bandwidths can be selected from a pull-down list.
Start/Stop/Center/Span	Definition of the measurement range/sweep range of the analyzer or receiver. The sweep range is a continuous frequency interval which is either defined by a *Start* and *Stop* value or by a *Center* frequency and *Span. Start/Stop* and *Center/Span* are alternative settings and overwrite each other according to: *Center = (Start + Stop)/2* *Span = Stop – Start* (must be positive) Depending on the sweep range, the test device automatically sets the number of sweep points and their position.

The following settings are provided for the TSMU:

Preamplifier	Switches the preamplifier in the TSMU on or off.
Max. Display Lines	Sets the number of displayed measurement points per sweep and thus the frequency resolution of the measurement curves in the spectrum views. Increasing the value broadens the *Spectrum History View.*

NOTE The maximum frequency resolution of the TSMU is approx. 48 kHz. The *Max. Display Lines* setting is ignored if it results in a frequency resolution beyond this value. At a measurement span of 20 MHz, the maximum number of display lines is 20 MHz / 48 kHz ≈ 420.

Top N

The *Top N* tab defines the top N pools to be evaluated in the *PNS Top N View;* see chapter 3. Top N pools also appear in the data tree so they can be analyzed in general ROMES views, e.g. in the *Alphanumeric View*, the *2D Chart View*, the *Route Track View,* and the *Statistic Histogram View*.

Definition:

Suppose that, at a given position and time, a test device receives several UMTS downlink signals from different Node Bs. The ***Top N*** *signals are the N (N = 1,2,...) signals with the strongest P-CPICH level. A* ***Top N Pool*** *contains up to N Node Bs with specific characteristics providing the strongest P-CPICH level at a given position and time.*

Top N and *Top N Pool* are dynamic concepts: The signal level from a specific Node B varies in time and according to the measurement position. The elements of a top N pool are exchanged accordingly and even their number may change, if the system detects less than N signals.

On loading the UMTS PNS driver, ROMES generates a default top N pool with the following properties:

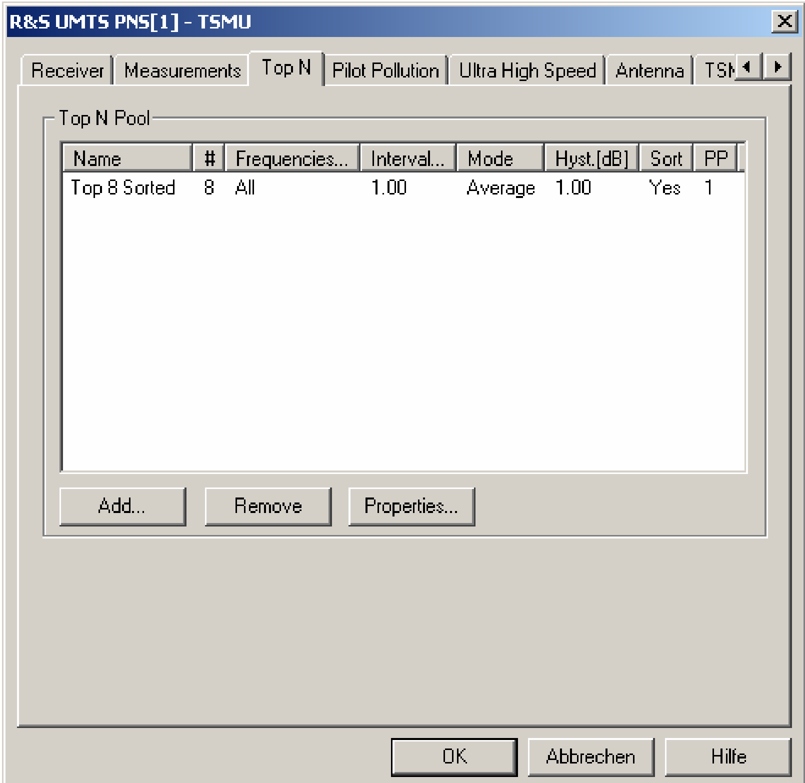
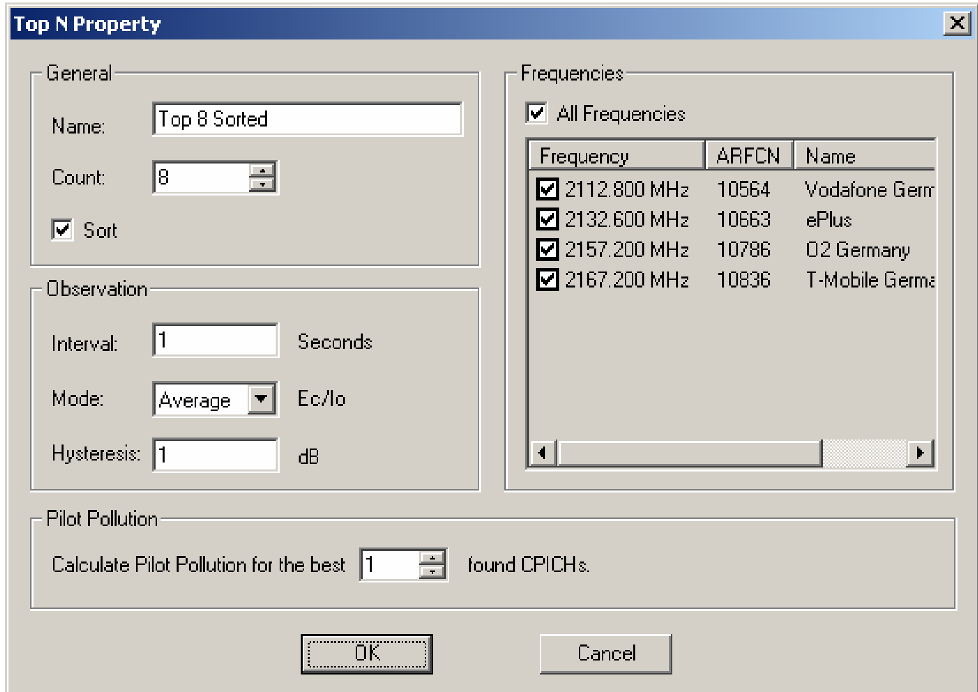


Fig. 6-114 UMTS PNS configuration – Top N

Top N Pool Table of the defined top N pools with their *Name,* the (maximum) number of elements (#), the allowed *Frequencies,* and the update and sorting criteria. The parameters are set when a new pool is created *(Add)* or when a selected pool is changed *(Properties)*; see below.

Add Opens the *Top N Property* dialog to generate a new top N pool:



The following parameters are set in the *General* panel:

Name Name of the top N pool. The name identifies the pool in the views and in the data tree, so it is worth selecting meaningful names

Count Maximum number N of elements/Node Bs in the top N pool. The actual number of elements can fall below N and vary if the system is not able to detect and analyze enough signals.

Sort In an unsorted pool (box unchecked), the elements remain at fixed positions unless they are replaced by a new element with a stronger CPICH. Unsorted pools are suitable for monitoring a Node B or a fixed set of Node Bs for an extended period of time; they are particularly easy to monitor in graphical diagrams where fixed positions always correspond to the same Node Bs.

In a sorted pool (box checked), the elements are sorted according to their CPICH signal strength. The positions are re-distributed after each update, according to the current signal strengths. Sorted pools are suitable for monitoring or comparing signals with definite strength, e.g. the strongest and second-strongest signal along a measurement tour, irrespective of the transmitting Node Bs.

The parameters in the *Observation* panel define the update and sorting criteria for the top N pool:

Interval Moving evaluation period for the average or maximum of the quantity Ec/Io (CPICH) for all signals. The average or maximum value is re-calculated and the pool is updated every time the system receives new UMTS PN scan data. All Ec/Io values received within the evaluation *Interval* before the current time enter into the calculation. Large evaluation *Intervals* tend to stabilize the pool by delaying the exchange of pool elements.

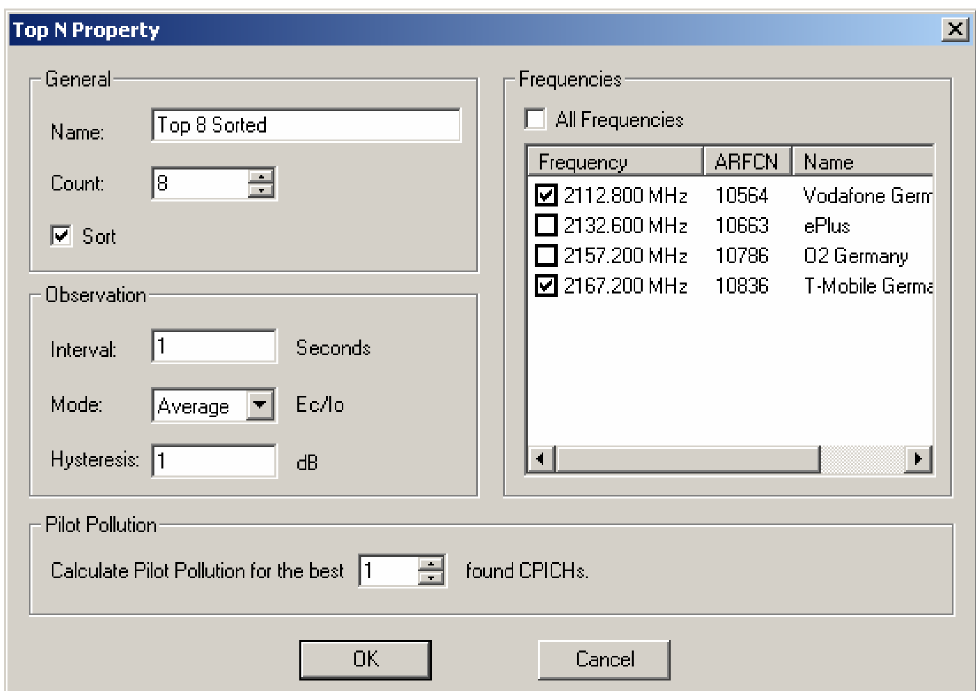
Mode Update and sorting criterion for the pool: *Average* or *Maximum* value of Ec/Io (CPICH) in the moving evaluation *Interval.* Ec/Io (CPICH) is the ratio of the received energy per PN chip for the P-CPICH to the total transmit power spectral density; see also section *PNS CPICH View* in chapter 4.

Hysteresis Minimum level difference between the Ec/Io of a pool candidate and the lowest Ec/Io in the pool. A pool candidate becomes a pool element and replaces a previous element if

Ec/Io (candidate) $\geq$ *Ec/Io (previous)* + *Hysteresis*

A large hysteresis stabilizes the pool, preventing elements from being replaced because of small fluctuations in the measurement results.

Frequencies The *Frequencies* panel shows all frequencies selected for measurement in the *Frequency Table* of the *Receiver* tab. It is possible to select *All Frequencies* in the list or only a number of specific frequencies, e.g. to generate a pool with Node Bs from a particular provider, as shown below:



Pilot Pollution The *Pilot Pollution* panel contains an input field to select the number of reference CPICHs for which a pilot pollution analysis is performed (see *Pilot Pollution* tab below). The pilot pollution if always calculated for the k signals in the top N pool with the strongest P-CPICH level, where $0 \leq k \leq N$. A selected number $k > N$ is replaced by N upon pressing *OK.*

Remove Removes the current *Top N* from the *Top N Pool. Remove* is disabled while no *Top N* is selected.

Properties Opens the *Top N Property* dialog showing the properties of the current *Top N. Properties* is disabled while no *Top N* is selected. The properties of the current *Top N* can be edited and changed.

Pilot Pollution

The *Pilot Pollution* tab defines the thresholds for the calculation of the Hard Pilot Pollution (HPP) and the Soft Pilot Pollution (SPP). HPP and SPP are weighted sums of the Received Signal Code Powers (RSCP) of all measured CPICHs relative to a reference CPICH signal and thus a measure of the potential interference/pollution of the reference CPICH.

The HPP and SPP is indicated in the *PNS Top N View;* see chapter 3. Pilot pollution signals also appear in the data tree so they can be analyzed in general ROMES views, e.g. in the *Alphanumeric View*, the *2D Chart View*, the *Route Track View,* and the *Statistic Histogram View*.

The same thresholds apply to all reference pilot signals selected in the *Top N Property* dialog.

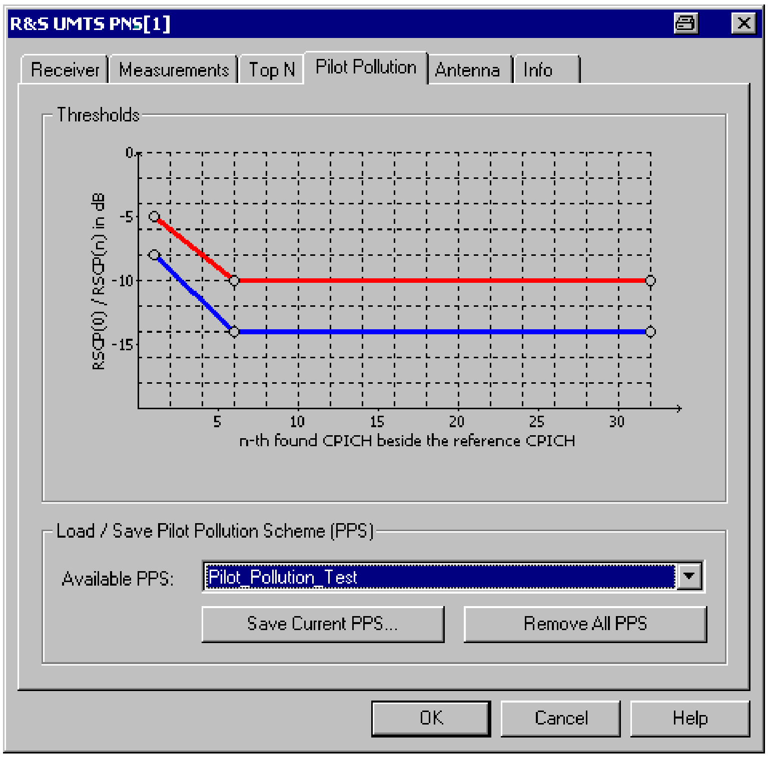


Fig. 6-115 UMTS PNS configuration – Pilot Pollution

Thresholds Graphical representation of the upper threshold T_{high} and the lower threshold T_{low} for the calculation of the pilot pollution. To calculate the pilot pollution for a given reference signal CPICH(0), all other detected CPICHs are sorted according to their signal strength and compared with T_{high} and T_{low} :

HPP(0) is equal to the total number of received channels CPICH(n) (n=1,2,3...) exceeding the upper threshold $T_{high}(n)$.

SPP(0) is equal to HPP(0) plus the sum of all received channels CPICH(n) between the lower threshold $T_{low}(n)$ and the upper threshold $T_{high}(n)$, each weighted by the ratio (RSCP(n) – $T_{low}(n)$) / ($T_{high}(n)$ – $T_{low}(n)$).

Signals below $T_{low}(n)$ contribute to neither HPP nor SPP. This definition shows that HPP(0) $\leq$ SPP(0) irrespective of the reference CPICH and that both quantities are minimized for the strongest CPICH in the top N pool (CPICH(j) > CPICH(k) $\Rightarrow$ HPP(j) $\leq$ HPP(k) and SPP(j) $\leq$ SPP(k)).

Threshold Settings

The thresholds $T_{high}(n)$ and $T_{low}(n)$ are both defined by means of two polygonal curves in the range $1 \le n \le 32$. The cursor shows an A symbol when pausing over one of the circles separating the straight sectors of the curves. It can then be used to drag the circle in vertical direction. Double-clicking a point on a curve inserts a new point or removes the current point. $T_{high}(n)$ and $T_{low}(n)$ can be modified with the following restrictions:

$T_{high}(n)$ must be larger than $T_{low}(n)$ for all n.

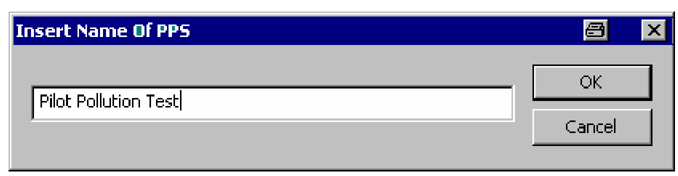
Both functions must be monotonically descending: $n > m \Rightarrow T_{high}(n) \le T_{high}(m)$ and $T_{low}(n) \le T_{low}(m)$.

Load/Save PPS

Once defined in the *Thresholds* diagram, a pilot pollution scheme can be named and stored for later reuse.

Available PPS List of all defined pilot pollution schemes. A selected PPS appears in the *Thresholds* diagram. *OK* applies the selected PPS.

Save current PPS Opens an input box for the name of the current PPS. The saved PPS is added to the list of available PPS.



Remove all PPS Clears the list of available PPS.

Ultra High Speed (TSMU)

The *Ultra High Speed* tab configures the TSMU for a measurement on a single frequency with known scrambling code but with highest measurement rate (up to 333/s). The *Ultra High Speed Mode* is mainly intended for measuring different echoes of a single Node B signal. It must be activated explicitly in the *Measurements* tab of the driver configuration menu. The results can be displayed in the *PNS Rake Finger View* and in the *PNS Rake Finger Chart View* (see chapter 4).

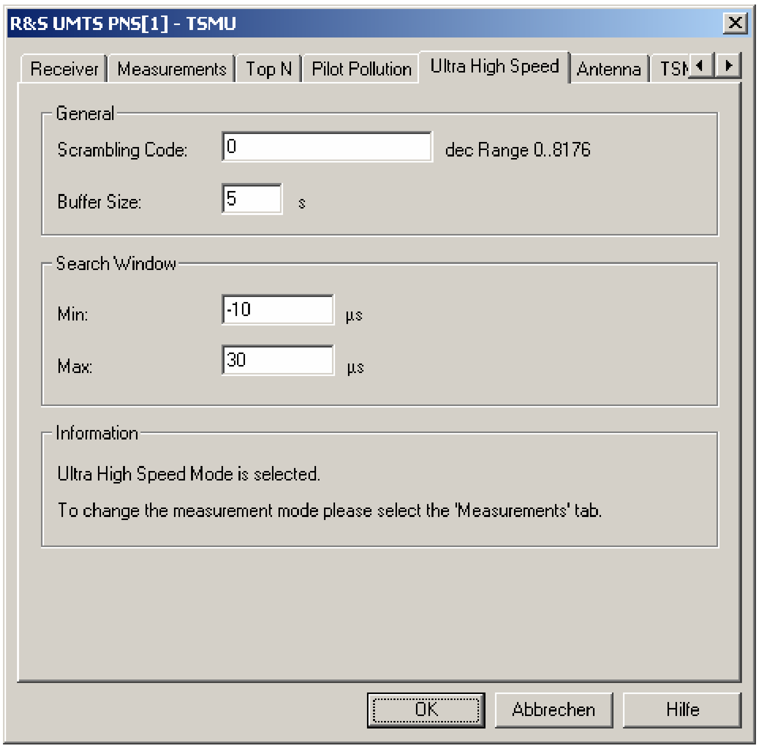


Fig. 6-116 UMTS PNS configuration – Ultra High Speed (TSMU)

General Provides basic measurement settings for the TSMU:

Scrambling Code Scrambling code of the measured cell signal in decimal format.

Buffer Size Time for which the raw measurement data is stored in the TSMU, should ROMES be unable to process it immediately (e.g. due to temporary low performance of the controller). This buffer size is only valid for the ultra high speed mode where it replaces the buffer size in the *Measurement* tab (for a detailed description see *Buffer Size* on p. 6.187).

Search Window Minimum and maximum time delay of the measured echoes relative to the strongest echo. A signal with a negative time delay arrives prior to the strongest echo, which is a typical situation if there is an obstacle in the direct path between the node B transmitter and the receiver. A small search window limits the number of echoes measured.

The maximum number of echoes measured simultaneously is 12. This maximum number decreases for very high measurement rates (8 for 250 Hz, 4 for 333 Hz).

TSMU / TSML-W

The *TSMU / TSML-W* tabs display the properties of the TSMx devices and available options. This information is also displayed in the *Device Chooser* described on p. 6.21.

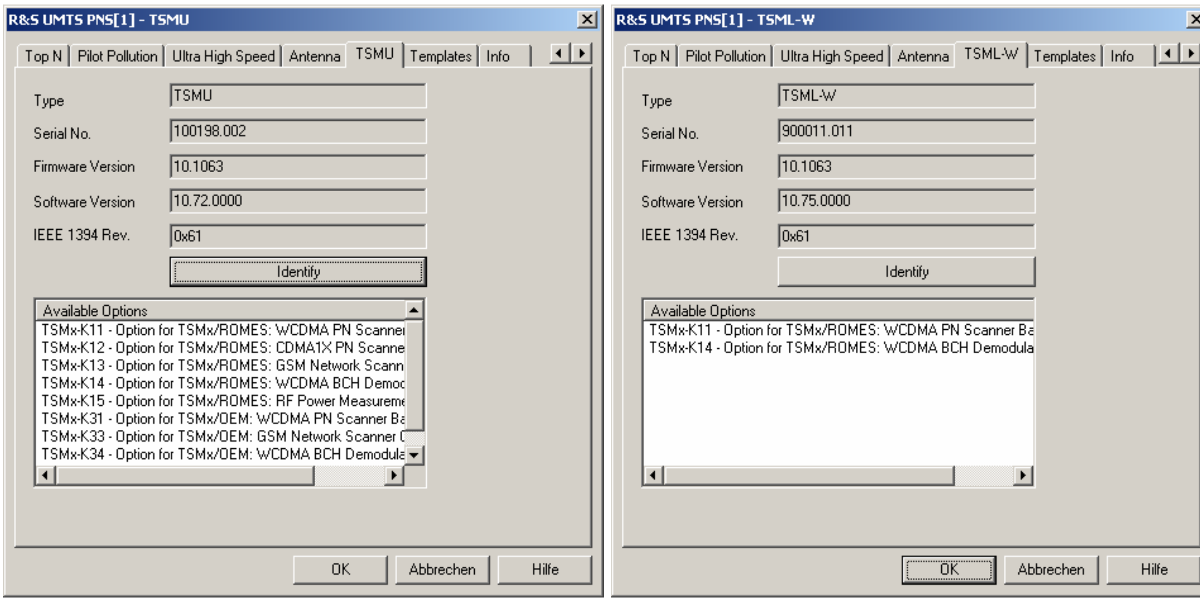


Fig. 6-117 UMTS PNS configuration – TSMU and TSML-W

Templates (TSMU / TSML-W)

The *Templates* tab stores the current TSMU / TSML-W driver configurations as a template, lists, loads or deletes driver templates.

Note:

When a driver is loaded using Configuration – Preferences – Hardware (see section Driver Installation on p. 6.1 ff.) ROMES checks whether a driver template is stored in the Driver Templates directory and its subdirectories (see below). The driver can be loaded with default settings or with the settings stored in any of the templates found.

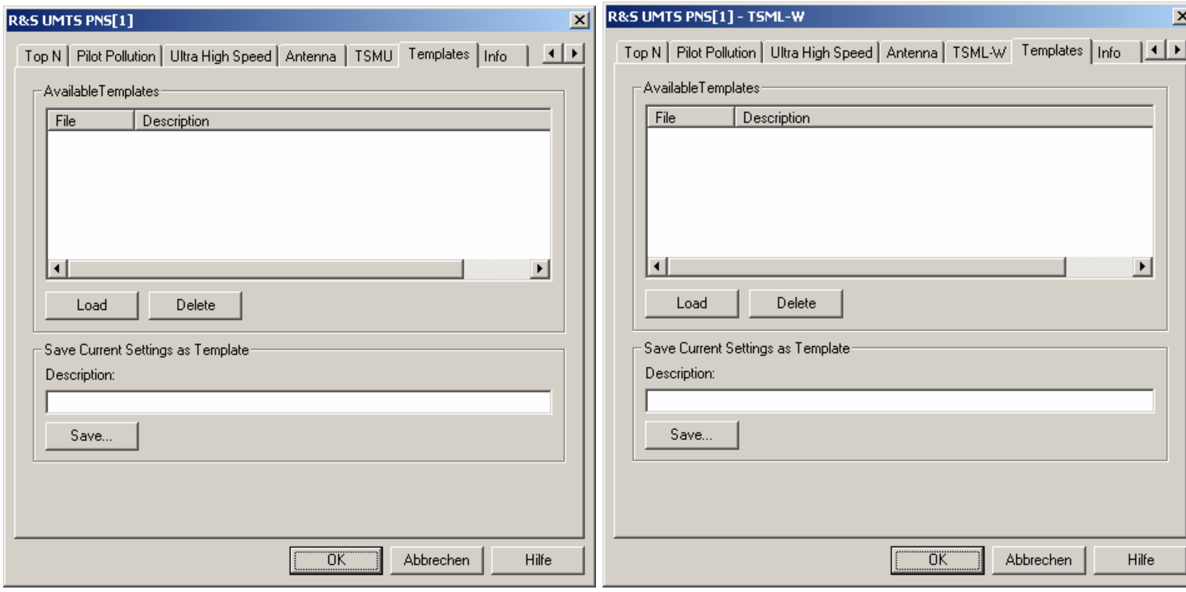
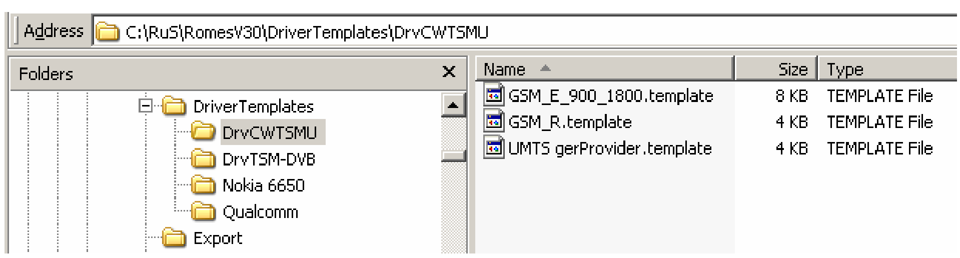


Fig. 6-118 UMTS PNS configuration – Templates

Load/Delete

Loads a driver template or deletes a template displayed in the list of *Available Templates*. Template files are ASCII files with the extension *.template. The template definition is independent of the workspace. A selection of template files for the TSMx is supplied with the ROMES installation:



Save

Saves the current driver settings together with the *Description* to a selected template file.

Antenna

The *Antenna* tab defines *Antenna Name, Antenna Gain* and *Cable Loss*. These values are used to correct the received signal powers:

- If a *Cable Loss* of n dB is specified, the system assumes the received signals to be attenuated by n dB. n dB is added to all measured signal powers so that the displayed results correspond to the unattenuated signal.
- If an *Antenna Gain* of n dB is specified, the system assumes the received signals to be amplified by n dB. n dB is subtracted from all measured signal powers so that the displayed results correspond to the unamplified signal

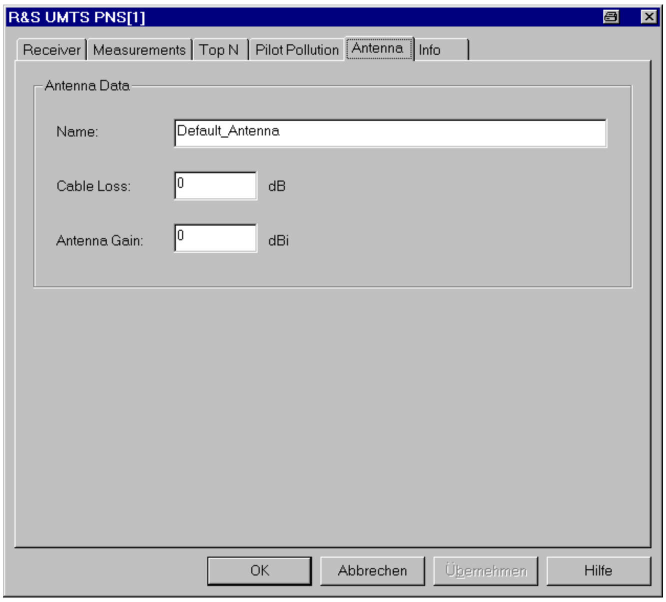


Fig. 6-119 UMTS PNS configuration – Antenna

GSM Network Scanner Driver

The GSM NWS (Network Scanner) driver controls a TSMU / TSML-G radio network analyzer to measure and identify all GSM downlink signals in the air. The driver is available with option R&S ROMES-GS3, *GSM Network Scanner.*

Installation of the driver is explained in section *Driver Installation* on page 6.1; its configuration is explained below. The GSM NWS data can be viewed in the *GSM NWS Views* (see chapter 4). A special export format for GSM NWS data is described in chapter 7.

Resources Configuration

The GSM NWS driver is installed by selecting *GSM NWS – R&S GSM NWS* in the *ROMES Hardware Configuration* dialog (see *Fig. 6-1* on page 6.1).

A *Device Chooser* dialog is opened when the UMTS PNS driver is loaded. The *Device Chooser* is used to select the test device and the necessary options.

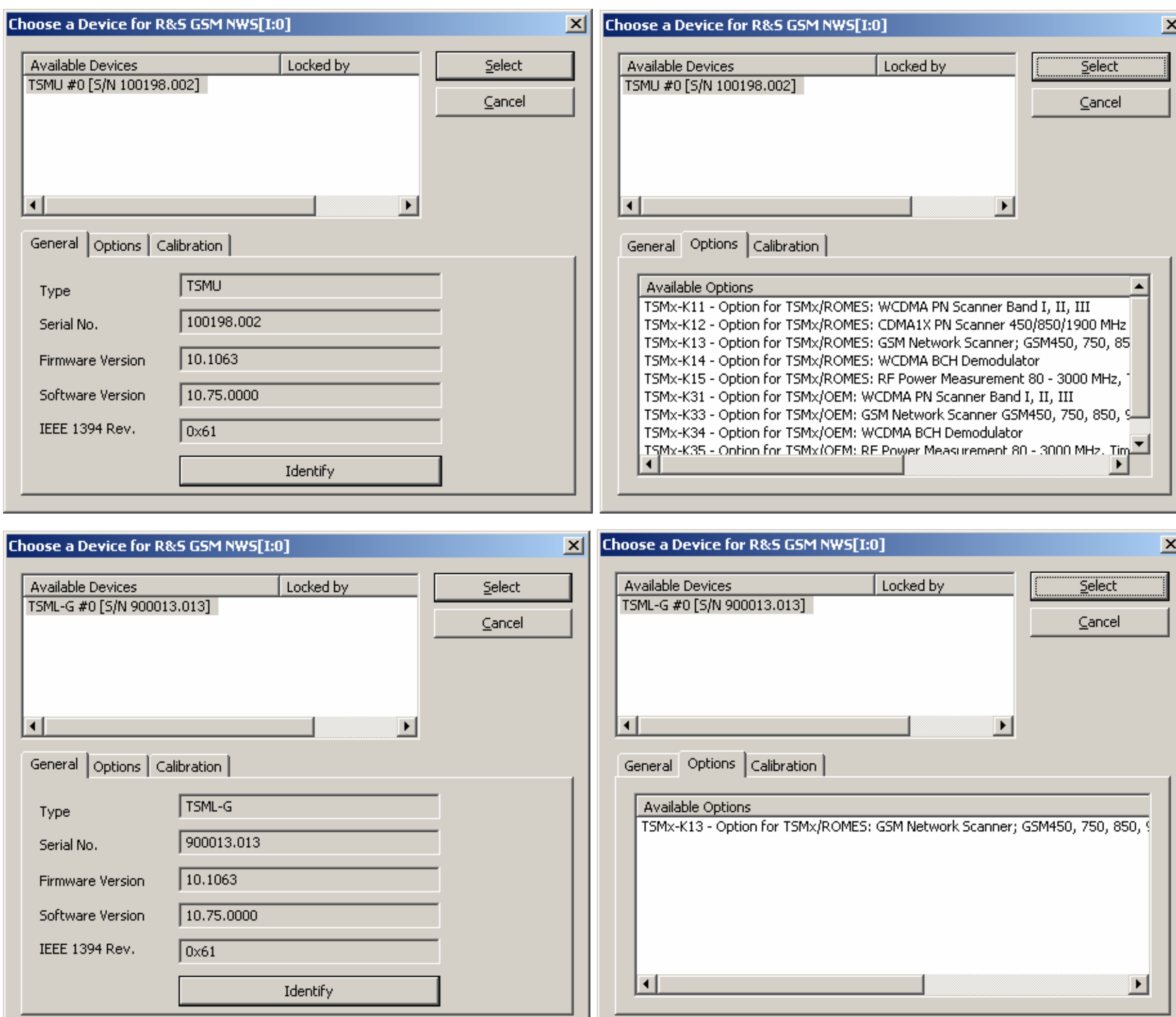


Fig. 6-120 GSM NWS Device Chooser TSMU / TSML-G

TSMx

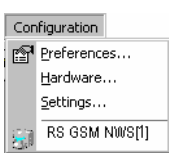
The TSMx must be connected to the controller via one of the Firewire interfaces (IEEE1394) on the rear panel. No external trigger unit is needed, however, the performance and accuracy of the GSM NWS Scanner measurement can be improved by adding a high-precision PPS (pulse per second) signal from a GPS receiver (e.g. GINA, Trimble Placer). The synchronization mode is selected in the *Setup GSM NWS Driver* tab of the driver configuration menu.

The PPS signal from the GPS receiver is directly fed to the BNC connector labeled *PULSE IN* at the rear panel of the TSMU. No additional synchronization unit is required.

The TSMx operating manual and an installation tool for the Firewire Interface is provided on the ROMES CD-ROM. Refer to the directory Firmware & Drivers\R&S RF Receivers\TSMx. See also the paragraph about the Firewire Driver on p. 6.11.

Configuration Menus

ROMES provides a configuration menu for the GSM NWS driver that is opened by clicking the *RS GSM NWS[1]* command line in the *Configuration* menu. The command line is available as soon as the driver has been loaded.



The GSM NWS driver configuration menu contains several tabs to select the measured channels, the measurement rate, and the synchronization mode, to display information on the test receiver driver *(Info),* and to store the settings to a template.

Setup GSM NWS Driver

The *Setup GSM NWS Driver* tab selects the measured channels, the measurement rate, and the synchronization mode.

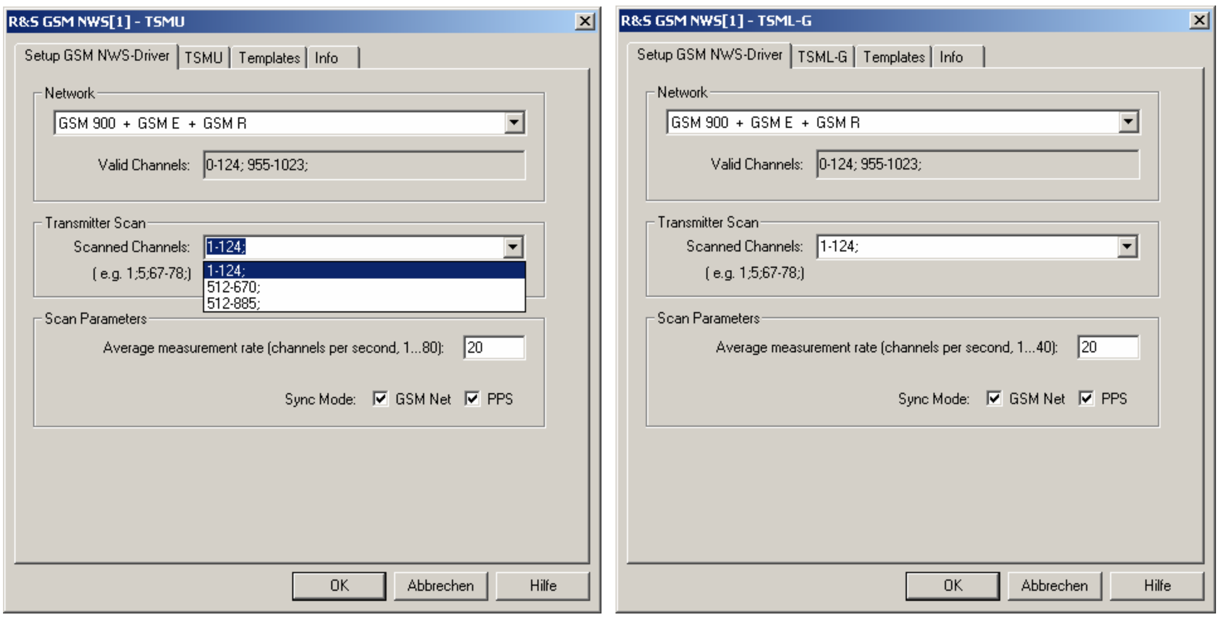


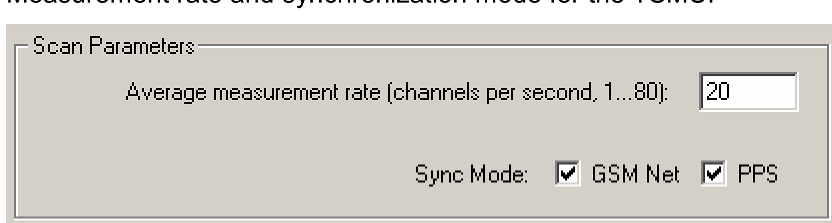
Fig. 6-121 GSM NWS configuration – Setup GSM NWS Driver

Network Selection of the measured GSM band or a combination of bands. The GSM channel numbers (ARFCNs) for the selected bands are displayed below *(Valid Channels)*.

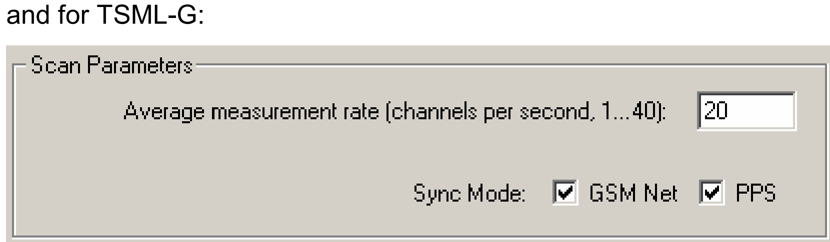
For an overview of GSM bands, channels, and frequencies refer to chapter 8.

Transmitter Scan Selection of the scanned channels within the selected GSM bands. The channels are scanned periodically with the measurement rate selected below. A warning *The channel list is invalid* indicates that one or more channels do not belong to any of the selected GSM bands.

Scan Parameters Measurement rate and synchronization mode for the TSMU:



and for TSML-G:



Average measurement rate…	Number of GSM channels measured per second. Please note that the TSMU supports measurement rates up to 80 channels per second, and the TSML-G supports up to 40 channels per second. A lower measurement rate limits the size of the measurement file. If the system performance is not sufficient, ROMES reduces the amount of evaluated data by discarding part of the results acquired by the TSMx.
Sync. Mode	Selection of the signal source providing the time base for the network scan measurements. In the default configuration where both checkboxes are selected, the GSM Netw. | PPS synchronization mode is used. If the GSM Net checkbox is cleared, PPS synchronization is used. If the PPS checkbox is cleared, GSM Network synchronization is used. If both checkboxes are cleared, the TSMx uses internal synchronization.

TSMx Synchronization

In addition to the default *PPS* time base setting described above, the TSMx provides the following synchronization types for GSM network scans:

GSM Netw. | PPS	Use GSM Network or PPS synchronization, if one of these signal types is available. If none of the signals is available, use Internal synchronization. If both signal types are available and almost synchronous to each other, use the PPS signal. If both signal types are available but not synchronous, assume that the PPS signal is inaccurate (e.g. because the GPS receiver cannot detect a sufficient number of satellites so that it must use its internal reference signal) and use the GSM signal. This mode is always used while no measurement is active.
GSM Network	Synchronization by means of approx. 2/3 of the received GSM signals, discarding the signals with the strongest timing deviation and time drift. This mode remains active as long as the TSMx is capable of measuring the signals from at least 3 GSM cells and the standard deviation of the time drift of all used signals is below 60 ns/s. If at least one of the two conditions is no longer met, the TSMx automatically switches to Internal time base. The TSMx synchronizes either to the GSM900/1800 or GSM850/1900 dual band. When it is switched on the instrument automatically scans the entire frequency range and selects the dual band where signals are available. GSM Network is the recommended setting if no PPS signal is available.
PPS	The PPS (pulse per second) signal from an external GPS receiver fed to the PULSE IN connector at the rear panel of the TSMx is used for synchronization (see section Resources Configuration on p. 6.178 ff.). This signal provides maximum accuracy.
Internal	Synchronization by means of the reference signal generated by the internal quartz oscillator of the analyzer. The internal time base is activated automatically if no PPS signal is available. While a network time base is selected, the network signals constantly correct the frequency and phase of the internal

oscillator in order to compensate for a possible drift. If the network signals are affected by a systematic error (e.g. due to a Doppler shift in a moving test vehicle), Internal time base can be used to prevent this correction.

TSMU / TSML-G

The *TSMU / TSML-G* tabs display the properties of the TSMU / TSML-G devices and available options. This information is also displayed in the *Device Chooser* described on p. 6.21.

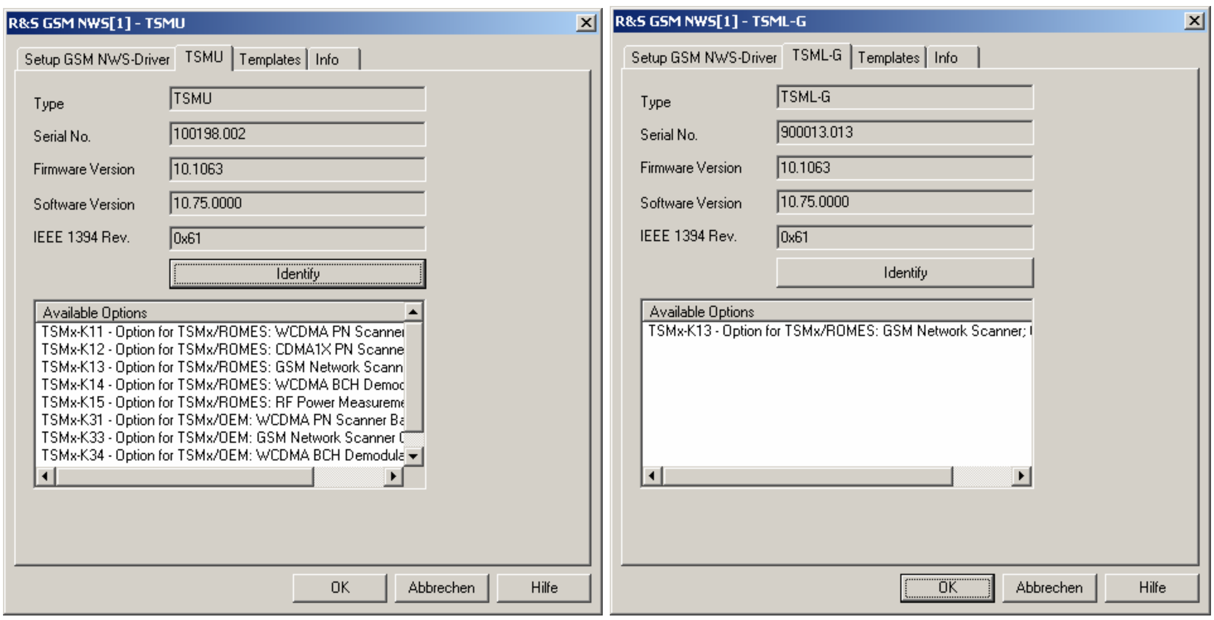


Fig. 6-122 GSM NWS configuration – TSMU / TMSL-G

Templates

The *Templates* tab stores the current GSM NWS driver configuration as a template, lists, loads or deletes driver templates.

Note:

When a driver is loaded using Configuration – Preferences – Hardware (see section Driver Installation on p. 6.1 ff.) ROMES checks whether a driver template is stored in the Driver Templates directory and its subdirectories (see below). The driver can be loaded with default settings or with the settings stored in any of the templates found.

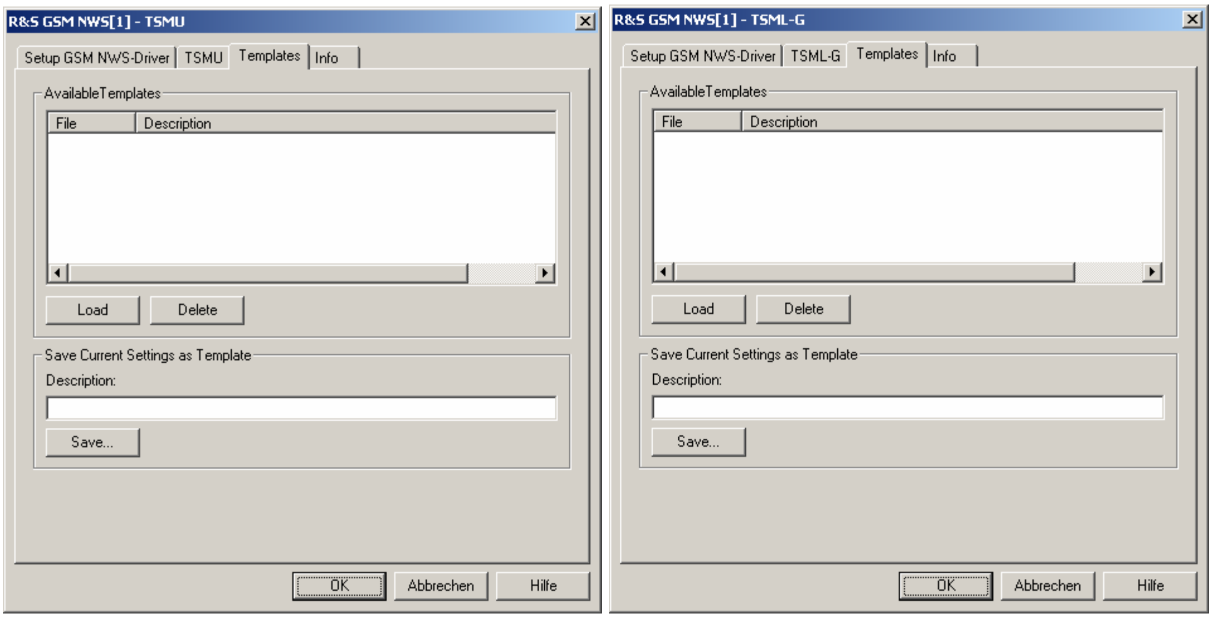
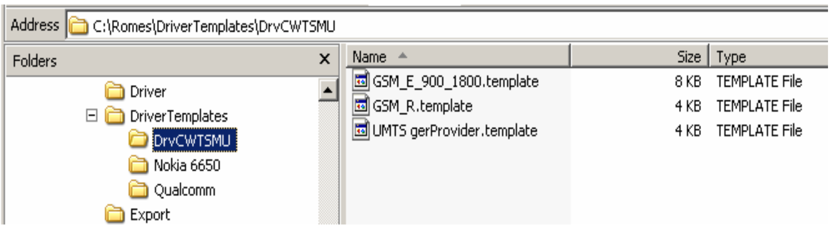


Fig. 6-123 GSM NWS configuration – Templates

Load/Delete

Loads a driver template or deletes a template displayed in the list of *Available Templates*. Template files are ASCII files with the extension *.template. The template definition is independent of the workspace. A selection of template files for the TSMx is supplied with the ROMES installation:



Save

Saves the current driver settings together with the *Description* to a selected template file.

CDMA2000 PN Scanner (PNS) Driver

The CDMA PNS (Pseudo Noise Scanner) driver controls an R&S TSMU / TSML-C radio network analyzer in order to perform CDMA Pseudo Noise (PN) scans. In a CDMA PN scan, the test device measures and identifies all CDMA2000 downlink (BTS) signals in the air.

Installation of the driver is explained in section *Driver Installation* on page 6.1; its configuration is explained below. The CDMA PN data can be viewed in the *CDMA PNS Views* (see chapter 3).

Resources Configuration

The CDMA PNS driver is installed by selecting *CDMA2000 PN Scanner – R&S PNS* in the *ROMES Hardware Configuration* window (see *Fig. 6-1* on page 6.1).

A *Device Chooser* dialog is opened when the CDMA PNS driver is loaded. The *Device Chooser* is used to select the test device and to define the essential connection parameters, if necessary .

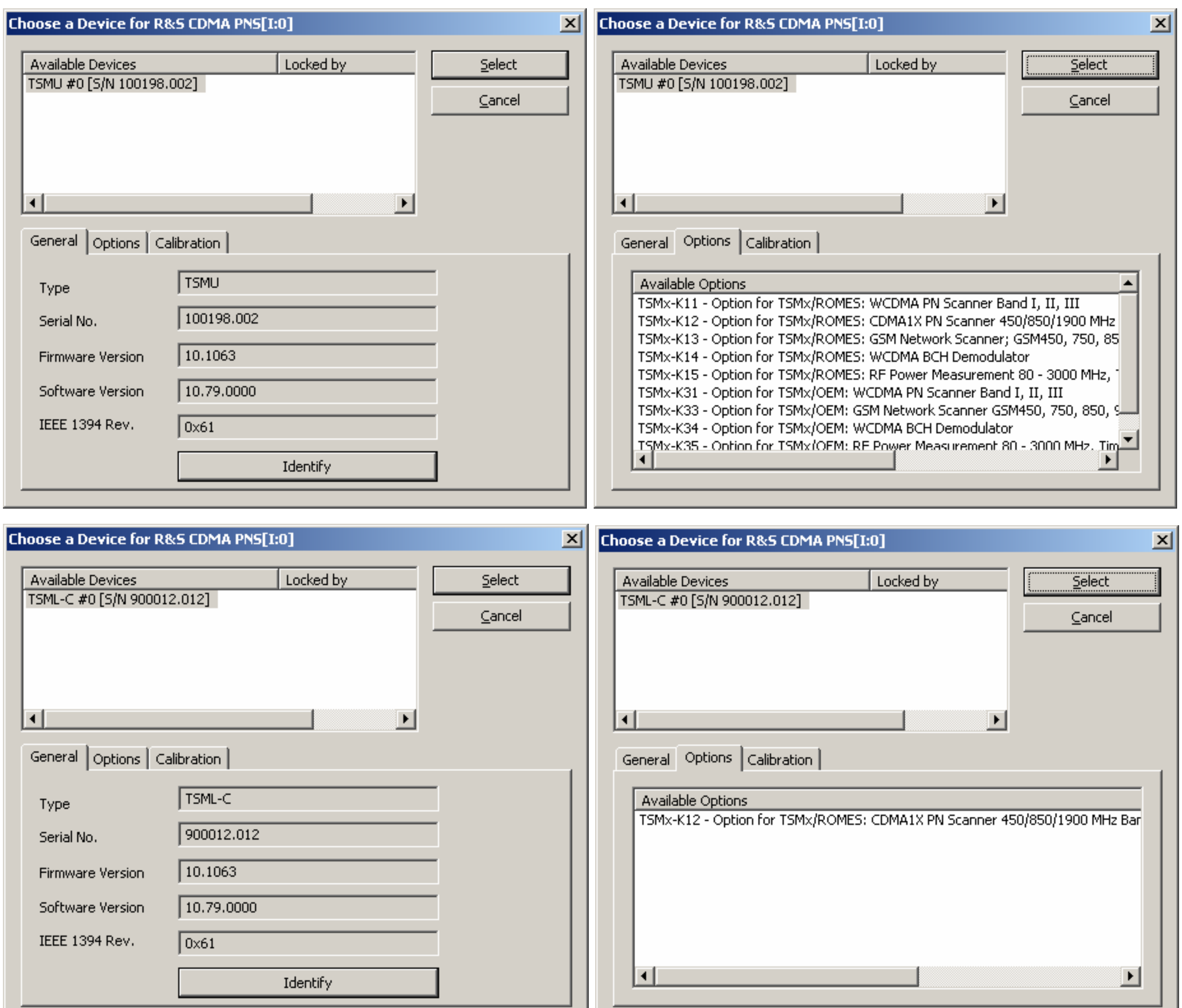


Fig. 6-124 CDMA PNS Device Chooser TSMU / TSML-C

TSMx

The TSMx must be connected to the controller via one of the Firewire interfaces (IEEE1394) on the rear panel. No external trigger unit is needed, however, the performance and accuracy of the CDMA PN Scanner measurement can be improved by adding a high-precision PPS (pulse per second) signal from a GPS receiver (e.g. GINA, Trimble Placer). The synchronization mode *(Time Base)* is selected in the *Measurements* tab of the driver configuration menu (*TSMx Advanced Settings)*.

The PPS signal from the GPS receiver is directly fed to the BNC connector labeled *PULSE IN* at the rear panel of the TSMx. No additional synchronization unit is required.

TIP *The TSMx operating manual and an installation tool for the Firewire Interface is provided on the ROMES CD-ROM. Refer to the directory Firmware & Drivers\R&S RF Receivers\TSMx. See also the paragraph about the* *Firewire Driver on p. 6.11.*

Configuration Menus

ROMES provides a configuration menu for the CDMA PNS driver that is opened by clicking the *RS CDMA PNS[1]* command line in the *Configuration* menu. The command line is available as soon as the driver has been loaded.

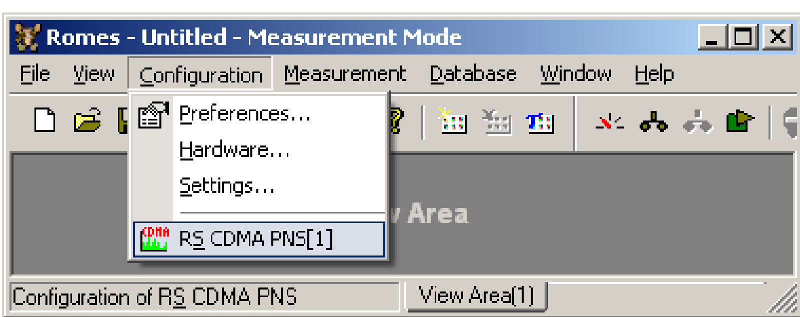


Fig. 6-125 Accessing the CDMA PNS driver configurations

The CDMA PNS driver configuration menu contains several tabs to display information on the test receiver driver *(Info),* configure the *Receiver* and the two alternate *Measurements,* identify the connected *TSMU / TSML-C* and their options, and load driver *Templates*.

Receiver settings

The *Receiver* tab selects the frequencies measured in an CDMA PN scan.

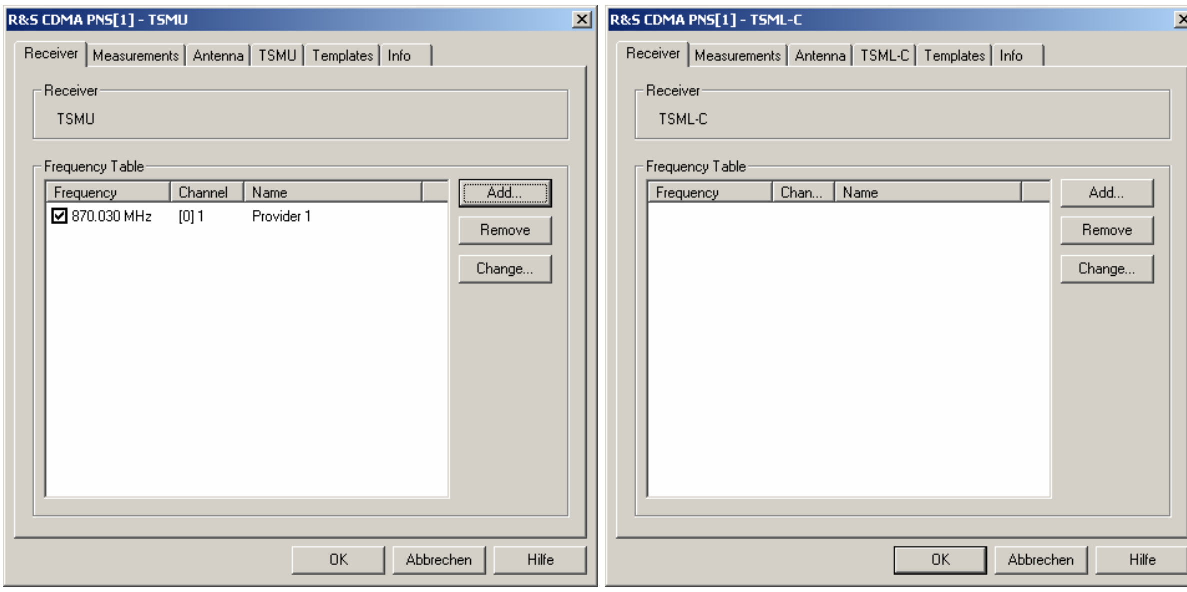


Fig. 6-126 CDMA PNS configuration – Receiver

Frequency Table The *Frequency Table* displays a selection of forward CDMA frequencies with their channel numbers. In the *Channel* columns, the SR 1 band class of the channel is displayed in angular brackets. To modify or extend the list use the *Add Frequency* dialog; see below. The TSMU / TSML-C measure all channels with selected check boxes.

Add Opens a dialog for adding a new channel frequency to the table; see section *Add Frequency* below.

Remove Removes a selected channel from the list.

Change Opens an input field to change the *Name* of the current channel or assign a new name.

Add Frequency

The *Add Frequency* dialog adds frequencies to the frequency table in the *Receiver* tab (see above). It is opened by the *Add…* button in the *Receiver* tab of the R&S CDMA PNS driver configuration menu.

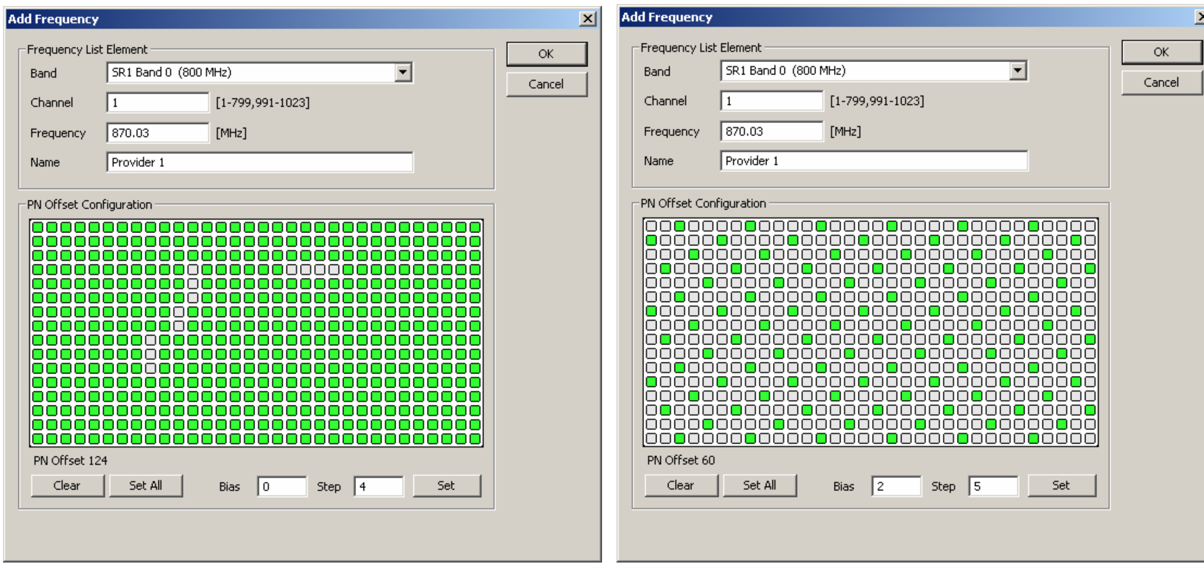


Fig. 6-127 CDMA PNS configuration – Add Frequency

Frequency List Element Adds frequencies to the frequency table in the *Receiver* tab. The driver supports all Spreading Rate 1 (SR 1) band classes 0 to 10 specified in standard 3GPP2 C.S0002. It is even possible to select frequencies off the nominal CDMA downlink bands.

Band Selection of the SR 1 band class (0 to 10).

Channel CDMA channel number within the selected band. If an undefined channel number is specified, the frequency becomes invalid.

Frequency Either the frequency calculated according to the selected *Band* and *Channel,* or any frequency within the TSMU frequency range. *Out of Band !* indicates that the frequency entered is an off-band frequency.

Name Arbitrary, optional identification string for the selected frequency.

PN Offset Configuration Different CDMA cells and cell sectors all use the same short code, but use different phases of it, which is how the mobile differentiates them from each other. The phase is known as the *PN Offset*, which defines the offset of the PN sequence. Changing the PN offset changes the timing of the pilot channel, the timing and contents of the sync channel message, and the long code mask of the paging channel.
Each square represents one unit of 64 PN chips. The squares can either be selected manually (clicking on a square toggles its value) or they can be defined by entering values into the *Bias* and *Step* entry fields, which are activated by the *Set* button.

PN Offset Shows the selected value for the PN Offset as configured (range from 0 to +511)

Clear Clears all unit squares in the PN Offset Configuration table.

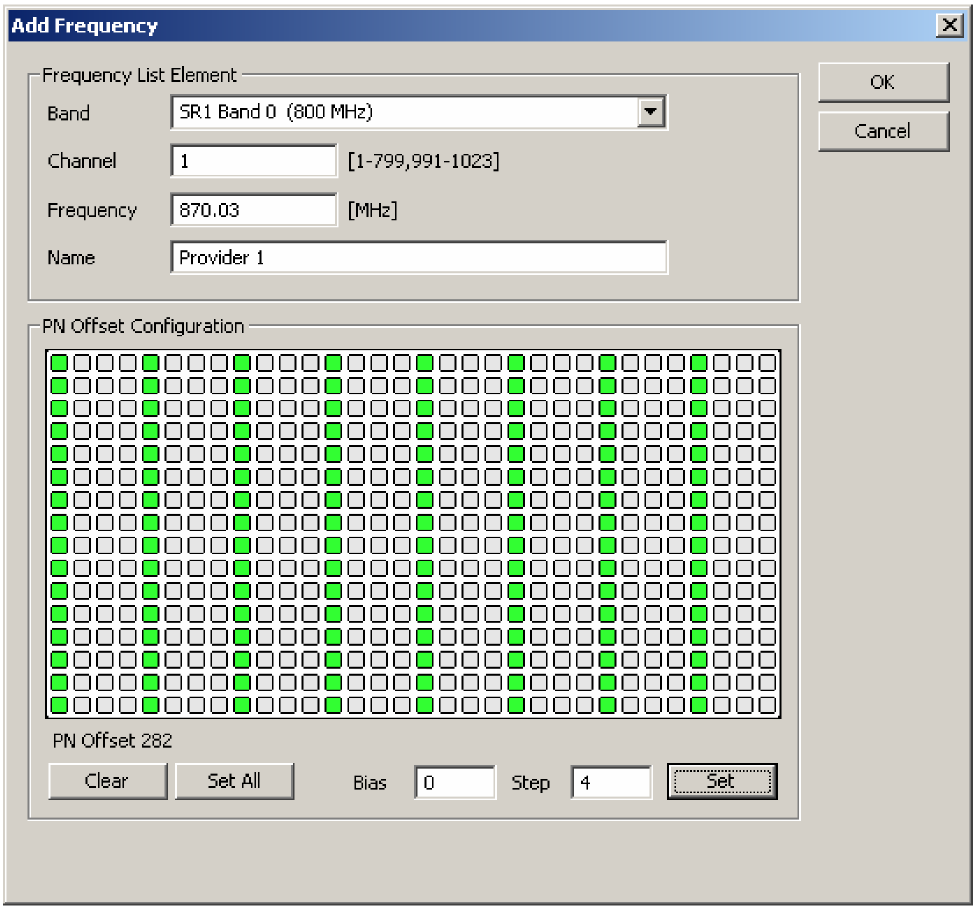
Set All Sets all unit squares in the *PN Offset Configuration* table.

Bias The bias value sets the number of cleared unit squares at the beginning of the *PN Offset Configuration* table. The change becomes active after *Set* is clicked.

Step The step value defines the interval of the set unit squares as a sequence. The change becomes active after *Set* is clicked.

Set Activates the defined settings for *Bias* and *Step*.

An example for a setup with a Bias of 0 and a Step of 4, resulting in a PN Offset of 282, is shown below:



Measurements

The *Measurements* tab defines general measurement settings for the CDMA PN scan.

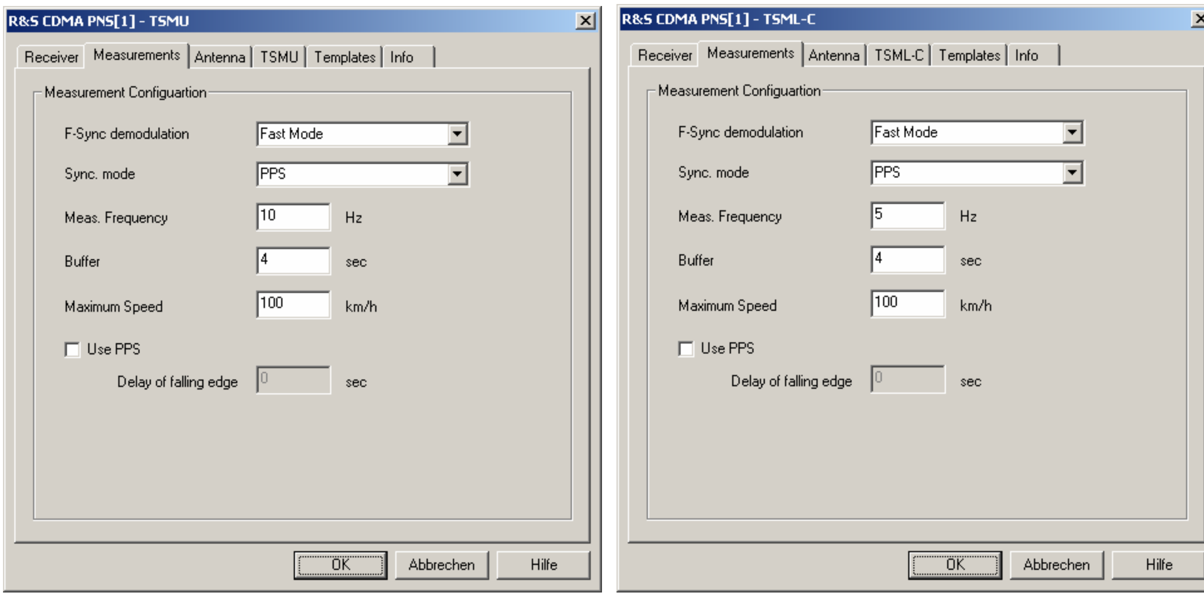
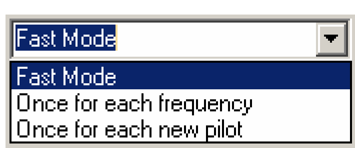


Fig. 6-128 CDMA PNS configuration – Measurements

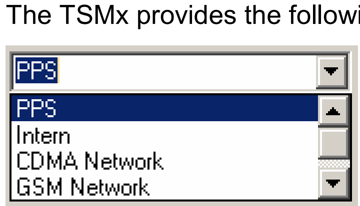
Measurement Configuration The settings in the *Measurement Configuration* panel define how ROMES processes the baseband (I/Q) data for an CDMA PN scan.

F-SYNC Demodulation Determines how often the TSMU will demodulate the Forward Synchronization Channel (F-SYNC) and decode the information elements in the synchronization message (see description of the *CDMA PNS F-SYNC View* in chapter 4).



The synchronization message is demodulated at least once per measured frequency. A smaller F-SYNC demodulation rate has no impact on the measurement but can considerably reduce the size of the measurement file.

Sync. Mode Signal source providing the time base for the TSMx measurements. The TSMx must synchronize to a reference signal at the beginning of each measurement. The TSMx provides the following methods for synchronization:



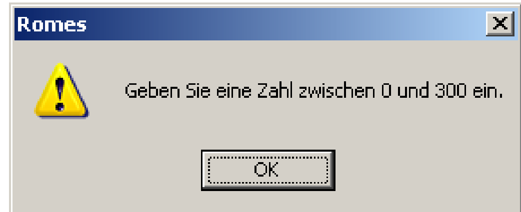
PPS The PPS (pulse per second) signal from an external GPS receiver fed to the *PULSE IN* connector at the rear panel of the TSMx is used for synchronization (see section *Resources Configuration* on p. 6.178 ff.). This signal provides maximum accuracy.

Intern	Synchronization by means of the reference signal generated by the internal quartz oscillator of the analyzer. The internal time base is activated automatically if no PPS signal is available. While a network time base is selected, the network signals constantly correct the frequency and phase of the internal oscillator in order to compensate for a possible drift. If the network signals are affected by a systematic error (e.g. due to a Doppler shift in a moving test vehicle), *Internal* time base can be used to prevent this correction.
CDMA Network	Synchronization by means of the received CDMA signals. *CDMA Network* is the recommended setting if no PPS signal is available.
GSM Network	Synchronization by means of approx. 2/3 of the received GSM signals, discarding the signals with the strongest timing deviation and time drift. This mode remains active as long as the TSMx is capable of measuring the signals from at least 3 GSM cells and the standard deviation of the time drift of all used signals is below 60 ns/s. If at least one of the two conditions is no longer met, the TSMx automatically switches to *Internal* time base. The TSMx synchronizes either to the GSM900/1800 or GSM850/1900 dual band. When it is switched on the instrument automatically scans the entire frequency range and selects the dual band where signals are available. *GSM Network* is the recommended setting if no PPS signal is available.
GSM Netw. | PPS	Use *GSM Network* or *PPS* synchronization, if one of these signal types is available. If none of the signals is available, use *Internal* synchronization. If both signal types are available and almost synchronous to each other, use the PPS signal. If both signal types are available but not synchronous, assume that the PPS signal is inaccurate (e.g. because the GPS receiver cannot detect a sufficient number of satellites so that it must use its internal reference signal) and use the GSM signal. This mode is always used while no measurement is active.

Buffer Time for which the raw measurement data is stored in the TSMx, should ROMES be unable to process it immediately (e.g. due to temporary low performance of the controller). If the ROMES buffer continues to be blocked after the buffer size time, the oldest data in the buffer is deleted and overwritten by new data. Data transfer starts as soon as ROMES is ready again to receive and process data.

A large buffer size increases the probability that no measurement data is lost, even though ROMES may be blocked for an extended time. On the other hand, storage and transfer of large amounts of buffer data increase the possible delay between data recording and evaluation/display in the views.

Maximum Speed The value for the maximum speed of the measurement vehicle is used for improved evaluation of fading channel measurements. The range is between 0 and 300 km/h, otherwise an error message is displayed:

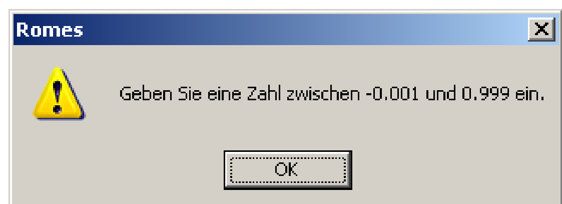


(Please enter a number between 0 and 300)

Use PPS The checkbox toggles the use of the PPS (pulse per second) signal from an external GPS receiver.

If *Use PPS* is activated, the delay of the falling edge of the PPS signal can be manually set in the corresponding field. This is useful for the calibation of the PPS propagation delay as described below.

The possible range is between -0.0010000 and 0.9999999 s, otherwise an error message is displayed:



(Please enter a number between -0.001 and 0.999)

Calibration of the PPS delay

The calibration of the PPS delay is done by first performing a measurement of a base station with a known distance. This measurement is configured such that "Use PPS" is deactivated:

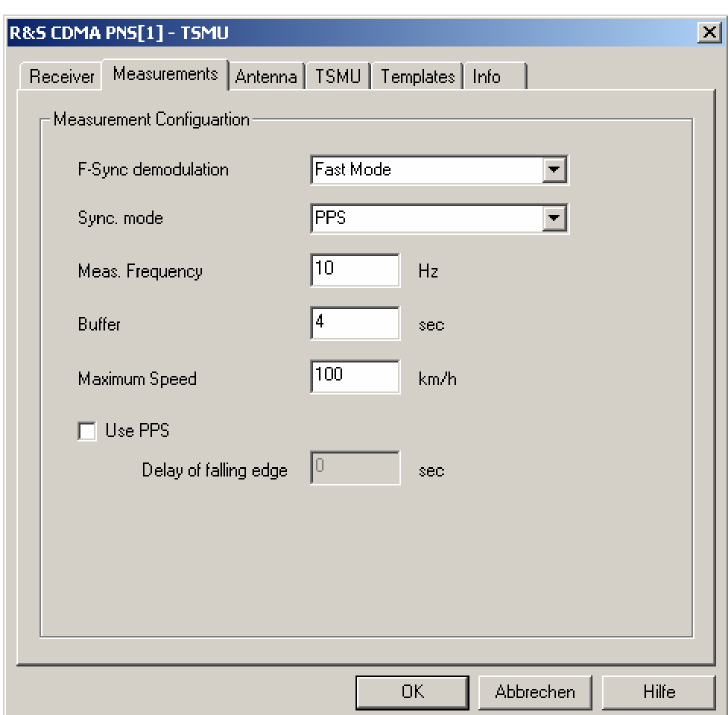
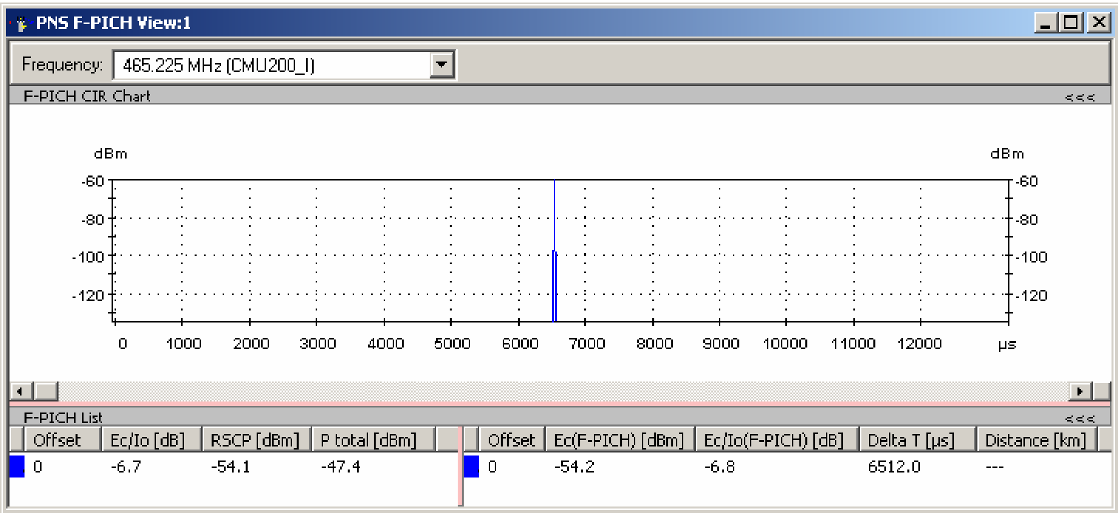


Fig. 6-129 CDMA PNS TSMU configuration – PPS Calibration

The measurement of the station with known distance yields the reference signal propagation time (Delta T_{Ref}). In the *PNS F-PICH View* list the measured Delta T (the time delay of the signal slot timing relative to the CDMA system time or GPS time) is shown.

In this example the Delta $T_{Meas.}$ is 6512 μs.



Also, the *PNS System Time Line Estimation View* shows the measured PPS Delay without calibration.

With these values, return to the CDMA PNS TSMU measurement configuration tab (see Fig. 6-129).

an enter the *Delay of falling edge*, which is calculated as follows:

$$\text{Delay of falling edge} = \text{PPS Delay}_{Meas.} - (\text{Delta } T_{Meas.} - \text{Delta } T_{Ref.})$$

The entered value should be as exact as possible (**at least 7 decimal places**), because 0,1 µs corresponds to 30 m distance, even though the dialog window only suggests three decimal places.

Note that as long as the measurements are performed in the same network using the same GPS/PPS signal source, the calibration is not necessary. For measurements in different networks, the calibration can be useful and if a different GPS signal source is used, the PPS calibration is recommended.

Antenna

The *Antenna* tab defines *Antenna Name, Antenna Gain* and *Cable Loss*. These values are used to correct the received signal powers:

- If a *Cable Loss* of n dB is specified, the system assumes the received signals to be attenuated by n dB. n dB is added to all measured signal powers so that the displayed results correspond to the unattenuated signal.
- If an *Antenna Gain* of n dB is specified, the system assumes the received signals to be amplified by n dB. n dB is subtracted from all measured signal powers so that the displayed results correspond to the unamplified signal

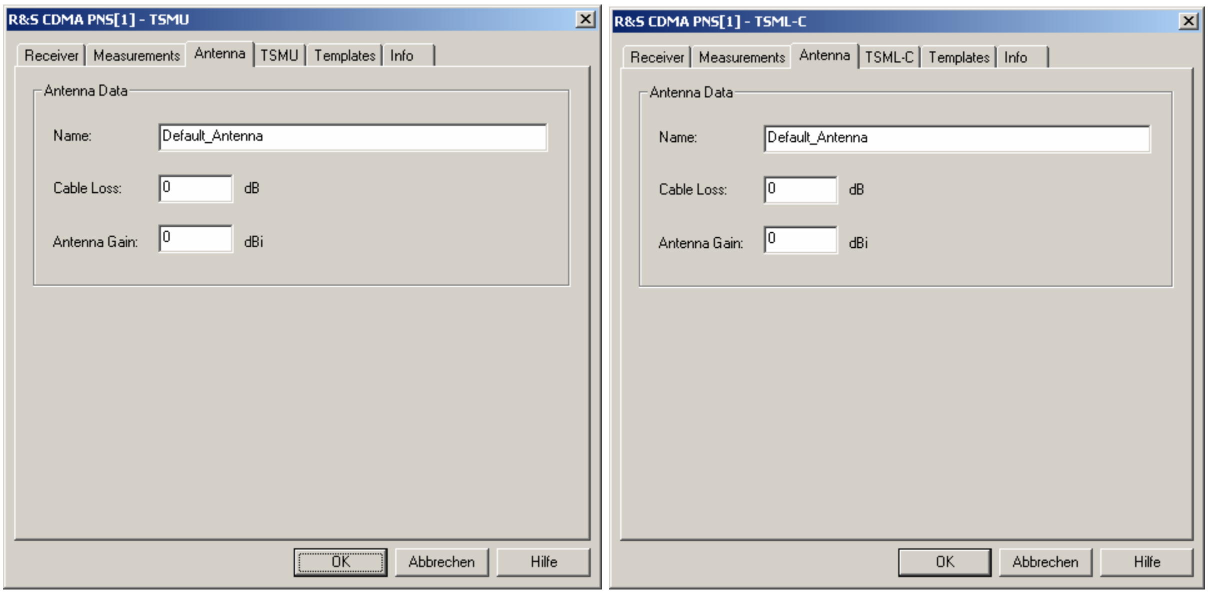


Fig. 6-130 CDMA PNS configuration – Antenna

TSMU / TSML-C

The *TSMU / TSML-C* tabs display the properties of the TSMU or TSML-C and their available options. This information is also displayed in the *Device Chooser* described on p. 6.21.

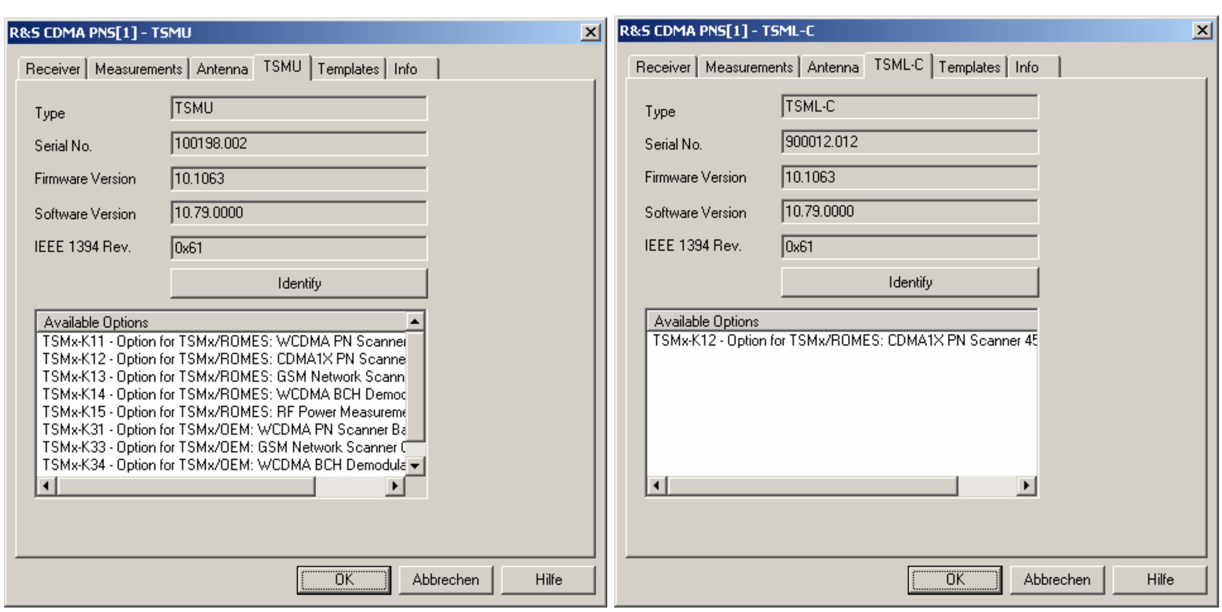


Fig. 6-131 CDMA PNS configuration – TSMU / TSML-C

Templates

The *Templates* tab stores the current TSMU / TSML-C driver configuration as a template, lists, loads or deletes driver templates.

Note:

When a driver is loaded using Configuration – Preferences – Hardware (see section Driver Installation on p. 6.1 ff.) ROMES checks whether a driver template is stored in the Driver Templates directory and its subdirectories (see below). The driver can be loaded with default settings or with the settings stored in any of the templates found.

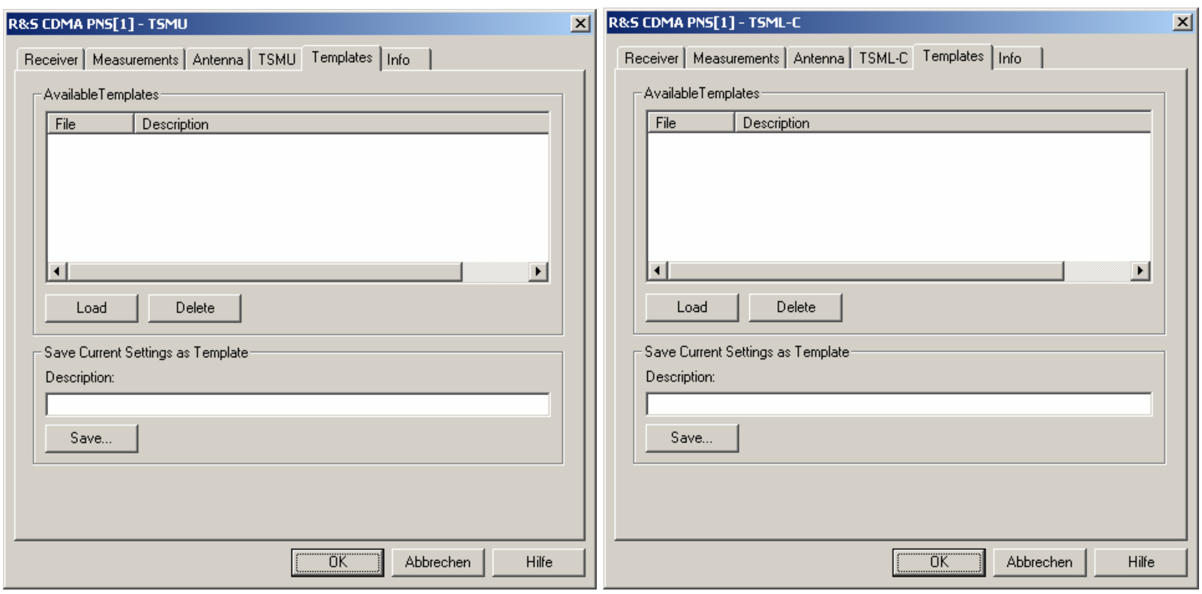
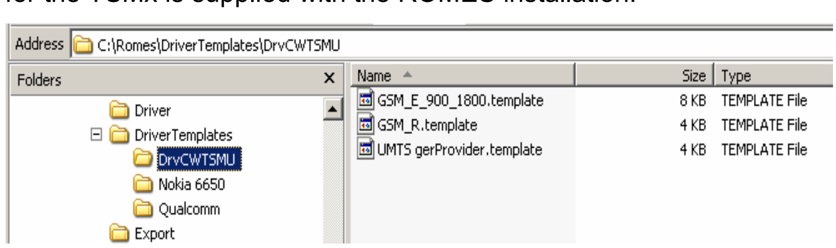


Fig. 6-132 CDMA PNS configuration – Templates

Load/Delete Loads a driver template or deletes a template displayed in the list of *Available Templates*. Template files are ASCII files with the extension *.template. The template definition is independent of the workspace. A selection of template files for the TSMx is supplied with the ROMES installation:



Save Saves the current driver settings together with the *Description* to a selected template file.

ESPI (Spectrum) Driver

The *ESPI (Spectrum)* driver controls an ESPI test receiver or FSP spectrum analyzer in order to perform a spectrum analysis. The spectrum analysis consists of a frequency sweep over a specified range to detect and analyze arbitrary signals.

Installation of the driver is explained in section *Driver Installation* on page 6.1; its configuration is explained below. The measured spectrum can be viewed in the *Spectrum Views* (see chapter 4).

Resources Configuration

The *ESPI (Spectrum)* driver is installed by selecting *SPECTRUM – ESPI (Spectrum)* in the *ROMES Hardware Configuration* dialog (see *Fig. 6-1* on page 6.1). The resources needed are identical for the FSP spectrum analyzer and the ESPI test receiver; they are listed in section *Resources Configuration* on p. 6.148 ff. (see paragraph on *ESPI Driver)*. No external trigger or trigger device (e.g. a *Trigger Box* or *Sync Box* used for UMTS Pseudo Noise Scans) is needed.

Configuration Menus

ROMES provides a configuration menu for the *ESPI (Spectrum)* driver that is opened by clicking the *ESPI (Spectrum) [1]* command line in the *Configuration* menu. The command line is available as soon as the driver has been loaded.

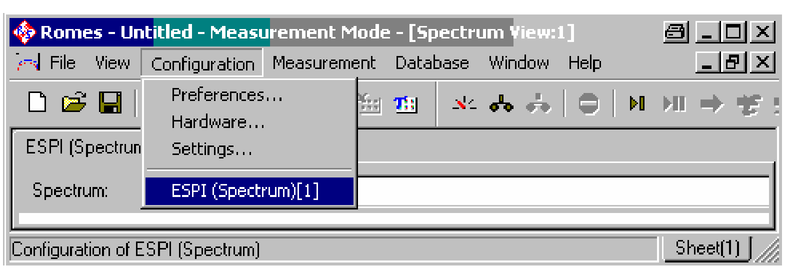


Fig. 6-133 Accessing the ESPI (Spectrum) driver configurations

The *ESPI (Spectrum)* driver configuration menu contains three tabs to configure the sweep range *(Settings),* report the characteristics of the *Antenna* and display information on the test receiver driver *(Info)*.

Receiver settings

The *Settings* tab selects the receiver address and the sweep settings for the analyzer or test receiver.

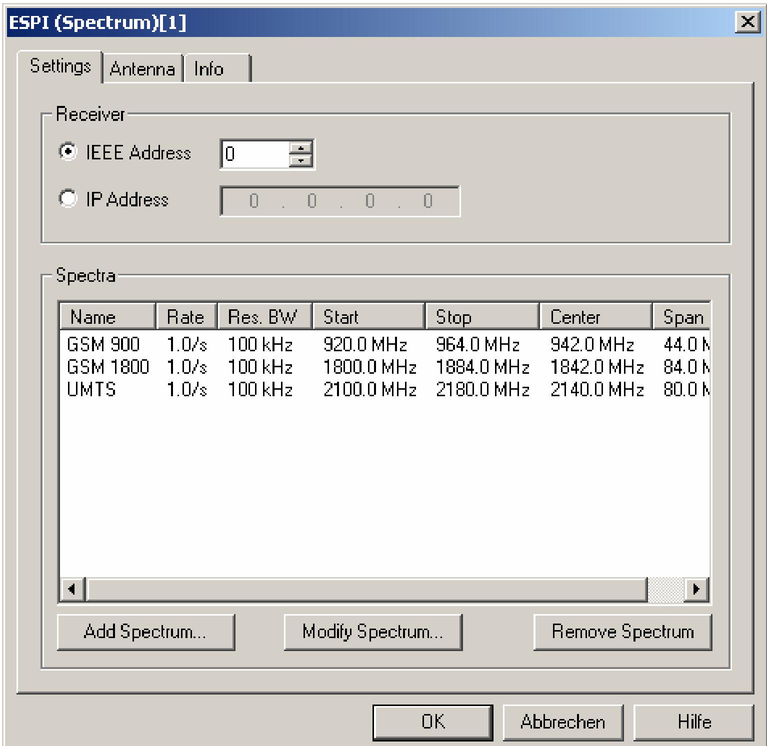


Fig. 6-134 ESPI (Spectrum) configuration – Receiver

Receiver The two *Receiver* radio buttons select the interface used for the connection of the test instrument and the IEC/IEEE bus address (for a connection via IEC/IEEE-bus interface) or IP address (for a connection via Ethernet/LAN interface). The LAN interface is provided as an option for both the FSP spectrum analyzer and the ESPI receiver (option FSP-B16, LAN Interface).

The test device (ESPI or FSP) is automatically identified by the system.

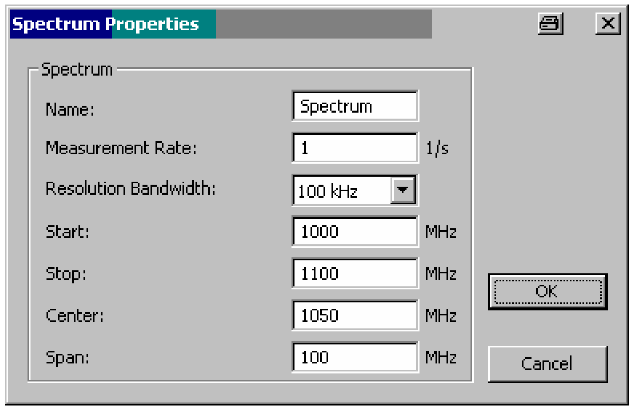
Spectra The table in the *Spectra* panel shows the different spectra defined by means of the buttons below. A spectrum is a set of hardware-related settings which define a basic measurement sequence (sweep) of the receiver or analyzer. The spectra are measured cyclically in the order of the table, taking into account the *Measurement Rate* defined in the *Spectrum Properties* dialog.

Add Spectrum Opens the *Spectrum Properties* dialog to define a new spectrum.

Modify Spectrum Opens the *Spectrum Properties* dialog to change the properties of the selected spectrum.

Remove Spectrum Removes a selected spectrum from the list.

Spectrum Properties The *Spectrum Properties* dialog is opened by clicking the *Add Spectrum* or *Modify Spectrum* buttons in the driver configuration menu.



Besides the name of the spectrum, the following analyzer/receiver settings can be set:

Measurement Rate	Maximum number of sweeps per second. The actual rate can be smaller if the measurement sequence comprises a large number of spectra.
Resolution Bandwidth	Bandwidth of the IF resolution filter of the analyzer or receiver. Possible bandwidths can be selected from a pull-down list.
Start/Stop/ Center/Span	Definition of the measurement range/sweep range of the analyzer or receiver. The sweep range is a continuous frequency interval which is either defined by a *Start* and *Stop* value or by a *Center* frequency and *Span. Start/Stop* and *Center/Span* are alternative settings and overwrite each other according to:

Center = *(Start* + *Stop)/2*

Span = *Stop* – *Start* (must be positive)

Depending on the sweep range, the test device automatically sets the number of sweep points and their position.

Antenna

The *Antenna* tab defines *Antenna Name, Antenna Gain* and *Cable Loss*. These values have no impact on the measurement but are stored in the measurement file header so they can be taken into account for the calculation of correction factors.

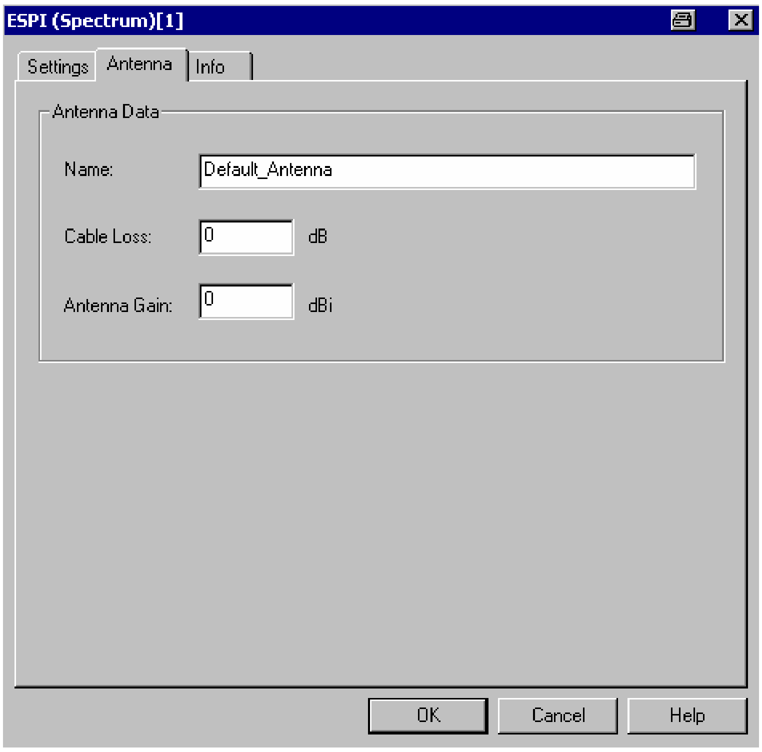


Fig. 6-135 ESPI (Spectrum) configuration – Antenna

WLAN (NDIS) Driver

The *IEEE 802.11 WLAN (NDIS)* driver controls the data transfer from Wireless LAN client adapters supporting Network Device Interface Specification (NDIS) V5.1 or higher, in particular the *CISCO Aironet Series 350 IEEE 802.11 Wireless LAN Client Adapter*.

Installation of the driver is explained in section *Driver Installation* on page 6.1; its configuration is explained below. The measured WLAN data can be viewed in the *WLAN Views* and in many general purpose views (see chapter 4).

Resources Configuration

The *WLAN (NDIS)* driver is installed by selecting *WLAN – NDIS* in the *ROMES Hardware Configuration* dialog (see *Fig. 6-1* on page 6.1). ROMES uses the adapter as it is configured by the manufacturer or by means of the manufacturer's configuration utility. Important adapter configuration parameters are displayed in the driver configuration menu.

The *CISCO Aironet Series 350 IEEE 802.11 Wireless LAN Client Adapter* supports the full functionality of the ROMES WLAN option.

Configuration Menus

ROMES provides a configuration menu for the *WLAN (NDIS)* driver that is opened by clicking the *WLAN (NDIS) [1]* command line in the *Configuration* menu. The command line is available as soon as the driver has been loaded.

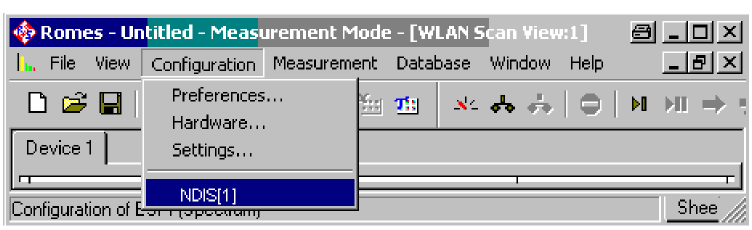


Fig. 6-136 Accessing the WLAN (NDIS) driver configurations

The *WLAN (NDIS)* driver configuration menu and configures the measurement interval and channel *(Device Setup)* and provides information on the test receiver driver *(Info)* and the device *(Device Info)*.

Device Setup

The *Device Setup* tab selects the measurement interval and channel.

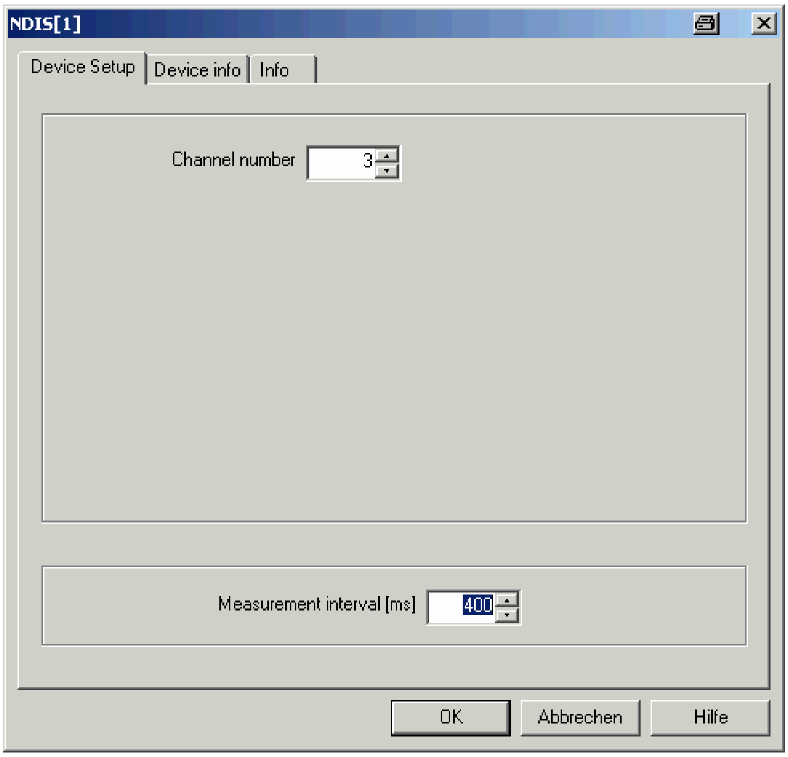


Fig. 6-137 WLAN (NDIS) configuration – Device Setup

Channel number Channel used for the noise measurement, providing the *Noise* and *S/N* results in the *WLAN Survey View* and the *WLAN S/N View*. The noise measurement and the channel definition requires a *CISCO Aironet Series 350 IEEE 802.11 Wireless LAN Client Adapter.*

Measurement interval [ms] The *Measurement interval* is the time in ms after which ROMES records and evaluates a new set of measurement data from the test device. A short measurement interval allows to analyze quick variations of the signal quality and the data traffic but causes large measurement files and requires more ROMES system capacity.

The actual update interval of the data in the test device is generally shorter than the *Measurement interval* so that ROMES skips part of the available information. This update interval is not influenced by the driver settings.

Device Info

The *Device Into* tab displays information about the test device.

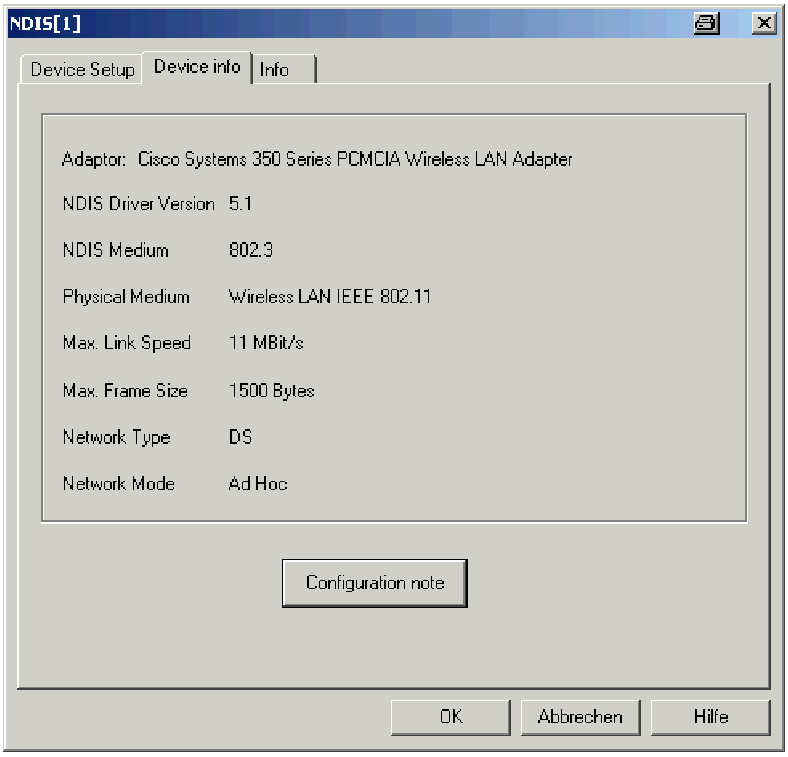


Fig. 6-138 WLAN (NDIS) configuration – Receiver

Device-Independent Drivers

The drivers in this section do not depend on a particular test device or technology. They can be loaded as explained in section *Driver Installation* on page 6.1, however, the ports (if needed) are assigned in the driver configuration menus.

Data Quality Tester Driver (DQA)

The DQA driver controls the measurement of parameters assessing the Quality of Service (QoS) of any kind of data transfer connection by means of the Data Quality Tester (DQA) ROMES-Z6.

Installation of the driver is explained in section *Driver Installation* on page 6.1; its configuration is explained below. The DQA data can be viewed in the *QoS Views* (see chapter 3). An example procedure for setting up and testing a connection is described in chapter 2; see section *Data Quality Tester*.

Resources Configuration

The DQA driver is installed by selecting *QoS – QoS Tester* in the *ROMES Hardware Configuration* window (see *Fig. 6-1* on page 6.1). Loading the driver does not require any hardware or additional test devices. In fact the Data Quality Tester can be used to test the QoS of any kind of physical connection between the test system and a remote address. The connection can be a network connection established by means of test mobiles of any supported technology (GSM, GPRS, HSCSD, EDGE, UMTS, ...) or a fixed connection to a remote server accessible from the test system. The driver provides configuration menus to configure and set up the different types of connections.

If test mobiles are used, the results of the DQA complement the information acquired by means of the test mobile drivers.

Configuration Menus

ROMES provides a configuration menu for the DQA driver that is opened by clicking the *DQA[1]* command line in the *Configuration* menu. The command line is available as soon as the driver has been loaded.

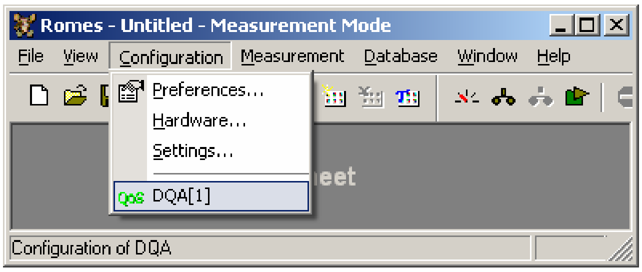


Fig. 6-139 Accessing the DQA driver configurations

The DQA driver configuration menu contains several tabs to define the connections to be set up and closed during the measurement, select connection and network-related parameters to be recorded, define patch files and display information on the current DQA driver version.

DQA Settings

The *DQA Settings* tab arranges and configures a list of jobs, each of them defining a connection to be set up or closed and defines a test file of definite size to be transferred.

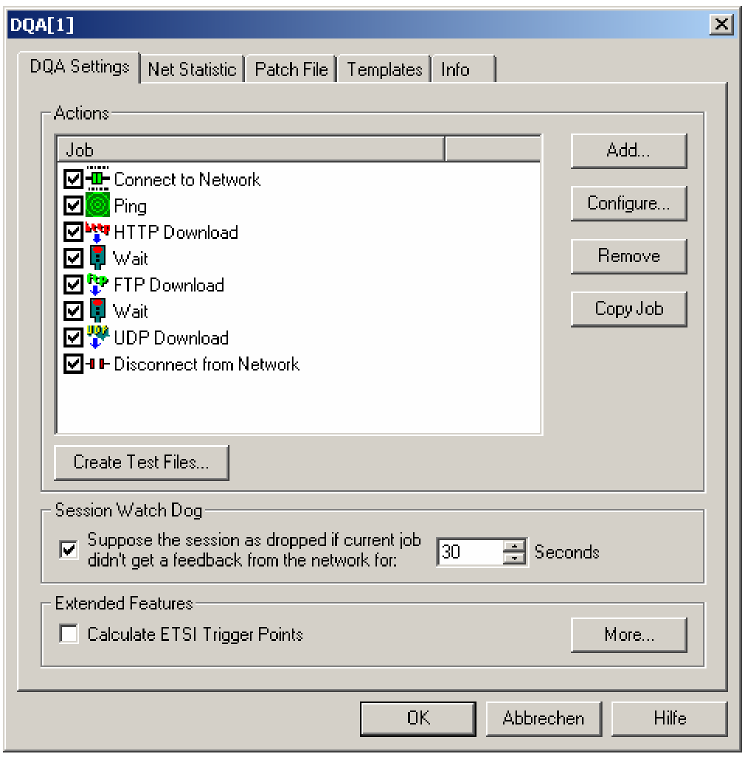


Fig. 6-140 DQA driver configuration – DQA settings

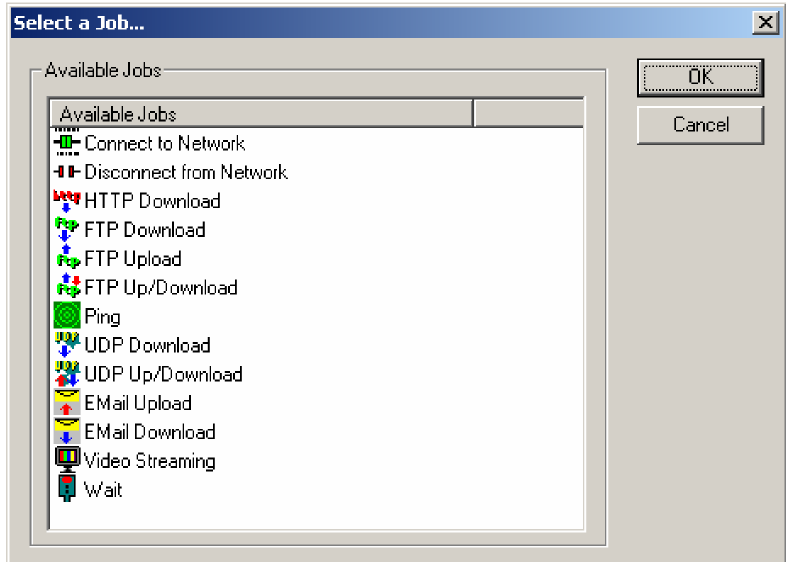
Job list The list shows the jobs to be executed in the DQA measurement. The jobs will be executed in the order of the list. According to the example of Fig. 6-140 above, ROMES will first set up a call to a network provider, then send a ping to a remote server, access an URL and download a HTTP site, wait for a predefined time period, download a file from a remote FTP server, wait for a predefined time period, download a file using UDP, download an e-mail, and finally release the call to the network provider. The entire job list is executed repeatedly while the DQA measurement is running.

A click on a job selects the job for further actions; see description of *Add…, Configure…, Remove* and *Copy Job* buttons below. A double-click opens the configuration menu for the job; see below.

Create Test Files… The *Create Test Files* button to define the size and file format *(Text File* or *Binary File)* of a test file that can be stored to a local directory and used for file transfer to a remote location. The contents of the file are random. A file of definite size is useful for many DQA applications.

Add

The *Add* button opens a list of jobs to be added to the current job list.



A new job is added at the end of the list (if no existing job is selected in the list) or directly before the selected job. The configuration menus for each job are opened before this is done.

Configure

The *Configure* button opens the configuration menu for the selected job. It is disabled as long as no job is selected in the *Job* list. The configuration menus provide input fields for the remote addresses to access and additional settings like timeouts. A separate configuration menu is provided for each job; see section *Configuration menus for the DQA jobs*.

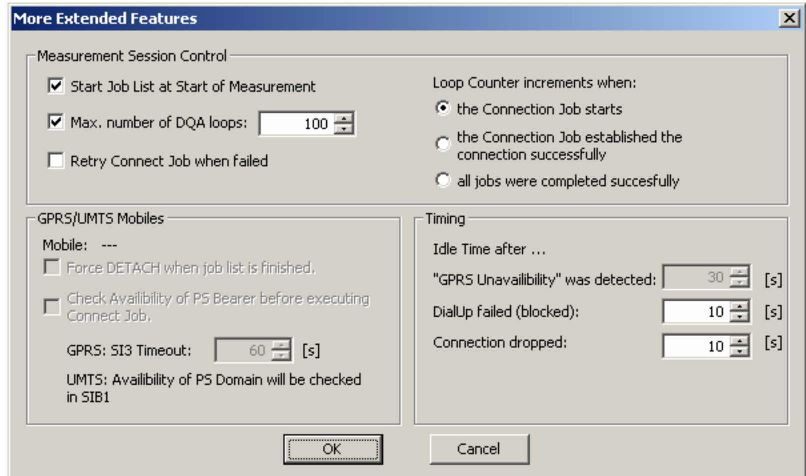
Copy Job

Duplicates the job selected in the job list.

Extended Features

Provides various settings to control the timing and statistics of the DQA session.

Calculate ETSI Trigger Points	Calculate trigger points according to the ETSI (IREG) specification; this provides parameters such as the *FTP Setup Time, GPRS Setup Time etc.* This feature is not time or performance critical. If the ETSI trigger points are disabled, the corresponding parameters in the QoS views are not available. For more information refer to the ETSI specifications, e.g. TS 102.250-3 (formerly: PRD IR.42) and related documents.
More…	Opens the *More Extended Features* dialog.



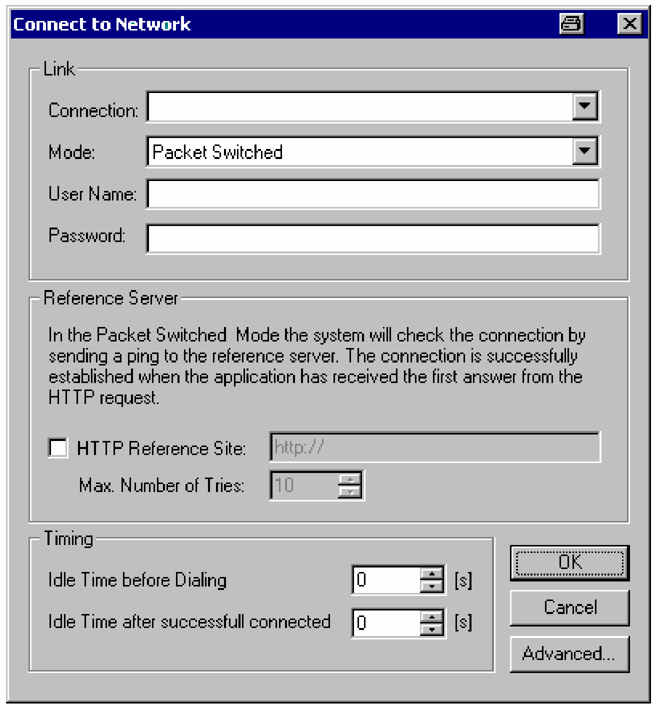
The two checkboxes in the *Measurement Session Control* panel define how and how often the job list is executed:

Start Job List …	If active, the entire job list is automatically started when the DQA measurement is initiated *(Measurement – Start Measurement).* Otherwise it is paused and can be initiated via *Action – DQA – Enable DQA.*
Max. Number of…	Limits the scope of the DQA measurement to a maximum number of job lists (loops) to be executed. In addition it is possible to specify whether all loops or just the successful loops are counted.
Retry Connect…	If this check box is selected ROMES will try to dial up to the network repeatedly if the previous connection fails.
GPRS/UMTS Mobiles	Controls a packet switched (PS) data connection through a GPRS or UMTS mobile. The panel is enabled after an appropriate GSM or UMTS driver is loaded and the virtual COM ports have been assigned; see section *Connection via USB Interface* on p. 6.5 ff. In the panel, it is possible to force the PS service to be detached after each job, to check whether the network supports the PS service *(Check Availability of …).* PS support is indicated through layer 3 System Information messages or blocks. For GSM/GPRS networks it is possible to specify a timeout after which a network will be considered as not supporting the PS service. An additional idle time after *GPRS Unavailability was detected* can be set in the *Timing* panel.
Timing	Defines an idle time to be inserted each time the connection failed because the cell was blocked, and each time the connection was dropped.

Configuration menus for the DQA jobs

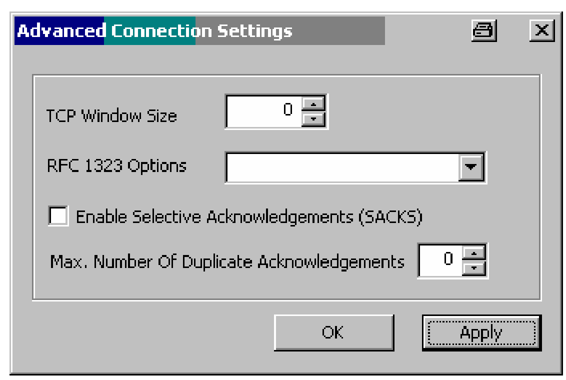
The configuration menus described below are opened when a job is added to the list in the *DQA Settings* dialog *(Add Job…)* or if a job selected in the list is re-configured *(Configure…)*.

Connect to Network The *Connect to Network* configuration menu selects a network link and a reference server and defines the idle time intervals for redialing.



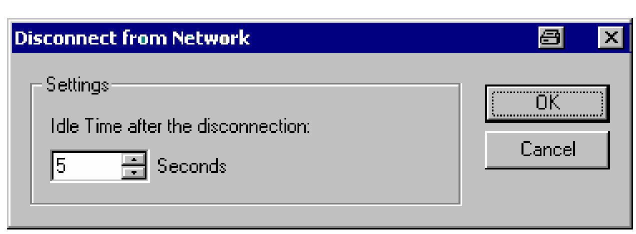
Connection	List of available network connections.
Mode	Type of connection: circuit switched or packet switched.
User Name/ Passw.	Optional input fields for authentication at the network.
Ping Ref. Server	Name of the reference server to ping; host name like in the example above or IP address. The reference server is used to check whether a packet switched connection could be established and to define a time limit for setting up the connection; see also explanation in the configuration menu.
Max. No. of Tries	Maximum no. of pings sent to the reference server before the system assumes that the dial-up has failed and aborts the job.
Timing	Idle time interval between the start of the job and dialing (The *QoS Message View* displays the message *Waiting <n> seconds before dialing)* and after a successful connection.

Advanced Opens a dialog to define additional connection settings.



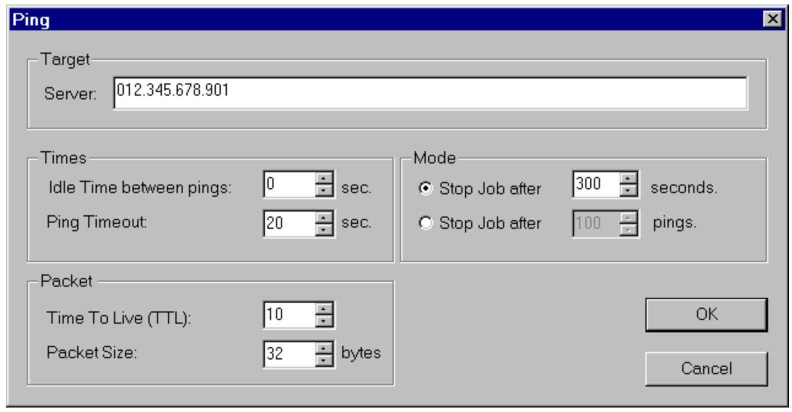
Disconnect from Network

The *Disconnect from Network* configuration menu defines an idle time in seconds between disconnection from the network and start of the next job in the *Job* list.



Ping

The *Ping* configuration menu defines a target server to ping (using an ICMP protocol), the timing and the number of pings to send.



Server Name of the target server to ping; IP address like in the example above or host name.

Idle Time between pings Time elapsed between reception of a response from the target server and start of the next ping.

Ping Timeout Maximum time between the start of a ping and reception of a response from the target server. After the *Ping Timeout* the ping is classified as unsuccessful.

Mode Defines the scope of the ping job: Either a time limit in seconds or a maximum number of pings can be set.

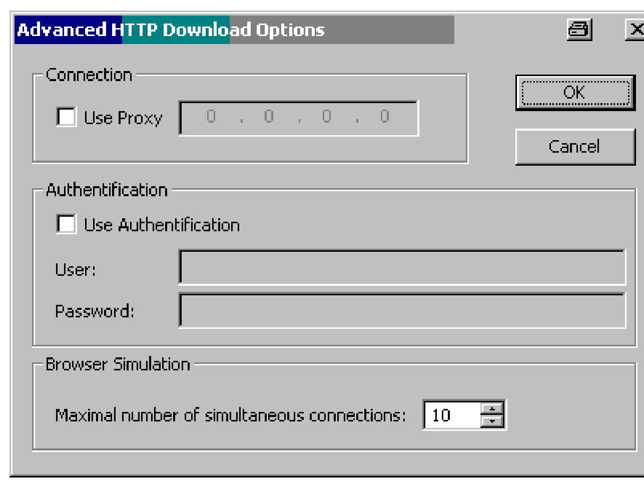
Time to Live Time_of_life parameter allocated to the transmitted data packets. Packets are discarded if their time to live has expired.

Packet Size Packet size in the range between 32 and 1024 bytes.

HTTP Download

The *HTTP Download* configuration menu defines a file on a target web server to be downloaded using TCP/IP. The downloaded file can be displayed in a HTTP browser and printed using the *Action* menu.

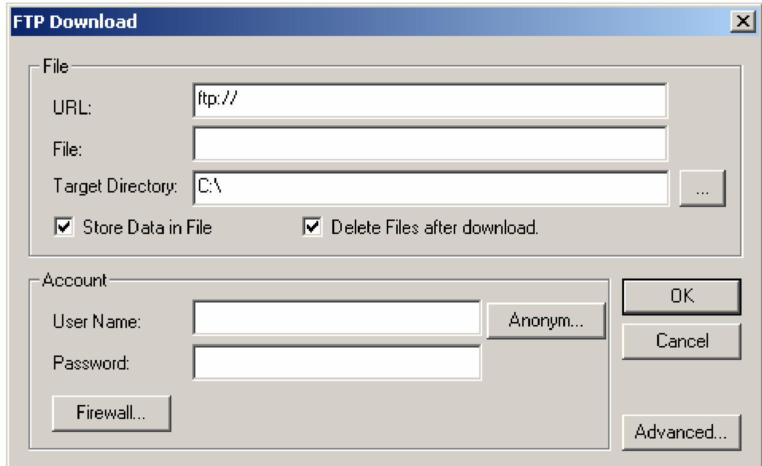
URL	Universal Resource Locator encoding the link to the file to be downloaded.
Target Directory	Standard directory (subdirectory of the ROMES program directory) where the downloaded file is stored.
Advanced	Opens an additional dialog with more connection settings.



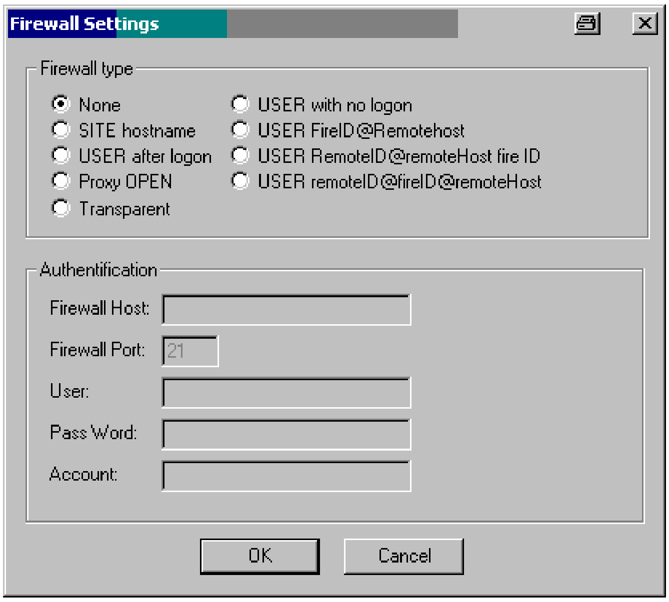
Connection	Use a proxy server to access the internet and download the HTTP site. If the option is checked, the IP address of the proxy can be entered.
Authentication	Use of authentication procedure to access and download protected HTTP sites. If the option is checked, the user name and password can be entered.
Browser Simul.	Limitation of the maximum number of HTTP connections.

FTP Download

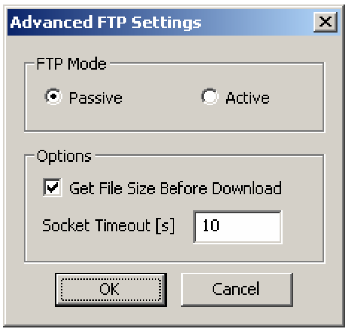
The *FTP Download* configuration menu defines a file on a remote server to be downloaded using FTP.



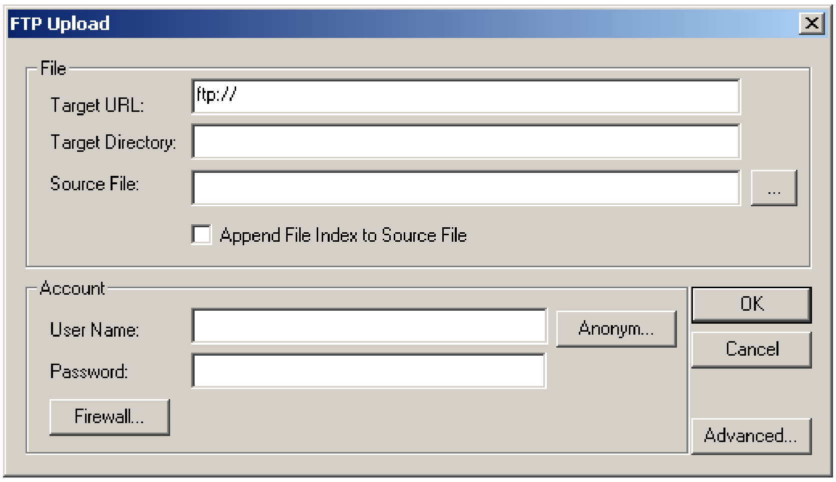
URL	Universal Resource Locator (host name) or IP address identifying the remote server.
File	File to be downloaded including the directory path.
Target Directory	Directory accessible from the test system (e.g. the harddisk of the PC) where the downloaded file is stored. The ... button provides a tree view of all available directories.
Store Data in File	If this option is selected, the downloaded data is stored in a file that is copied to the local hard disk. If it is cleared, the data can be kept in memory (see *Delete Files…* below) but are not processed, which generally improves the system performance.
Delete Files...	If this option is selected, no copy of the downloaded file is kept after the job is finished. Otherwise ROMES creates multiple copies of the downloaded file when the *FTP Download* job is performed repeatedly. For a downloaded file <file_name>.<extension>, the copies are named <file_name>_0.<extension>, <file_name>_1.<extension> etc.
Account	Optional input fields for authentication at the remote server *(User Name* and *Password)*. The *Anonym…* button inserts the user name *anonymous* and an arbitrary password. The password can be overwritten, if required.
Firewall	Opens an additional dialog to define the authentication information necessary to access a remote server protected by a firewall. For all firewall types (except *None* for non-protected servers) the fields in the *Authentication* panels must be filled in.



Advanced Opens a dialog to define additional file transfer parameters. If the option *Get File Size before Download* is selected, the size of the transferred file is indicated in the *QoS Progress View* together with downloaded number of bytes. The *Socket Timeout [s]* can be used to limit the transfer time and thus the amount of information transferred.



FTP Upload The *FTP Upload* configuration menu defines a target server and a file to be uploaded using FTP.



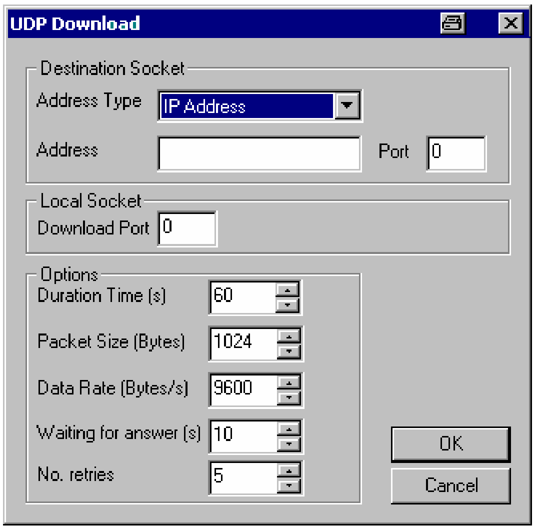
Target URL	Universal Resource Locator (host name) or IP address identifying the target server
Target Directory	Directory name and path on the target server.
Source File	File to be uploaded including the directory path.
Append File Index to Source File	If this option is selected the source file name is extended by an index before the file is transferred. The index is incremented before each FTP upload so the target server receives multiple copies of the same file with different file names.
Account	Optional input fields for authentication at the remote server *(User Name* and *Password)*. The *Anonym…* button inserts the user name *anonymous* and an arbitrary password. The password can be overwritten, if required.
Firewall	Opens an additional dialog to define the authentication information necessary to access a remote server protected by a firewall; see *FTP Download.*
Advanced	Opens a dialog to define additional file transfer parameters; see *FTP Download* above. *Get File Size…* is not available for uploaded files.

FTP Up/Download

The *FTP Up/Download* configuration menu defines a remote server and two files on the remote server and the local file system to be uploaded and downloaded using FTP. The configuration menu combines the *FTP Upload* and *FTP Download* menus.

UDP Download

The *UDP Download* configuration menu defines a remote server to be accessed for downloading data using the User Datagram Protocol (UDP) and configures the data transfer options. This job requires a remote server which is configured as a ROMES measurement server. This is done by installing the *ROMES DQA Measurement Server* software, which serves the measurement job with the expected data.



Address Type	Host name or IP address identifying the measurement server.
Address	Server address, conforming to the selected *Address Type*
Port	Measurement server port number
Local Socket	Port numbers of the local ports used to download data *(Download Port)*.

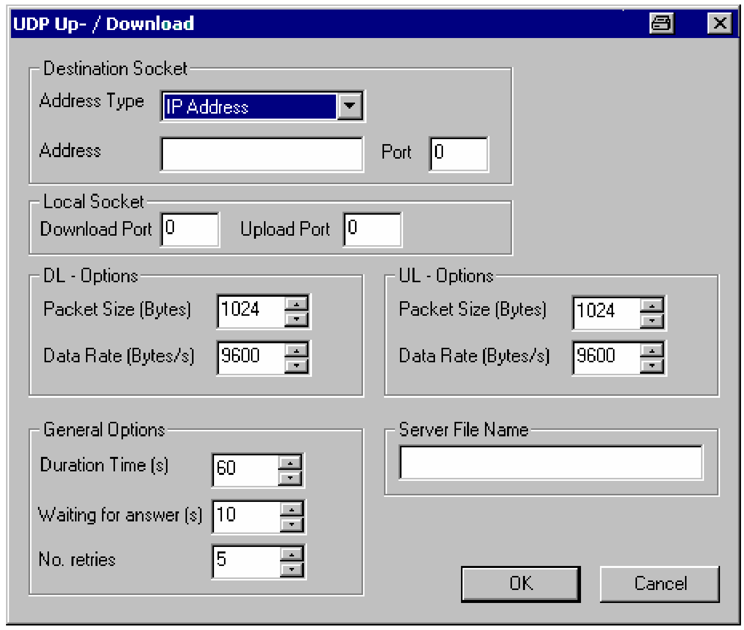
The following *Options* define transfer parameters and timeouts:

Duration Time (s)	Time to execute the job (download time) in seconds
Packet Size	Size of the transferred data packets
Data Rate	Number of bytes transferred per second
Wait. for answer	Timeout for an attempted connection to a measurement server that does not respond. ROMES will retry a connection several times (see *No. retries* below) with the same timeout before the job is aborted.
No. retries	Number of times that ROMES tries to connect to the remote server, using the *Waiting for answer* time, before the job is aborted.

UDP Up/Download

The *UDP Up/Download* configuration menu defines a remote server to be accessed for downloading data using the User Datagram Protocol (UDP) and configures the data transfer options. In addition it specifies a file on the local file system to be uploaded to the remote server and defines the file options.

This job requires a remote server which is configured as a ROMES measurement server. This is done by installing the *ROMES DQA Measurement Server* software, which serves the measurement job with the expected data.

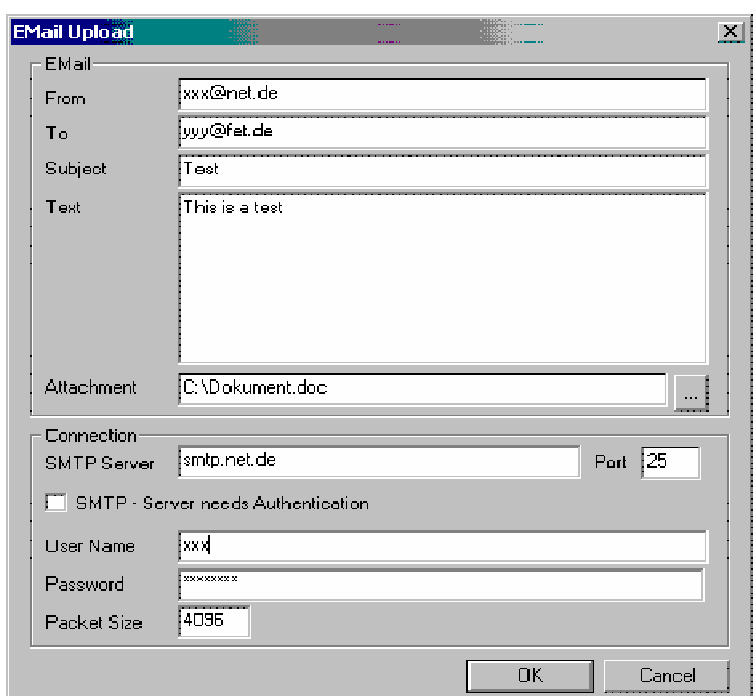


The settings concerning the measurement server, the ports, and the down-link options are identical with the *UDP Download* configuration menu; see above. The *General Options* are valid for both the download and upload.

Besides the configuration menu defines a packet size and data rate for the upload and the name of the file to be uploaded from the local file system to the measurement server.

EMail Upload

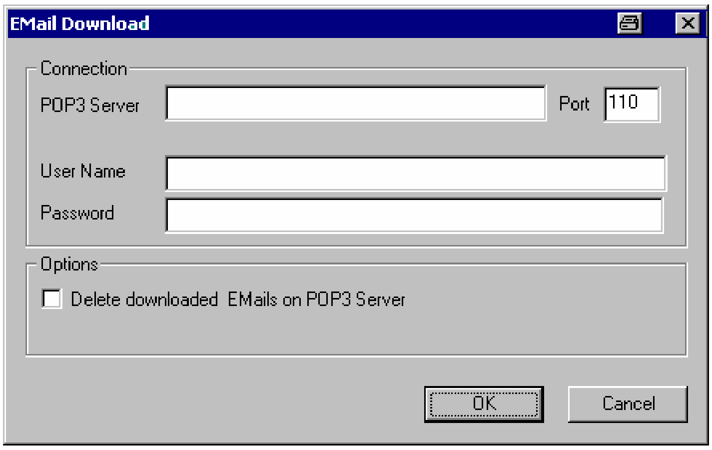
The *EMail Upload* configuration menu defines the addresses, contents and connection parameters for e-mail transfer to a remote SMTP server.



From / To	E-mail addresses of the sender and recipient.
Subject/Text	Contents of the message
Attachment	Arbitrary file to be uploaded with the mail, including the directory path. The "…" button opens a dialog to search the local directories.
SMTP server	Name of the Simple Mail Transfer Protocol (SMTP) server of the service provider that will receive the uploaded e-mail.
SMTP…	This box must be checked and the user name and password must be entered if the SMTP server need authentication.
Port	Port number of the SMTP server (in most cases: 25)
User Name / Password	Authentication information for accessing the SMTP server.
Packet Size	Size of the single packets that the e-mail is split into. Increasing the packet size can be useful if a large amount of data is transferred.

EMail Download

The *EMail Download* configuration menu defines the addresses, contents and connection parameters for e-mail transfer from a remote POP3 server.



POP3 Server	Name of a Post Office Protocol Version 3 (POP3) server of the service provider that will send the downloaded e-mail.
Port	Port number of the POP3 server (in most cases: 110)
User Name / Password	Authentication information for accessing the server.
Delete…	If the option is checked, the downloaded e-mail is deleted on the POP3 server. Otherwise the same e-mail can be downloaded repeatedly. Deleting the downloaded e-mail makes sense if the DQA job contains an upload/download cycle which is continuously repeated.

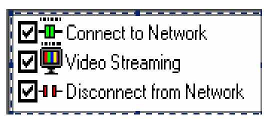
Video Streaming

The *Video Streaming* configuration menu defines the source addresses, the file transfer options, and evaluation criteria for a video stream download.

Video Streaming is available with option ROMES-Z7. A packet-switched network connection is set up to a server using a GPRS or UMTS test mobile or commercial mobile. The server provides a stream of MP4 video data at constant frame rate, using the Real Time Streaming Protocol (rtsp). The test system performs an analysis of the received data, evaluates the received frame rate and estimates the quality of the transferred video stream. No data is returned or retransmitted.

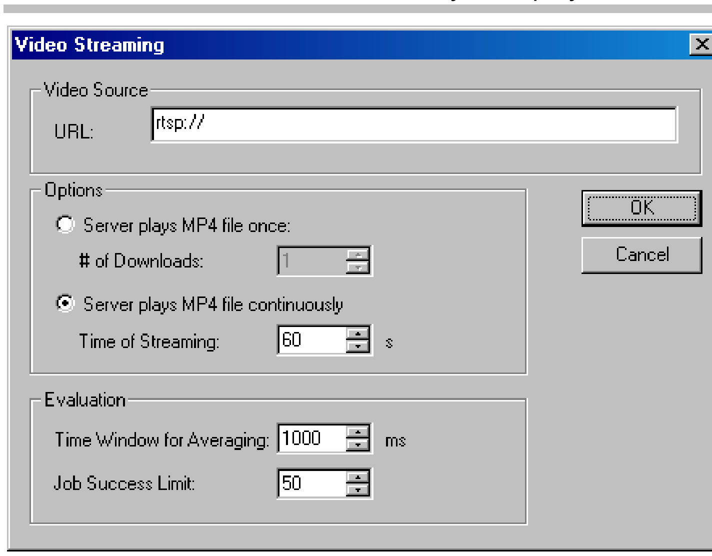
The video streaming results can be viewed in several QoS views, in particular the *QoS Progress View* (see chapter 4).

Video streaming is tested with a network connection through a mobile phone in packet data mode, i.e. with the job sequence:



Note:

To set up a connection to a server and test video streaming, the server must support the required (virtual) COM ports for the mobile connection (see section Connection via USB Interface on p. 6.5), and the network must support the rstp protocol. To exclude other sources of errors, first test the connection with an ordinary MP4 player before using ROMES.



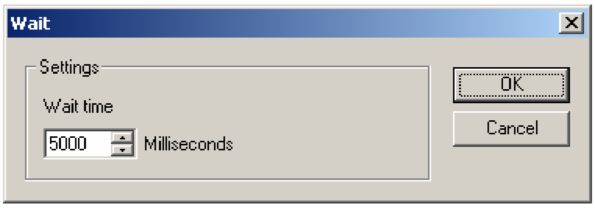
Video Source MP4 file name and location (URL) on the remote server (mount point) providing the video stream.

Options Defines the duration of the video stream measured in a single job. It is possible to specify either a definite amount of transmitted data *(number of downloads)* or a definite *Time of Streaming.*

Evaluation Defines the *Time Window…* for the calculation of the average *Frame Rate, Video Quality,* and *Spatial* and *Temporal* variation displayed in the *QoS Progress View. Job Success Limit* is the minimum video quality beyond which a job is considered to be successful; see description of *QoS Progress View* in chapter 4.

Wait

The *Wait* configuration menu defines a wait time between two jobs. A wait job can be used to provide the necessary time for system (re-)configurations before the next job is started.



Net Statistic

The *Net Statistic* tab selects the data to be recorded in a DQA measurement.

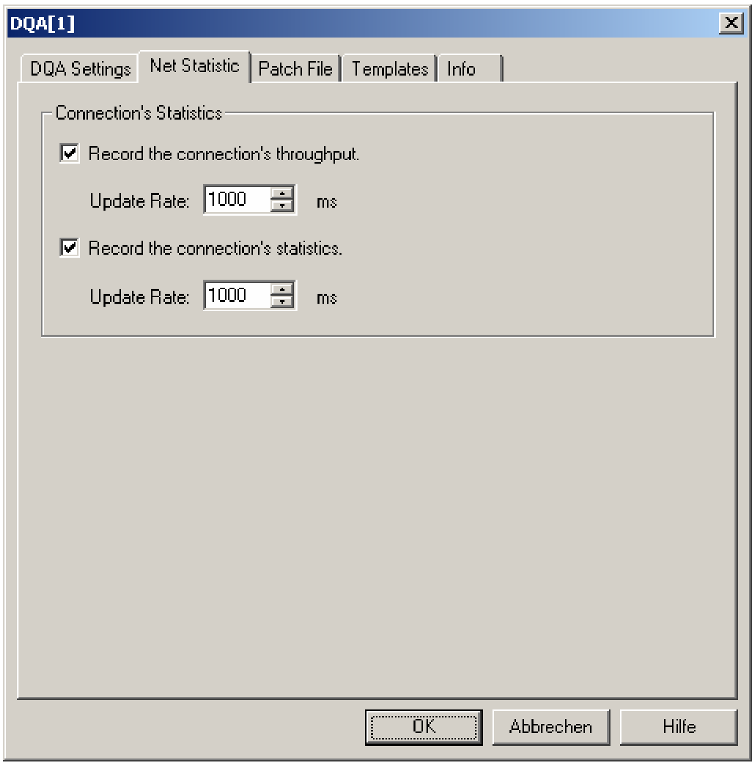


Fig. 6-141 DQA driver configuration – Net Statistic

Record the connection through-put

Selects the current and average data rate in uplink/upload and downlink/download direction to be recorded. The throughput is displayed in the *QoS Throughput View* which is empty if recording is disabled.

The data is recorded with a selectable update rate: An update rate of n milliseconds means that the throughput values are updated every n milli-seconds.

Record the connection statistics

Selects the parameters describing the network traffic to be recorded. The statistics is displayed in the *QoS RAS Statistics View* which is empty if recording is disabled.

The data is recorded with a selectable update rate: An update rate of n milliseconds means that the statistics values are updated every n milliseconds.

Patch File

The *Patch File* tab controls the transfer of DQA measurement data from the remote server back to a local measurement file.

Retrieving measurement data from the remote server is an essential step in assessing the QoS of an upload job. Every time an upload job is executed, the DQA software evaluates the results and stores them in a separate DQA measurement file (*.cmd) generated on the remote server. To view the results, the remote files are transferred to a local directory, and the measurement data is merged into a single measurement file.

Without the results evaluated on the remote server, there is still some information about an upload job available, however, it is obtained indirectly and therefore less accurate.

To evaluate the QoS of an upload connection...

1. Set up a connection to a remote server and configure an upload job *(FTP Upload, UDP Upload, UDP Up/Download),* specifying a prefix for the measurement files to be created on the remote server. See chapter 2, section *Data Quality Tester,* for further details.
2. Click the  icon to start the DQA measurement. Wait until the job has been repeated 10 times (the measurement progress can be monitored in the *QoS Message View),* then terminate the measurement by clicking the  icon.
3. Transfer the measurement files from the remote server to a local directory, e.g. via FTP.
4. Open the *Patch File* tab of the DQA driver configuration menu and patch the downloaded files to a single measurement file *(File to Patch)* as described below.
5. Open any of the QoS Views (see chapter 4) and replay the *File to Patch.*

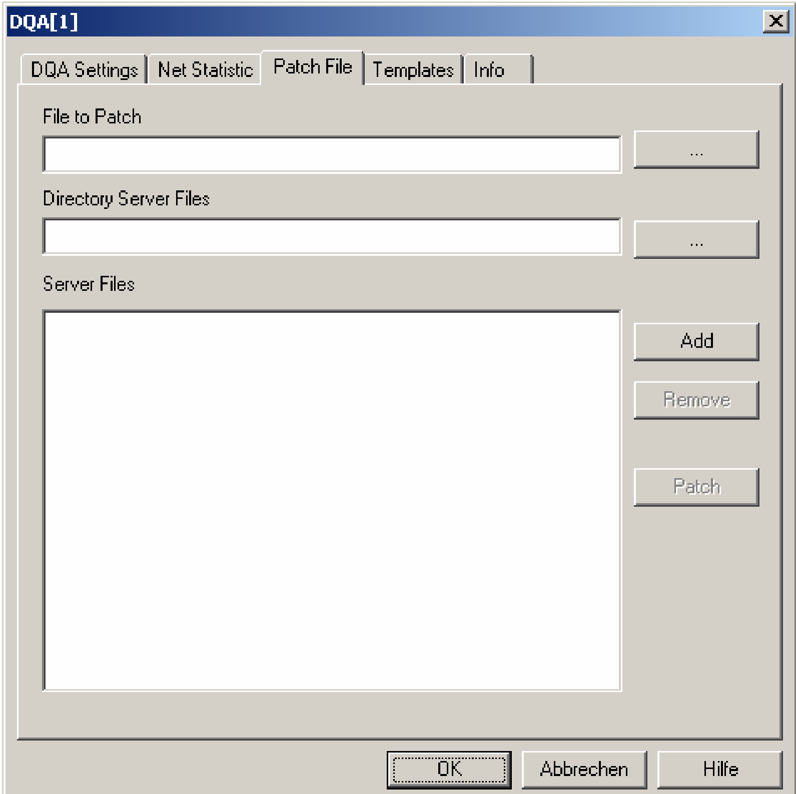


Fig. 6-142 DQA driver configuration – Patch File

File to Patch Name and (local) directory of an existing *.cmd file containing DQA data, preferably from a UDP Up/Download job. The file to patch is the target file for the DQA results retrieved from the remote server.

Directory Server Files Name and path of the local directory containing the DQA measurement files downloaded from the remote server.

Server Files List of all files on the remote server that contain information to be merged into the file to patch. The list is generated automatically according to the predefined measurement file names but can be modified with the buttons on the left side:

Add Add a file to the list, e.g. a file that was (erroneously or temporarily) removed before

Remove Remove a selected file from the list

Patch Patch the current file list to the file to patch: Merge the file information into a common file to be subsequently replayed

Templates

The *Templates* tab stores the current driver configuration as a template, lists, loads or deletes driver templates. It is provided for many test device drivers and is identical for all of them.

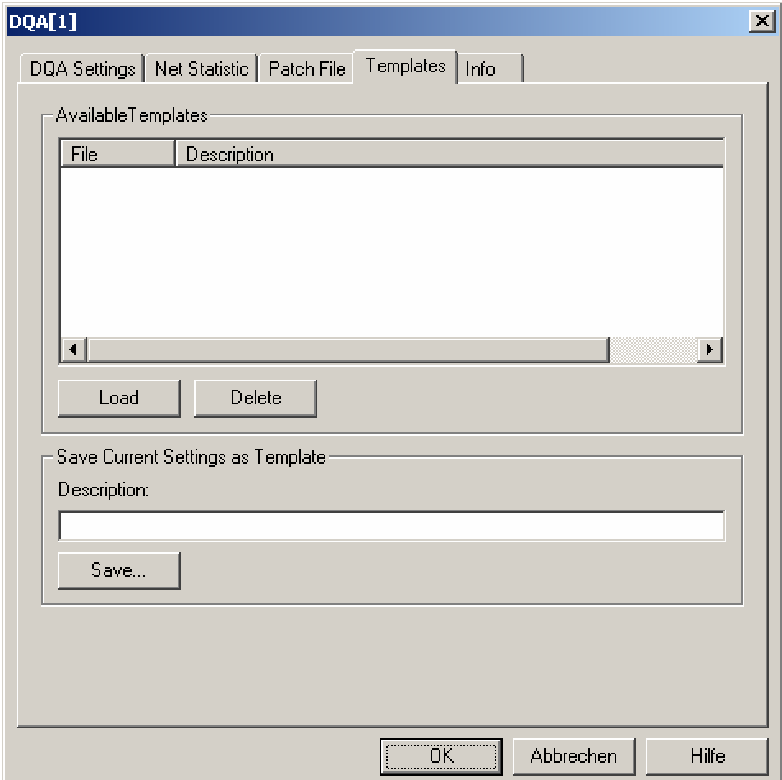


Fig. 6-143 DQA driver configuration: Templates

Action Menu

The *Action* menu provides DQA session control commands. It is added to the menu bar while a DQA measurement is running *(Measurement – Start Measurement* or *Start Recording)*. If the DQA driver has been loaded several times in order to define several DQA sessions, a separate command line is displayed for each of them.

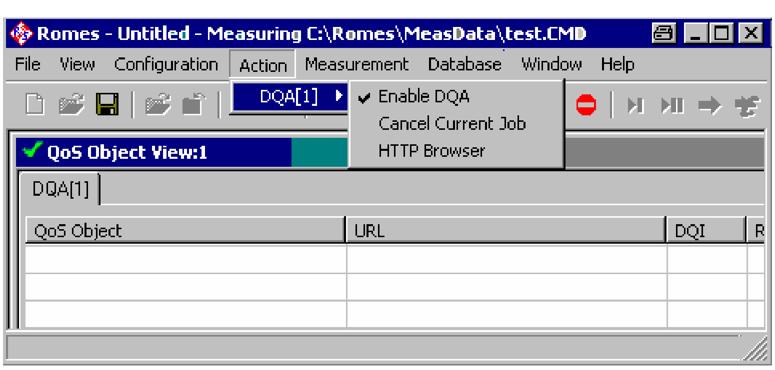


Fig. 6-144 Action menu (DQA driver)

Enable DQA

Starts a DQA measurement that is paused.

This command is relevant if *Start Job List at Start of Measurement* has been deactivated in the *More Extended Settings* dialog.

Cancel Current Job

Aborts a running DQA session.

HTTP Browser

Opens a HTTP browser window to display and print a HTML file transferred in a *HTTP Download* job.

Navigation

ROMES uses two different methods to determine the geographic coordinates of a measurement position:

- For ordinary outdoor applications, a GPS receiver is used to detect the satellite signals of the *Global Positioning System* (GPS).
- In areas where no GPS signals can be detected, e.g. inside closed buildings, the position is defined by means of a user-defined map.

GPS and indoor drivers and their configuration is described in the following sections.

GPS Drivers

The measurement system offers five different GPS (global positioning system) receiver drivers to be used with the different GPS receivers.

GPS drivers are installed by selecting *Positioning system* in the *Hardware Drivers* window (see Fig. 6-1 on page 6.1). The configuration menus are explained below.

Driver Types and Supported Devices

Table 6-15 GPS drivers and supported devices

Trimble Svee6/ Trimble Placer	**Travel Pilot RGS08 Pro**	**NMEA**
Six-channel GPS receiver Manufacturer: *Trimble Navigation* company NOTE The ROMES GPS driver accepts the following protocol settings of the Trimble GPS receivers: Svee6 TSIP (Trimble Standard Interface Protocol) Placer TAIP (Trimble ASCII Interface Protocol)	Car navigation system Manufacturer: *BOSCH* company Description: The system uses GPS information as well as CD-ROM based road map data and shows the current car position on an additional display, mounted in sight of the driver.	All GPS receivers supporting the NMEA (*National Marine Electronics Association*) protocol. This driver is required for GINA, the standard GPS receiver for ROMES running in a test vehicle.

In addition, a *Dummy GPS* driver is provided with each ROMES configuration. This driver assigns fictitious geographic information to a set of measurement data so that they can be displayed in the *Route Track View*. No GPS receiver is required; the COM port suggested during the installation will not be used.

Configuration Menus

The *GPS Driver Configuration* menus offer device-specific driver settings. They can be opened by clicking the *Driver* command line of the Configuration menu which is available as soon as a mobile driver is loaded (see Fig. 6-4).

Trimble Svee6

The *Svee6* configuration menu configures the Trimble SveeSix driver and indicates the current file version.

Svee6 Configuration

The *Svee6 configuration* tab selects the *DGPS Mode (Differential GPS)* and the corresponding port settings.

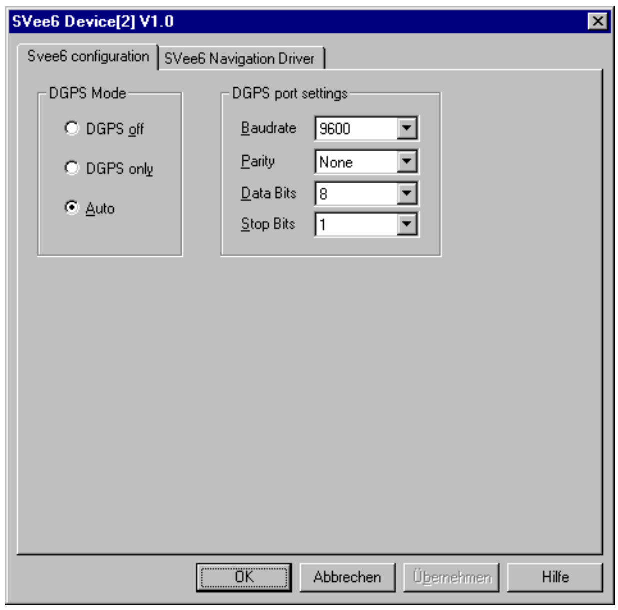


Fig. 6-145 Svee6 driver configuration

If a DGPS signal for maximum resolution is provided either the *DGPS only* or the *Auto* mode must be set. Otherwise, select *DGPS off*.

Inconsistent settings:

The DGPS settings are checked for consistency when the configuration menu is closed via *OK*. If the settings are incorrect, a message window is called up explaining the detected mistake. In this case the configuration window remains open so that the correct setting can be entered.

For more information see the GPS glossary in chapter 8.

Svee6 Navigation Driver

The *Svee6 Navigation Driver* tab indicates the current file version and allows to use the GPS time:

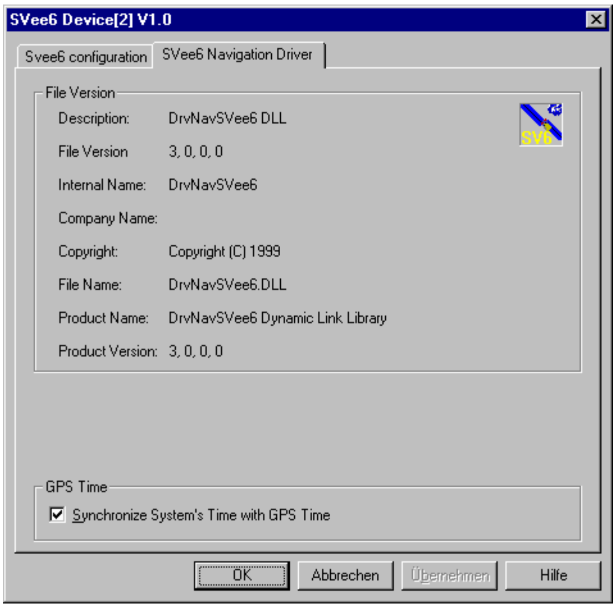


Fig. 6-146 Svee6 driver configuration –Info

GPS Time

If the *GPS Time* box is checked, the system time is synchronized with the GPS time so that the PC clock can be set according to the accurate GPS clock. This implies that the measurement can be started only after a string containing the time information has been received. This time delay can be avoided, however, by switching the correction off and starting the measurement immediately.

Trimble Placer

The *Trimble Placer* configuration menu configures the Trimble Placer driver and indicates the current file version.

Calibration Data

The *Calibration Data* tab handles the dead reckoning (calibration) data of the placer.

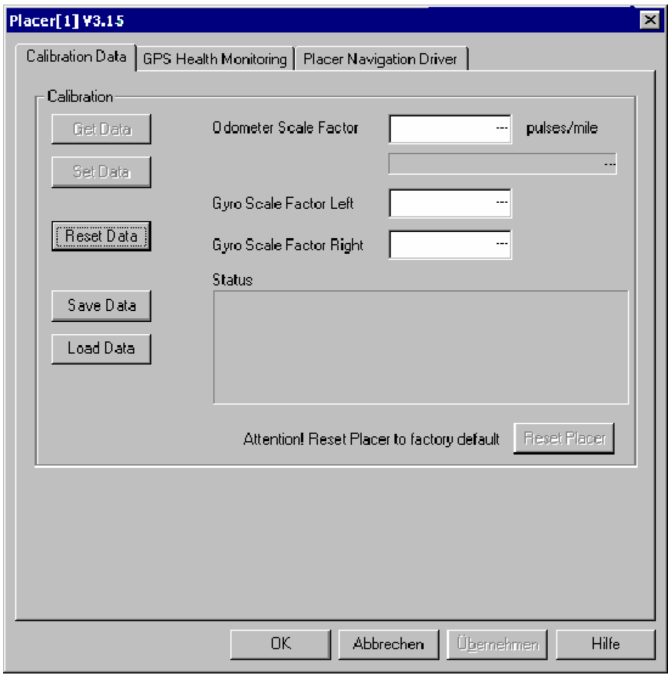


Fig. 6-147 Trimble Placer configuration: Calibration Data

Dead reckoning is used to calculate the geographic position of the test vehicle in situations where the GPS signal is not available. The calculation is based on the distance from a known position and the direction of the test vehicle; the placer determines both values by means of a calibrated odometer and a gyroscope. Usually, the three calibration data (the odometer scale factor and the left and right gyroscope scale factor) do not have to be changed.

In the *Calibration* panel, it is possible to retrieve the calibration data from the placer *(Get Data)* and replace the placer data by the current values entered in the three input fields *(Set Data)*. The *Reset Data* button sets the current data to default. *Save Data* writes the current data to a file named *Placer.dat* in the application program directory; *Load Data* loads the values in *Placer.dat* to the input fields. The factory calibration data of the placer are resident in the system; they can be used any time to reset the placer *(Reset Placer)*.

GPS Health Monitoring

The *GPS Health Monitoring* tab switches health monitoring in the *General Status View* on or off.

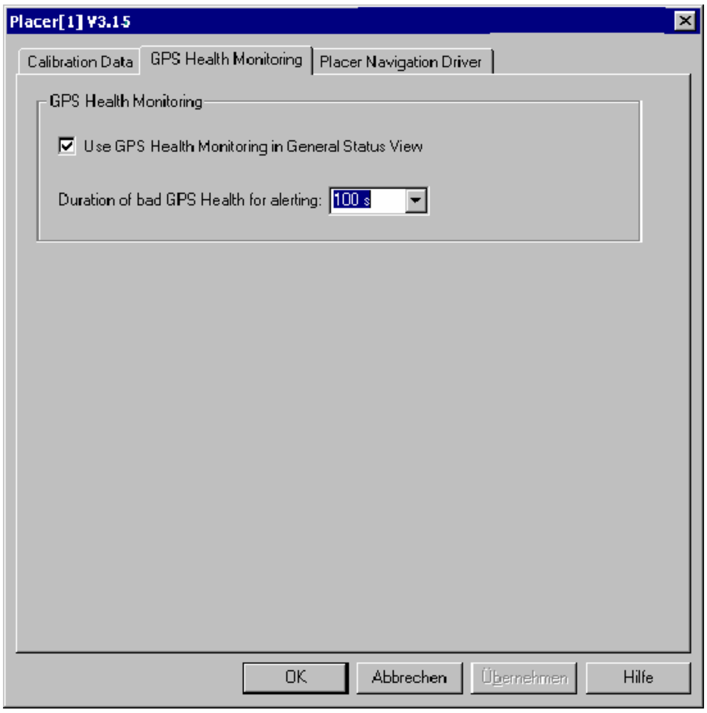


Fig. 6-148 Trimble Placer configuration: GPS Health Monitoring

Bad GPS health means that the GPS signal received is low. Bad health situations can frequently occur during an ordinary test trip, e.g. if the vehicle crosses an underpass or a tunnel. If *Use GPS Health Monitoring...* is checked, bad health situations will cause a warning message to be displayed in the *General Status View*, provided that they last longer than the time selected in the *Duration of bad GPS Health...* entry field.

Placer Navigation Driver

The *Placer Navigation Drive*r tab indicates the file version and selects either the active or the inactive communication mode.

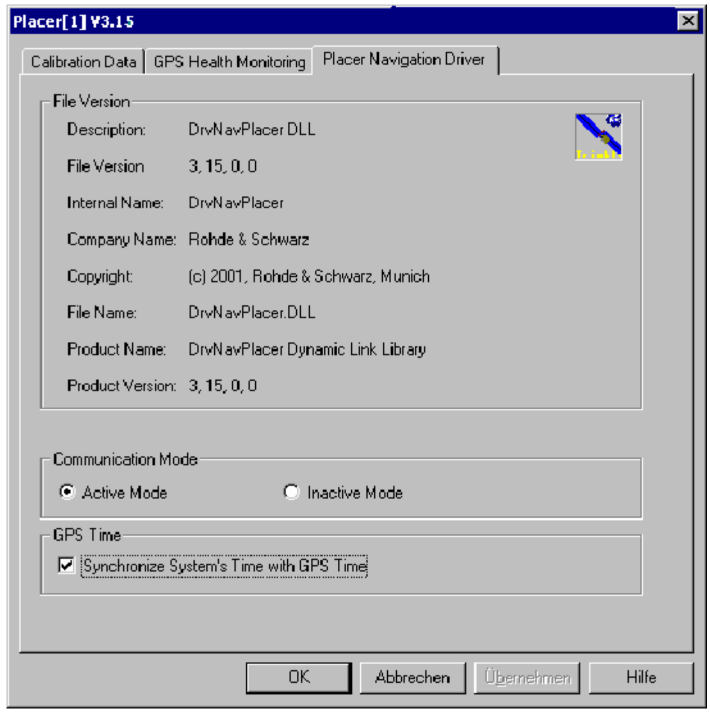


Fig. 6-149 Trimble Placer configuration: Placer Navigation Driver

Communication Mode:

The *Communication Mode* defines in which mode a connected system works:

Active mode	Basic (and default) mode; the system reads and sends data
Inactive Mode	System only reads data

Use of inactive mode:

The inactive mode allows to connect a second measurement system or one working in active mode without using a second *Trimble Placer*.

➢ Select communication mode active in system I, inactive in system II.

➢ Connect the devices as follows:

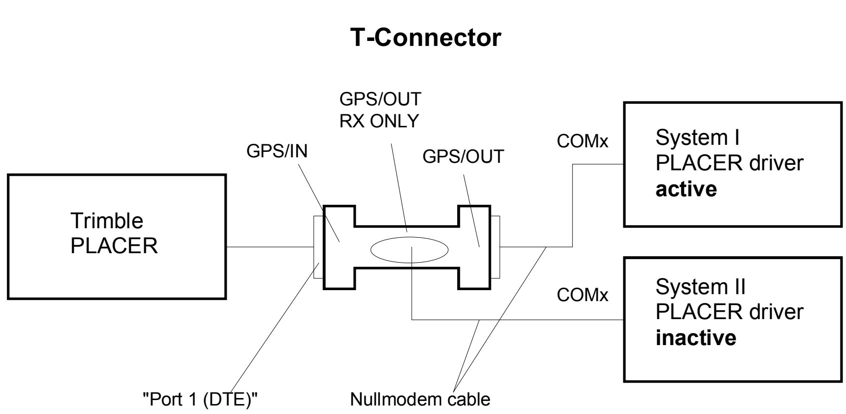


Fig. 6-150 Test setup for inactive GPS driver

Antennas, power supply etc. are not shown in Fig. 6-150.

Note:
As the inactive driver only reads data, the system cannot automatically detect cabling errors or wrong COM port settings. So check if correct GPS data is displayed on both systems in the *Route Track* window before starting the measurement tour.

It is indispensable to have one System working in active mode.

Do not load the *Placer* driver into the inactive system when it is connected to an active system while a measurement is running. The reason is, that the default setting is active I/O Mode, and two active systems will collide with each other. So disconnect the inactive system before loading.

Cabling of the T-Connector (stock no. 1086.5331):

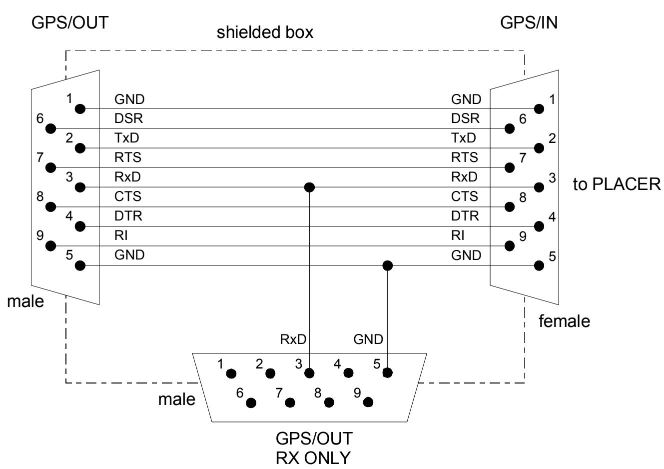


Fig. 6-151 Cabling of the T-connector

Inconsistent settings:

The *communication Mode* settings are checked for consistency when the configuration menu is closed via *OK*. If the settings are incorrect, a message window is called up explaining the detected mistake. In this case the configuration window remains open so that the correct setting can be entered.

For more information see the GPS glossary in chapter 8.

GPS Time

If the *GPS Time* box is checked, the system time is synchronized with the GPS time so that the PC clock can be set according to the accurate GPS clock. This implies that the measurement can be started only after a string containing the time information has been received. This time delay can be avoided, however, by switching the correction off and starting the measurement immediately.

The *Travel Pilot IDS* has no actual configuration menu assigned because no configuration settings are necessary. The corresponding message box indicates the associated COM port and detects the hardware at this port. If this fails, check the COM port and the device power supply.

Travel Pilot RGS08

The Travel Pilot RGS08 offers the configuration settings shown below.

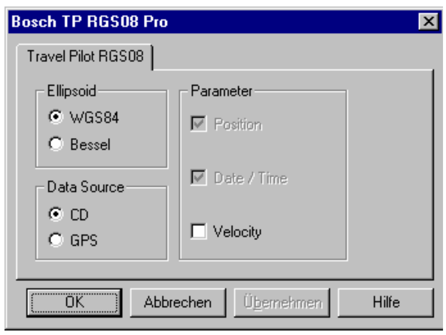


Fig. 6-152 Travel pilot – COM port messages

For more information, especially on the RGS08 settings, see the *Travel Pilot* user manual.

NMEA Driver

The NMEA driver is required for GINA, the standard GPS receiver for ROMES running in a test vehicle.

The ROMES NMEA driver version supports the following NMEA protocol versions: GSA, GGA, RMC, ZDA. Protocol versions not listed here are ignored. The format of the NMEA data depends on the protocol version. The following example shows a comparison of the RMC, GGA and VTG (not supported) protocols:

```
$GPRMC,144732,A,4807.530037,N,01136.650214,E,0,144,070800,001.0,E*76
$GPGGA,144732,4807.530037,N,01136.650214,E,1,09,1.1,546.6,M,46.8,M,,*4F
$GPVTG,144,T,069.3,M,0,N,0,K*5D
$GPRMC,144733,A,4807.530037,N,01136.650214,E,0,144,070800,001.0,E*77
$GPGGA,144733,4807.530037,N,01136.650214,E,1,09,1.1,546.6,M,46.8,M,,*4E
$GPVTG,144,T,080.7,M,0,N,0,K*5E
$GPRMC,144734,A,4807.530037,N,01136.650214,E,0,144,070800,001.0,E*70
$GPGGA,144734,4807.530037,N,01136.650214,E,1,09,1.1,546.7,M,46.8,M,,*48
$GPVTG,144,T,074.7,M,0,N,0,K*55
```

...

The NMEA *Navigation Driver* menu displays information on the current driver version. If the *GPS Time* box is checked, the system time is synchronized with the GPS time so that the PC clock can be set according to the accurate GPS clock. This implies that the measurement can be started only after a string containing the time information has been received. This time delay can be avoided, however, by switching the correction off and starting the measurement immediately. No other configuration settings are required.

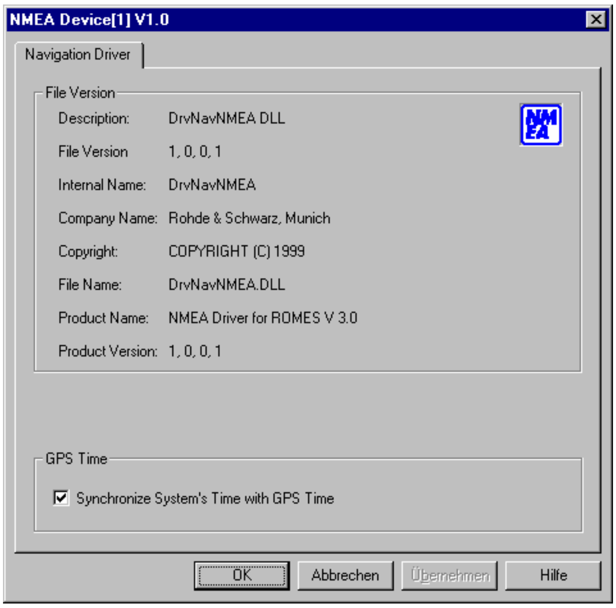


Fig. 6-153 NMEA Configuration

The system will detect any NMEA device at the selected COM port. If not, check the COM port and the device power supply.

Dummy GPS

The *Dummy GPS* configuration menu configures the *Dummy GPS* driver and indicates the current file version.

The *Position* tab selects a geographical start position and the speed and direction of the measurement curve on the map. It also assigns attributes to the measurement data.

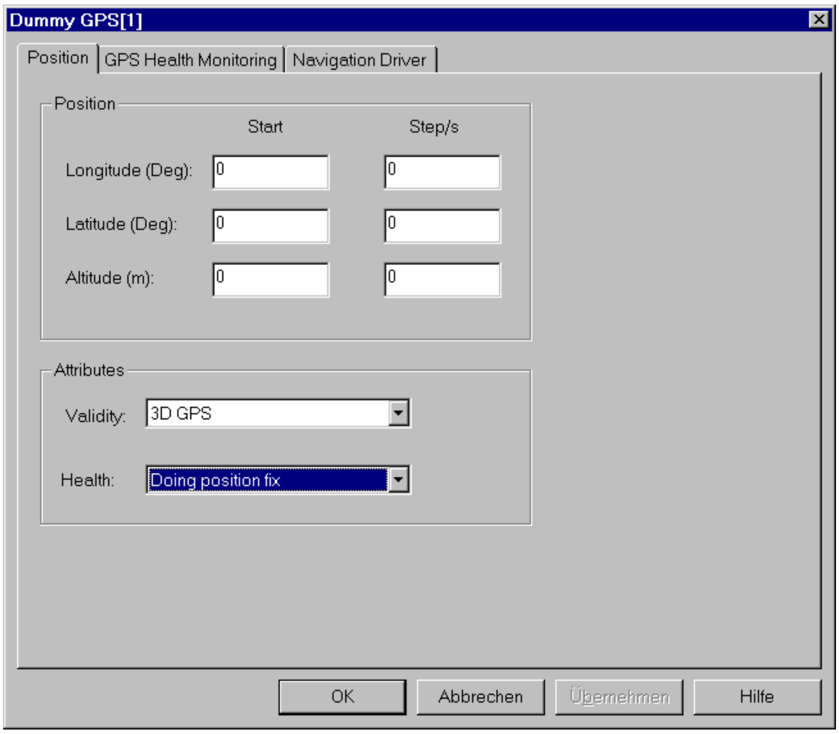


Fig. 6-154 Dummy GPS driver configuration

The *Position* panel defines the position of the measurement data on the map:

Start The first measurement point will be assigned the three geographic coordinates in the *Start* column. If the data is displayed in the *Route Track View*, then the *Altitude* coordinate does not contribute to the representation but is shown in the *GPS Info* view.

Step/s The three coordinates in the *Step/s* column define the geographical distance of a data point from another that was recorded 1 s earlier. The *Altitude* coordinate is not taken into account. The ratio between *Longitude* and *Latitude* determines the angle of the measurement curve on the map; the sum of the squares of both values is proportional to the square of the speed of the measurement curve on the map.

The *Attributes* panel assigns a (fictitious) *Validity* and *Health* value to the measurement. Both values are shown in the *GPS Info* view.

The settings in the *GRS Health Monitoring* tab are not used for the measurement. The *Navigation Driver* tab displays information on the current driver version.

Indoor Navigation Driver INDOOR

The INDOOR driver is used to perform measurements in areas where no GPS navigation signal is available, e.g. inside buildings. To visualize the measurement route, one or more user-defined maps, e.g. floor plans, are used, which are contained in a Geoset file (see *Background Set* paragraph on p. 6.254).

The INDOOR driver itself does not need additional hardware.

Note:

As opposed to all other hardware drivers, the Indoor driver must be loaded before indoor measurement data can be replayed. On loading the driver the Indoor submenu is added to the View menu, see below. At the same time, the Configuration menu is extended by the Indoor Navigation command line, see section Driver Configuration Menu on page 6.254.

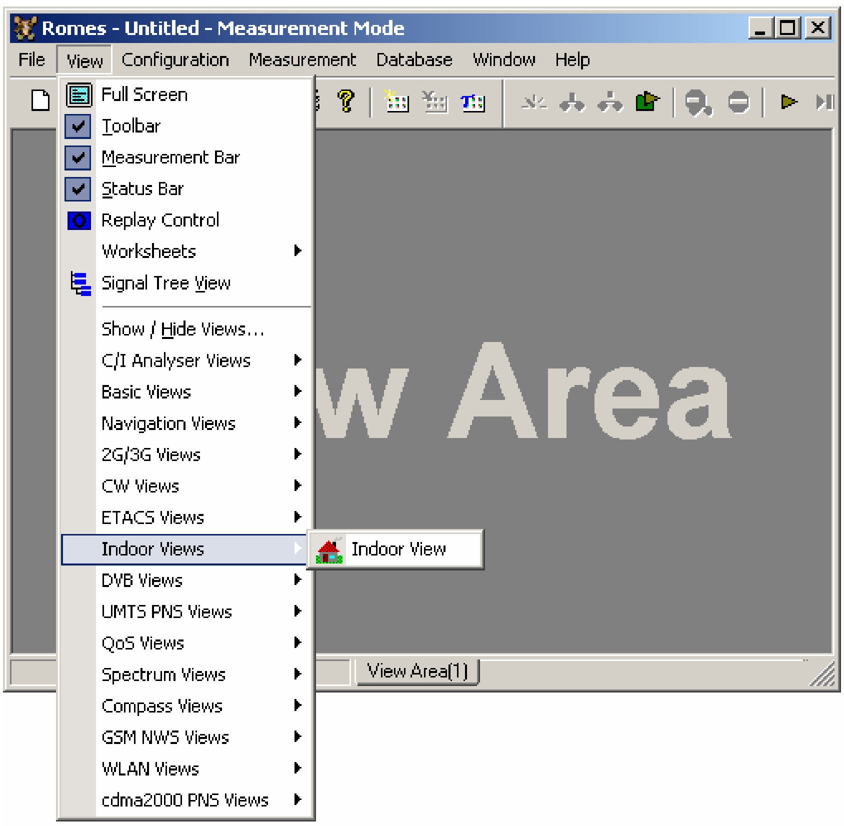


Fig. 6-155 Indoor submenu

Driver Configuration Menu

Indoor Navigation - Setup

The *Indoor Navigation* configuration menu is used to select the background bitmap set from an archive, to select the measurement mode and the navigation mode. The configuration menu can be opened by selecting the *Indoor* command line in the *Configuration* menu which is available after loading the Indoor driver.

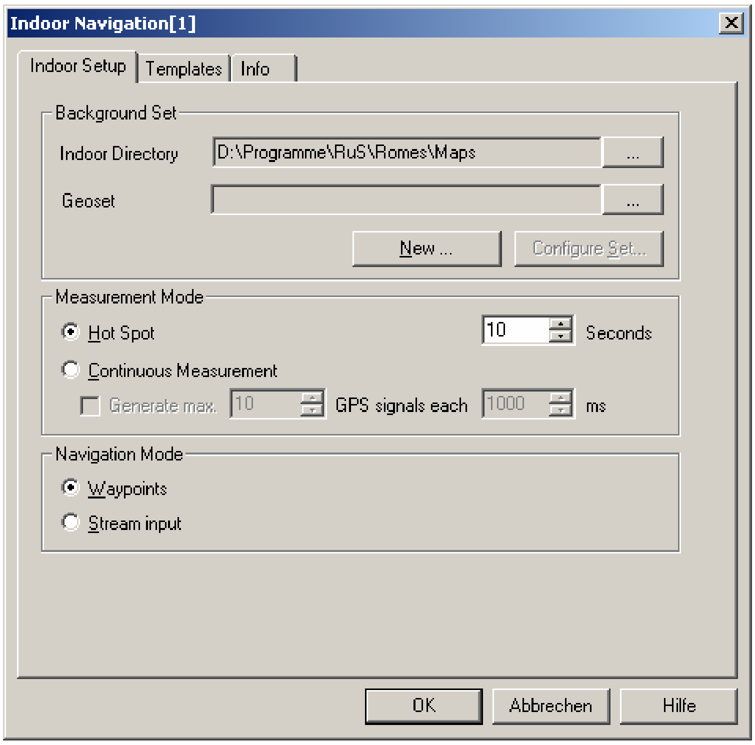


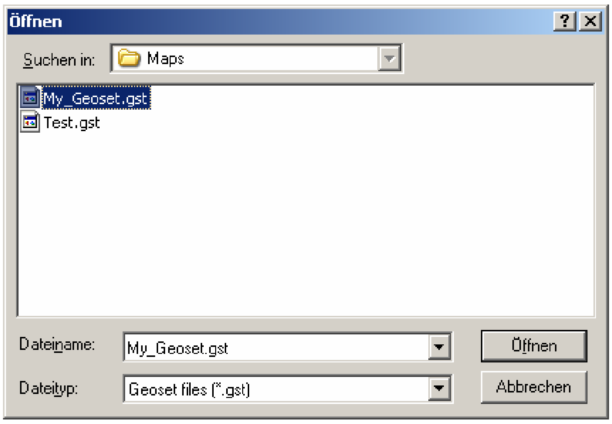
Fig. 6-156 Indoor driver configuration

Back-ground Set The *Background Set* panel contains the fields and buttons to select or create a so-called Geoset file (*.gst). Geosets can include several background floorplans, which makes it very easy to change the background map without stopping the measurement.

Indoor Directory First check if the displayed directory is the one where the background maps and Geosets are stored. Only from this directory Geoset files and maps can be selected later.

You may change the directory with the ... button next to the *Indoor Directory* field.

Geoset Using the ... button next to the *Geoset* field opens a standard *File Open* dialog (see chapter 2) to select one of the Geoset files available.



After selection, the file is indicated in the *Geoset* output field and the *Configure Set* button is enabled.

New The *New* button opens a dialog to define a new Geoset (*.gst) file:

Enter a name for the new Geoset file (*.gst) and click *OK*. The Configure Set dialog is the opened automatically.

Configure Set Once a Geoset file is selected or created, this button opens the Geoset configuration menu:

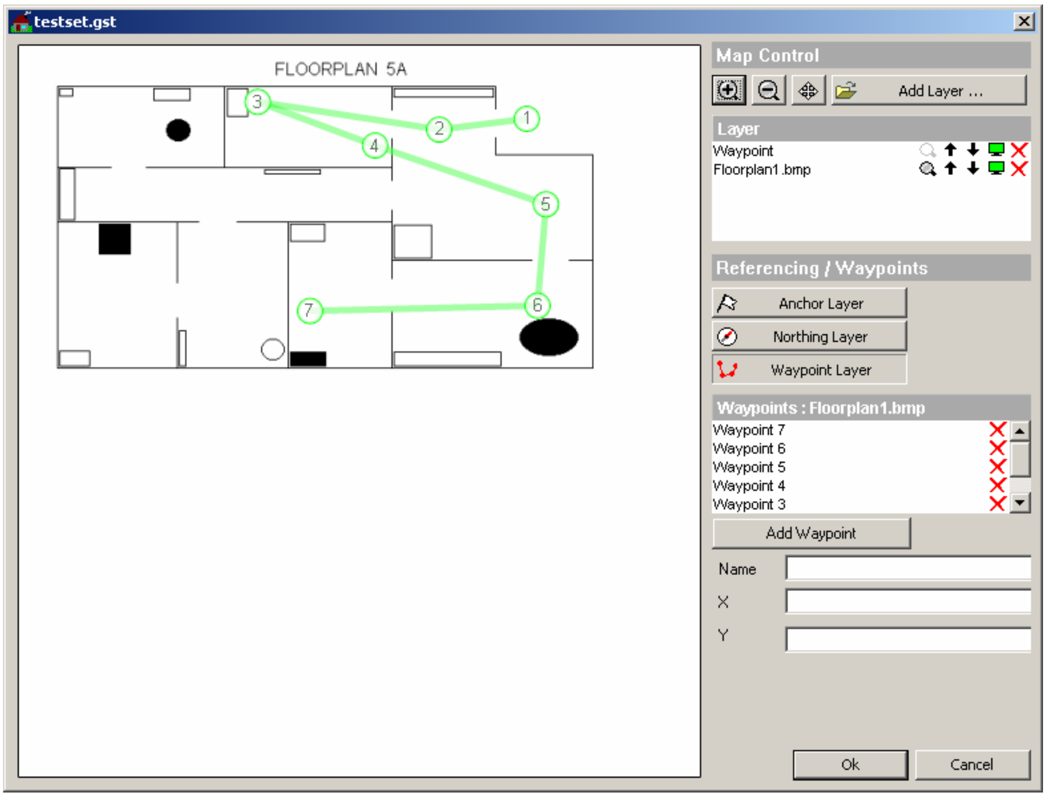
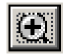


Fig. 6-157 Geoset configuration dialog

Map Control

The *Map Control* area consists of four buttons:



To zoom into the map, click this button and mark a rectangle in the background map to define the area to zoom. The marking of a rectangle is done by keeping the left mouse key pressed while moving from top left to down right. Different from the *Route Track View*, **a single click is not working**.

To reset the map scale after zooming, click the reset icon  in the Layer management field.

To zoom out of the map, click this button and single click on the background map.

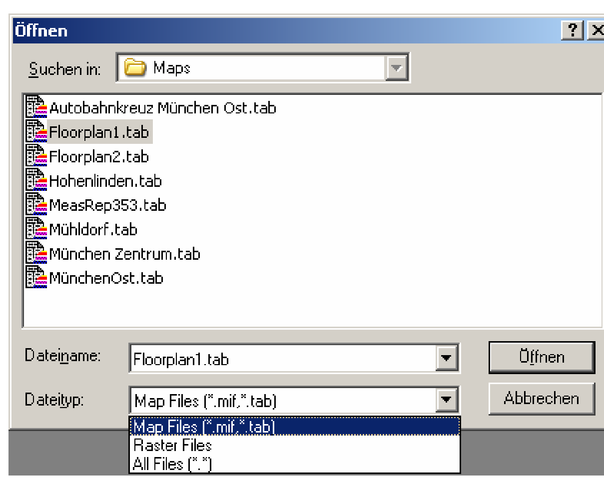
To reset the map scale after zooming, click the reset icon  in the Layer management field.

To scroll the map, click this button, click on a starting point on the background map and then move to the end point of the desired map scroll. After the starting point on the map is clicked, the scroll is shown by a thick line between the mouse cursor and the starting point.

Once the end point of the desired scroll is clicked, the map is scrolled accordingly.

To reset the map position after scrolling, click the reset icon  in the Layer management field.

Add Layer... Clicking this button an *Open File* dialog for background maps is displayed, where the directory is fixed to the previously defined *Indoor Directory*.



This example shows that already referenced maps as well as unreferenced ones can be loaded

The Indoor bitmap files are positioned and stored according to the scheme used for *Route Track* background maps; refer to section *Bitmap Handling and Positioning* in chapter 3: The coordinates are defined in a separate configuration menu (see *Referencing* below) and stored in a **.tab* file associated to the bitmap.

Once selected, the map is visible in the Geoset configuration menu and the Layer management field shows the related filename:

If a second background map is added using the *Add Layer...* button, the new map is inserted on the top layer, which causes the previously added map layer to disappear:

Layer display and management is described below.

Layer This field displays all loaded layer names or map filenames and offers a series of icons for layer display:

- A click on this icon resets the effects from the last map zoom or map scroll action. This icon is only active for background map layers, for other layers the icon is disabled ( ).
- Single-clicking on these icons moves the corresponding layer one level up or down. With background map layers, only the top active map layer is visible.
- This icon shows that the corresponding layer is active. To disable the layer, click on the icon. The icon is greyed ( ) and the corresponding layer becomes invisible. If the top map layer is disabled, the next map layer becomes visible, if defined.
- Clicking on this icon removes the corresponding layer from view and list.

Referencing To reference a map, the according layer must be on top, because only the top layer is selected for referencing.

Either **set three anchors** can be set directly; or **one anchor, northing and scale** can be used, similar to the previous Indoor version (in ROMES V.3.53).

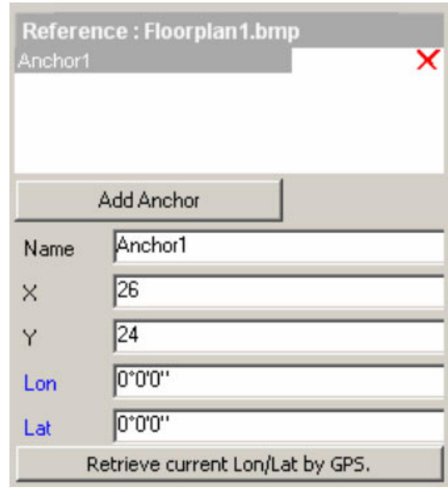
1.) Referencing by setting three anchors:

First select the Layer to be referenced and ensure that it is the top background map layer.

Then click on the *Anchor* Layer button Anchor Layer.

This creates a new layer caled "*Geo Referencing*" and changes the dialog content below the layer management list.

Now move the mouse pointer to the position where Anchor 1 should be placed and left-click to set the first anchor position. This inserts an anchor symbol into the map display and fills the reference list and the anchor property fields as shown below:



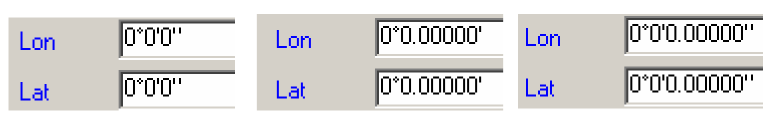
The anchor can be removed from the background map reference list by clicking on the  to the right of the anchor name.

The anchor can be moved in two ways: Either by clicking on the map anchor symbol and dragging it to the new position on the map, or by clicking on the map anchor symbol and clicking on the new position.

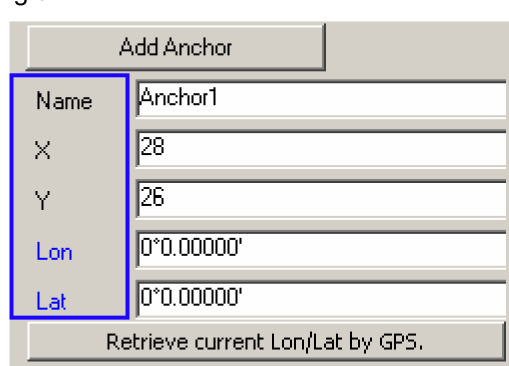
Once the anchor is on the desired map position, the geographic latitude and longitude of this position must be entered. With a connected GPS receiver, the anchor Lon/Lat can be taken from the receiver by clicking the 

button.

Alternatively, the anchor Lon/Lat can be entered manually, using either degree-minute-second or degree-minute-decimal or degree-minute-second-decimal formats:

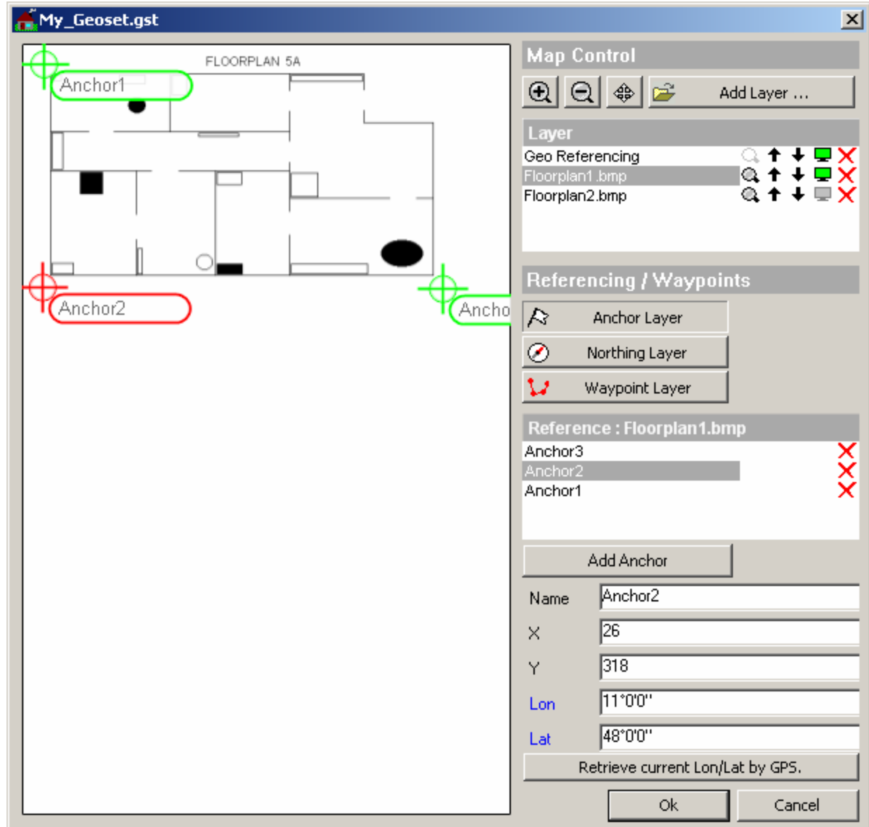


To switch between these formats, double-click in the area marked by the blue rectangle:

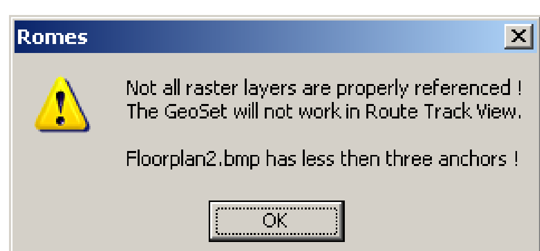


To place the second anchor, either click on *Add Anchor* and generate a new anchor in the top left corner which can then be moved to the wanted position, or click the *Anchor Layer* key again and then on the wanted position of the new anchor. Otherwise only the first anchor is moved to the clicked position. Repeat for the third Anchor.

Once all three anchors are set, the map display looks similar to the screenshot below, where the red anchor is currently selected:



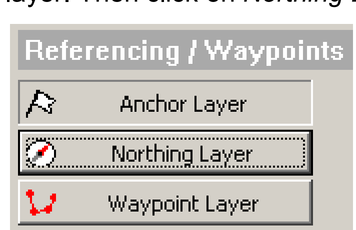
Save your changes to the Geoset by clicking the *OK* button. If there is a second background map layer that has not been referenced, the filloeing warning appears:



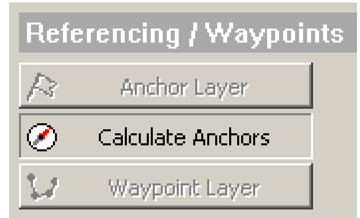
For the sake of clarity, the second background map is referenced using the second map layer referencing method:

2.) Referencing by setting one anchor, scale, and northing:

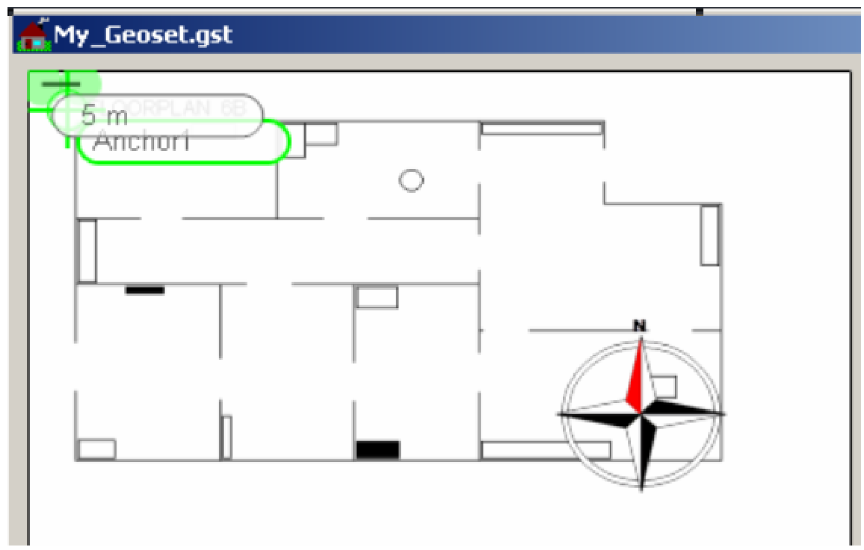
First select the second layer to be referenced and ensure that it is the top background map layer. Then click on *Northing Layer*:



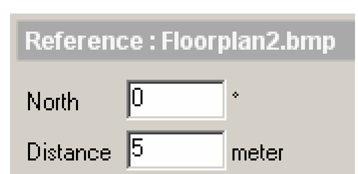
The *Northing Layer* button now changes to *Calculate Anchors:*



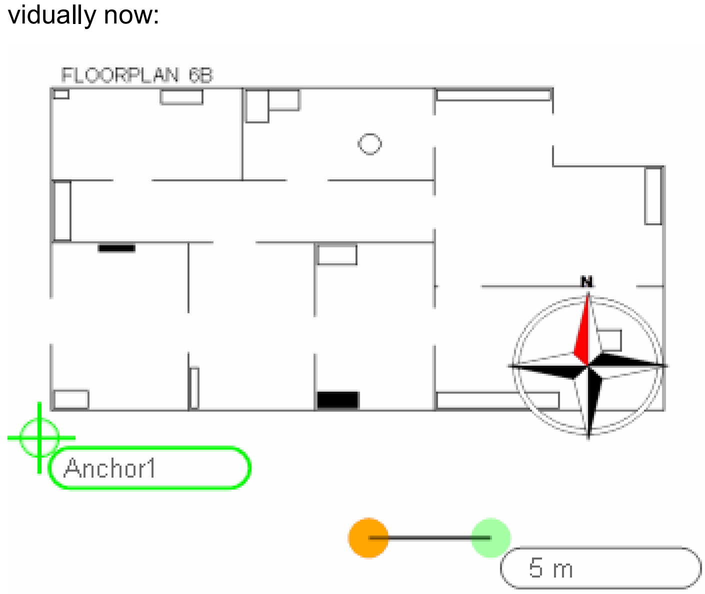
The map display now contains an anchor, a scale icon, and a compass:



Also instead of the list of anchors, the north direction (in degrees) and the scale distance value is shown (5 m default value).



The anchor and the two ends of the distance line can be placed individually now:

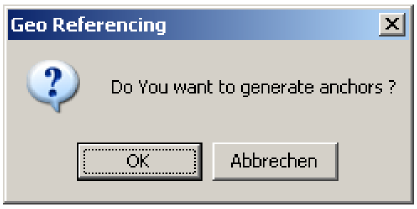


Enter another distance value if applicable, then select the anchor, and enter its Longitude/Latitude. If the compass is clicked, it can be rotated using the mouse.

Alternatively, position the anchor, and enter the North direction as well as the scale distance manually in the *North* and *Distance* entry fields.

Now that the necessary references have been entered, click on *Calculate Anchors* to generate three anchors, which is the internally used map positioning reference.

Verify the dialog

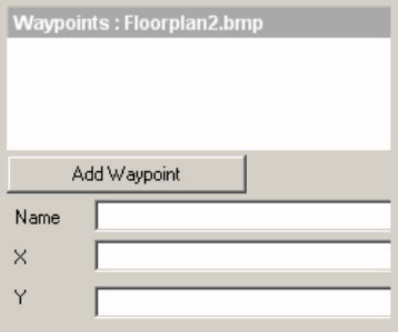


and save your changes to the Geoset by clicking the *OK* button.

Waypoints

A series of predefined positions on the indoor map is specified before the measurement is started. During the measurement, the operator informs the system by clicking on the waypoint when it has been reached.

To configure waypoints, click on the *Waypoint Layer* button. The layer management list now displays a layer called "Waypoint", and the dialog area below the button looks similar to this:



To add a Waypoint, either click on the desired map position, or click on the *Add Waypoint* button, which creates a waypoint in the top left corner of the map.

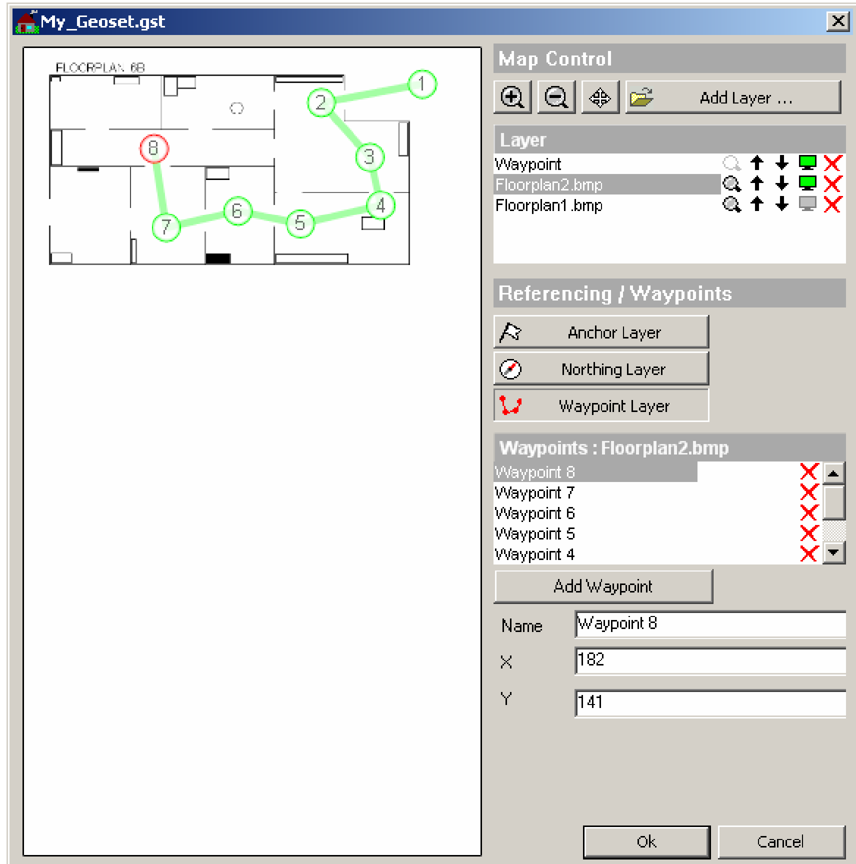
As with anchors, the waypoints can be moved by moving the mouse pointer on it and keeping the left mouse key pressed while dragging the waypoint icon to its desired position.

Inserting the next waypoint increases its index automatically.

The waypoints can be created intuitively:

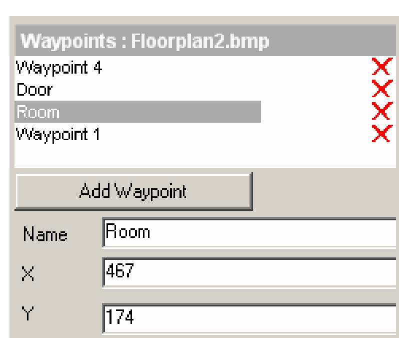
- Every click on the map *adds* a waypoint at the cursor position with a link to the previous waypoint.
- Every click on an existing waypoint *deletes* it and connects its former neighbors with each other.
- Drag-and-drop with the mouse *moves* a waypoint.

Create as many waiponts as necessary to obtain a map display similar to the following:



Waypoints can be removed from the waypoints reference list by clicking on the ✕ to the right of the waypoint name.

By filling the Name fiield fo a waypoint in the list, this waypont is re-named accordingly:



NOTE: If you would remove e.g. the 2nd waypoint ("Room") now, "Way-point 4" becomes the **logically third** waypoint, although the name remains the same. The automatically issued names from the waypoint creation are **static**.

Measure-ment Mode Selects either a measurement in a fixed time interval *(Hot Spot)* or a measurement which lasts for an undetermined time unless restarted explicitly *(Continuous).*

Like in the previous Indoor version, *Hot Spot / Continuous Measurement* can be com-bined individually with *Waypoints / Stream Input*, see Table 6-16.

See also section *Measurement Mode* on page 6.264.

If the *Generate Max. ... GPS signals each ... ms* checkbox iis checked, the position interpolation is activated during the measurement, which is available only in Continuous mode. The frequency and number of GPS signals define the granularity of the interpolation.

Navigation Mode Defines how the position of a measurement location is reported to the measurement system:

Waypoints	During the measurement, the current measurement position is set on the map by clicking on the waypoint button of the control menu, see Table 6-16.
Stream input	During the measurement, the current measurement position is set on the map of the control menu, via the mouse or trackball, see Table 6-16.

OK Applies the current configuration (if it is valid) and closes the *Indoor Navigation* menu.

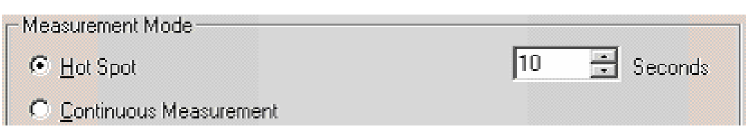
Cancel Discards the configurations made and closes the *Indoor Navigation* menu.

Table 6-16 Indoor measurements in different navigation and measurement modes

Navigation Mode	Measurement Mode	
	Hot Spot (measurement with time limit)	**Continuous** (measurement without time limit)
Waypoints (predefined measurement points)	➢ Go to next waypoint ➢ Click the waypoint button in the control menu to initiate new measurement after preset second count. The result is shown at the waypoints (discrete values)	➢ Go to next waypoint ➢ Click waypoint button in the control menu to initiate new measurement The result is shown between the waypoints (color scale)
Stream input (measurement points defined ad hoc)	➢ Go to next measurement point ➢ Use mouse to mark the measurement point (current position) on the Indoor view ➢ Click position to initiate new measurement after preset second count The result is shown at the measurement points (discrete values)	➢ Go to next measurement point ➢ Use mouse to mark the measurement point on the Indoor view ➢ Clickmap location to initiate new measurement. The result is shown between the measurement points (color scale)

Measurement Mode

The *Measurement Mode* panel of the *Indoor Navigation* configuration menu offers two different measurement modes, the *Hot Spot* and *Continuous* measurement:



Hot Spot Performs a measurement that is terminated after a fixed time but can be restarted at each measurement position (hot spot). The fixed measurement time is set in the input field to the right of the *Hot Spot* radio button. Values between 1 s and 10 s are allowed.

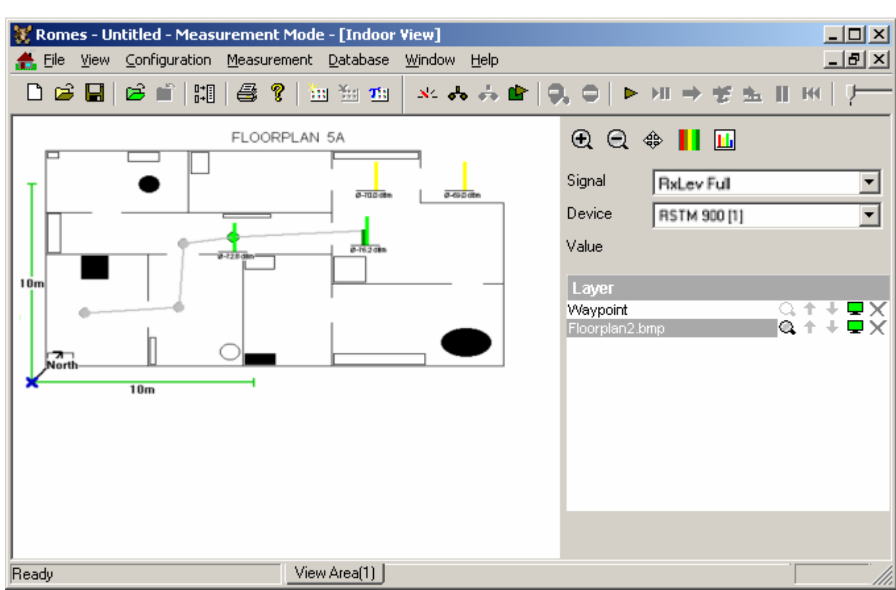


Fig. 6-158 Performing a hot spot measurement

Depending on the *navigation mode* set (see p. 6.263) the hot spots are either the waypoints defined before the actual measurement (see Fig. 6-157 on page 6.255) and stored in the waypoints configuration file or arbitrary points on the map that are defined during the measurement via the mouse or trackball.

Every single measurement is initiated via the Waypoint button of the Indoor Control view.

Note:

A measurement can be started and the next hot spot can be defined only after the end of the previous measurement, i.e. after the measurement time has elapsed.

Continuous Performs a measurement without time limit at previously defined waypoints. The *Check Point* button is to be clicked every time the operator reaches a waypoint.

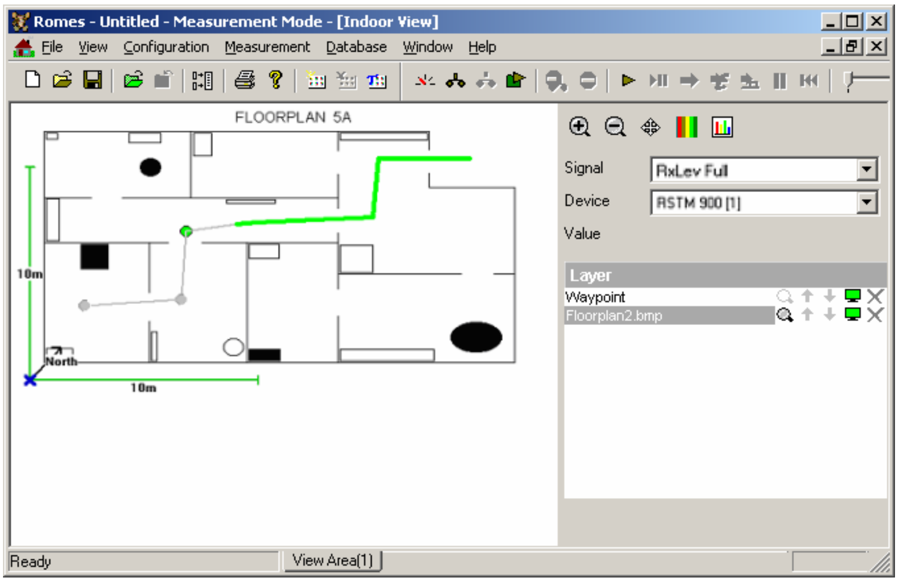


Fig. 6-159 Performing a continuous measurement

In this mode, the measured data is visualized along the way between two waypoints according to the color scale shown in the legend of the view window. To achieve this graphical representation, ROMES interpolates the measurement data along the straight lines between each pair of consecutive waypoints.

Note:

After the last waypoint is reached, the measurement is not stopped automatically. To terminate, click the Stop Measurement button or the corresponding command line in the Measurement menu.

ROMES uses the measurement results at the predefined waypoints to interpolate intermediate points and measurement results and store them in the measurement file. The number of the interpolated points is controlled by entering a time difference Δt (in ms) in the *Seconds* field associated to the *Measurement Mode* field: The number of interpolated values between two waypoints numbered n and n+1 equals to the integer number closest to the ratio $(t_{n+1} - t_n) / \Delta t$. The smaller Δt, the larger the number of interpolated values stored in the measurement file.

The interpolated positions and measurement results are not visible in the *Indoor View*.

They can be exported though to an ASCII file or evaluated and viewed by an appropriate .cmd evaluation and post-processing software.

Indoor Navigation - Templates

The *Templates* tab stores the current indoor driver configuration as a template, lists, loads or deletes driver templates.

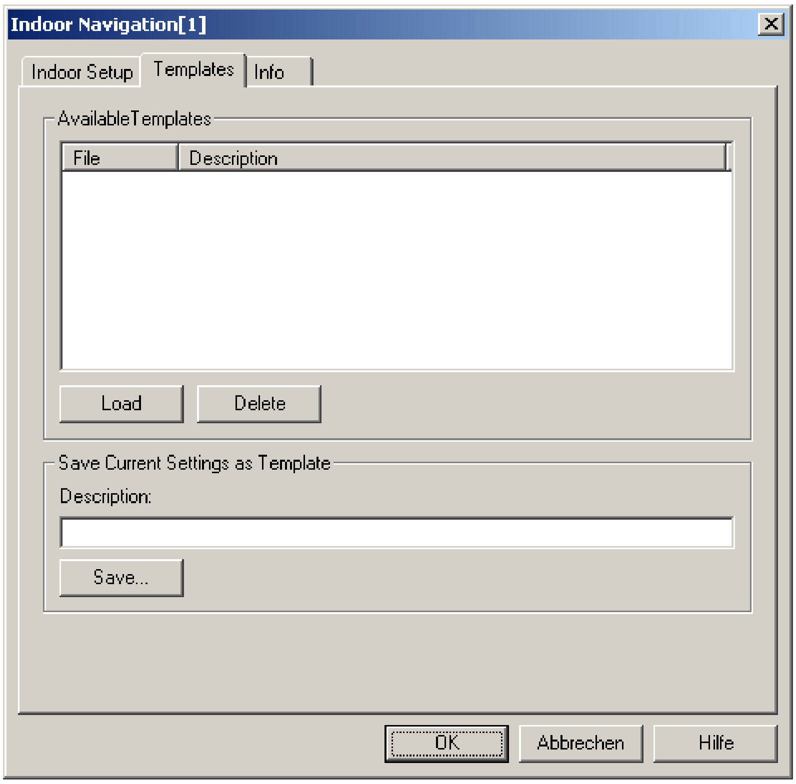
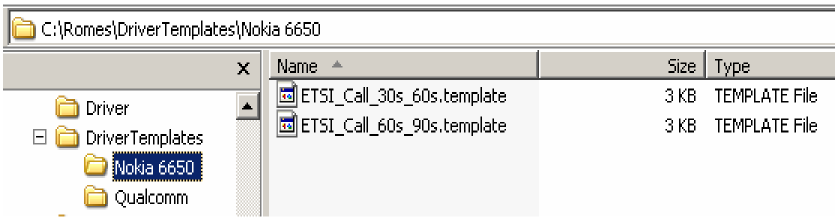


Fig. 6-160 Indoor Navigation - Templates

Load/Delete Loads a driver template or deletes a template displayed in the list of *Available Templates*. Template files are ASCII files with the extension *.template. The template definition is independent from the workspace.



Save Saves the current driver settings together with the *Description* to a selected template file.

Mast Controller GB127M Driver

The Mast driver supports the control of the mast movement via the control unit GB127M. Together with the *Compass* driver, it provides the data for the *Compass Views* and the *Polar View.* The driver operates in two modes:

- In the auto mode, the user enters the start angle and the end angle. When the *Start Recording* button is clicked, the mast will first move itself to the start angle. Then the measurement starts and the mast keeps moving between the two extreme angles until the *Stop* button is clicked.
- In the manual mode, the mast is controlled via the *Action* dialog. See the section *Manual Mode Action Dialog* on p. 6.268.

The mast driver is installed by selecting *Mast – GB127M* in the *Hardware Drivers* window (see Fig. 6-1 on page 6.1). The configuration menus are explained below.

GB127M Configuration Menu

The configuration menu determines the position and speed of the mast rotator.

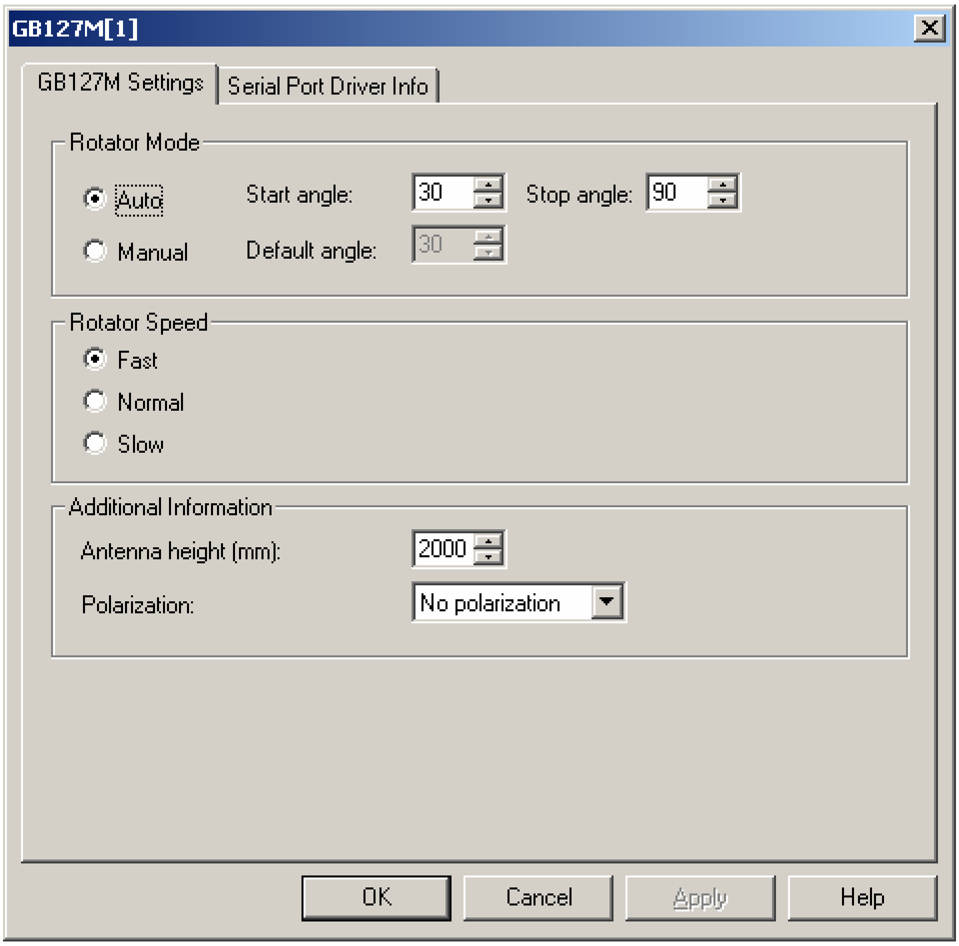


Fig. 6-161 Mast driver configuration

Rotator mode

In the auto mode, the user enters the start angle and the end angle. When the measurement starts, the mast will rotate from the start angle to the stop angle. Then it rotates back to the start angle and the process repeats until the *Stop* button is clicked.

In the manual mode, the user enters only the start angle. This is the angle the mast will move to in preparation for the start of measurement. The manual control of the mast is controlled via the *Manual Mode Action* dialog.

Rotator speed

The user selects one of the three possible speeds for the mast's rotation.

Additional information

The antenna height and the polarization fields are currently not being used in ROMES.

Manual Mode Action Dialog

The *Manual Mode Action Dialog* is opened when the measurement starts and only when the *Manual* radio button is selected in the GB127M configuration menu. Once opened, it will show the current mast position in degrees.

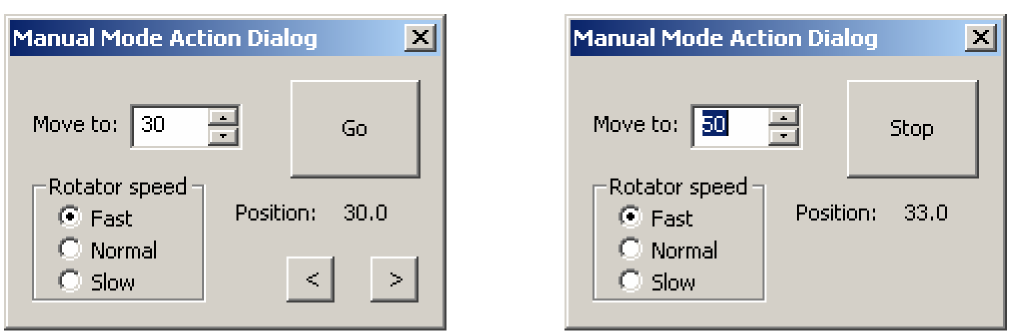


Fig. 6-162 Mast driver: Manual Mode Action

There are two ways to control the mast movement manually. One way is to enter the final position in the *Move to* field, select the *Rotator speed* by clicking one of the three radio button and click the *Go* button. The second way is to hold down the > button or the < button using the mouse pointer. The mast will rotate continuously until the button is released. The rotator speed selection has no effect on the second way of control.

Carrier-to-Interference Analysis

The drivers described in this section are required for interference measurements with options ROMES-GS.

- The C/I driver of ROMES-GS is necessary to acquire interference measurement data.
- The *R&S GSM Demodulator* included in ROMES-GS is needed for the demodulation of the *System Information Type n* (*n = 1, ..., 4)* from the Transmitter Scan and (optional) network scan signals.
- The *R&S GSM Network Scanner* (network scanner) scans the C0 carrier signals in a specified channel range and exports the measurement data.

The *R&S GSM Network Scan* option provides a fast, periodic scan of all C0 carrier signals in the GSM channel range that is also used for the interference measurement. The C0 signals are measured with their power, NCC, BCC, and timing. Additional parameters transmitted in the System Information Type 3 (CI, LAC, MNC, MCC) can be either demodulated (with the *R&S GSM Demodulator)* or obtained from a comparison with a BTS list. A statistical analysis of the C0 scan data can be the basis for network optimization and in particular improve frequency planning.

The network scan option is configured in the *C/I Analyzer* driver configuration menu; see section *Configuration Menus* on p. 6.269 ff.:

- The C0 analysis is activated in the *C/I Driver Measurement Selection* tab.
- The channel range is selected in the *C/I Driver Measurement Specification* tab.

The C0 scan results are automatically exported to a special C0 export (*.cox) file after the end of the measurement. The file format is described in chapter 7.

Installation of the drivers is explained in section *Driver Installation* on page 6.1 ff.; their configuration is explained below. The C/I data can be analyzed and viewed in the *C/I Analysis Views* (see chapter 3).

C/I Driver

The C/I driver is required to acquire the interference measurement data. This driver is mandatory for any C/I measurement including the *Transmitter Scan Only* option, but not for the analysis of data in *Replay* mode.

The driver can be installed by selecting *K6 C/I Unit – C/I* in the *ROMES Hardware Configuration* menu (see section *Driver Installation* on page 6.1 ff.).

Configuration Menus

ROMES provides a configuration menu for the C/I driver that is opened by clicking the *C/I Analyser[1]* command line in the *Configuration* menu. The command line is available as soon as the driver has been loaded.

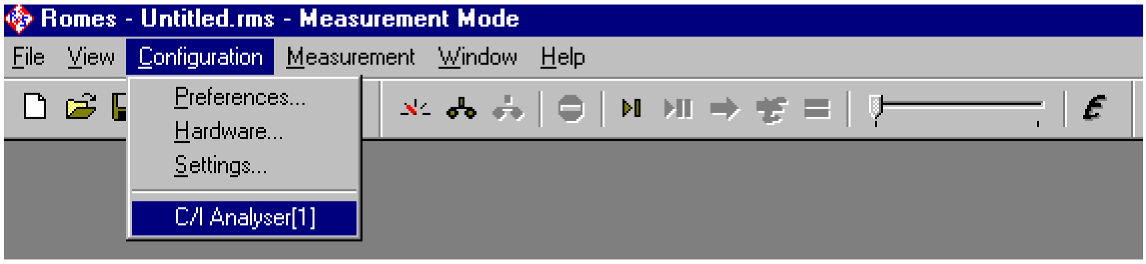


Fig. 6-163 Accessing the C/I driver configurations

The C/I driver configuration menu contains three tabs to configure the C/I measurements and display information on the driver.

C/I Driver Measurement Selection

The *C/I Driver Measurement Selection* tab defines the scope of the interference measurement and selects the test devices.

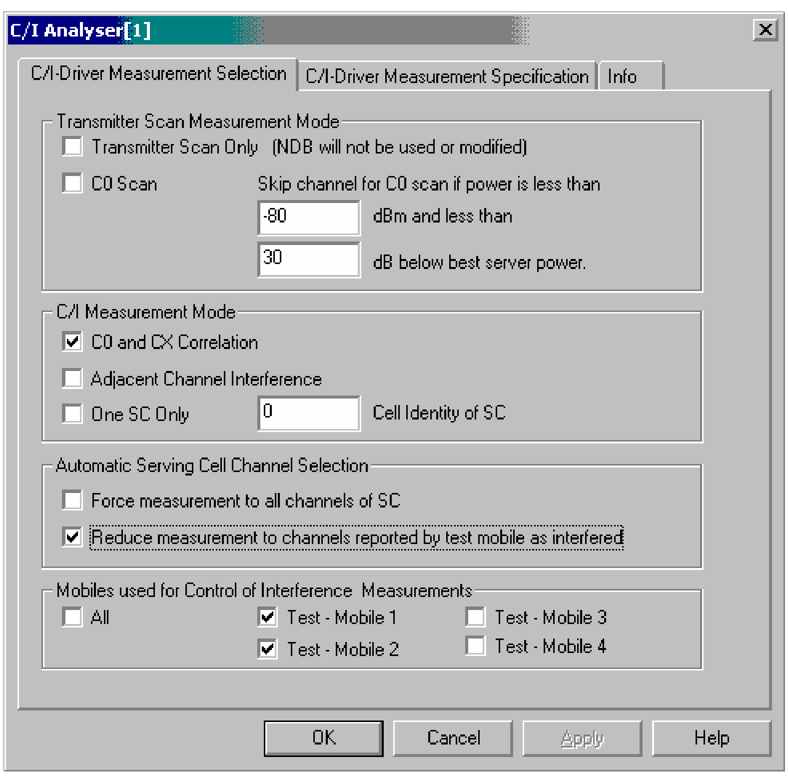


Fig. 6-164 C/I Driver Measurement Selection (C/I driver)

Transmitter Scan Measurement Mode The *Transmitter Scan Measurement Mode* panel defines the scope of the measurement while it is in Transmitter Scan (TS) mode:

Transmitter Scan Only If the box is checked triggering of an interference measurement is inhibited regardless of the *C/I Trigger* conditions set in the *C/I Driver Measurement Specification* tab. Also manual triggering (see *K6 Trigger*

View in chapter 5) is not possible. With this option only Transmitter Scan files are created (see chapter 1), no database is updated. The latter must be done either manually or by selecting the *Disable C/I* option in the *K7 Transmitter Scan View* configuration menu (see chapter 5).

C0 Scan

If the box is checked, the C0 scan (network scan) described on p. 6.269 is performed in parallel to the transmitter scan and interference measurement. The C0 scan extends over the channel range selected for the transmitter scan (see *Channel Map* parameter in the *C/I Driver Measurement Specification* tab), excluding the channels with low power. Two power thresholds are specified: A channel is not measured if its absolute power is too small, and if its power relative to the strongest C0 channel at the measurement position (measured on any channel, *best server power)* is too small.

The power thresholds allow to skip very weak (and thus irrelevant) channels in order to speed up the measurement and save system resources

C/I Measurement Mode

The *C/I Measurement Mode* panel defines the scope of the measurement while it is in Carrier-to-Interference (C/I) mode (interference measurement):

C0 and CX Correlation

If the box is checked, the system performs a complete measurement including FCCH correlations, training sequence detection, dummy burst and SCH analysis etc. With this option C0 and the Cx interferers can be analyzed.

If the box is unchecked, the system performs only FCCH correlations so that C0 interferers can be measured only.

Adjacent Channel Interference

If the box is checked, adjacent channel interferences are included in the measurement.

Use SC only

If the box is checked, the C/I measurement is only triggered if the system detects an interference situation for the signals from the cell with the specified Cell Identity. Restricting the C/I analysis to a single cell leaves more time for the TS (including a possible C0 scan) and reserves the system resources for the C/I analysis of a single cell of interest.

Automatic Serving Cell Channel Selection

The settings in the *Automatic Serving Cell Channel Selection* panel define the GSM channel range considered for the C/I analysis.

Force measurement to all channels of SC

If the box is checked, the interference measurement is performed on all channels of the SC, regardless whether or not the SC supports frequency hopping.

Reduce measurement to channels reported from test mobile as interfered

If the box is checked, the interference measurement is performed only on channels that the mobile reports as interfered channels. This option requires a SAGEM OT 190 test mobile.

Restricting the C/I analysis to a subset of channels improves the system performance and makes the evaluation easier.

Mobiles Used for Control ...

Only the checked test mobiles are used to trigger an interference. Excluding some or all of the mobiles can be desirable, e.g. if some of them are used in a different mode.

C/I Driver Measurement Specification

The *C/I Driver Measurement Specification* tab defines the conditions for triggering an interference measurement, the GSM band of the network and of the FCCH measurement, the type of the receiver used for the Transmitter Scan, a frequency correction, and the channels scanned during the Transmitter and C0 Scan.

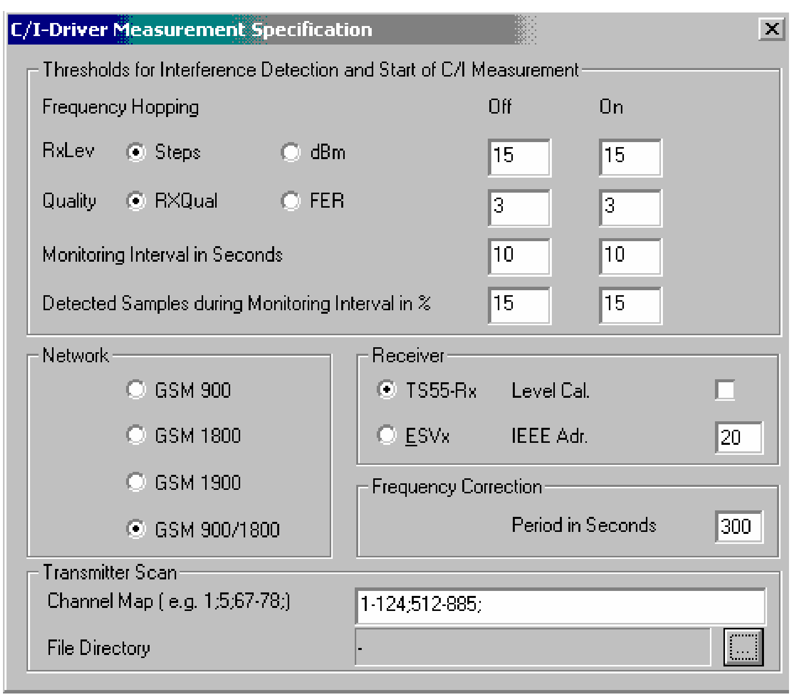


Fig. 6-165 C/I Driver Measurement Specification

Thresholds...

The *Thresholds for Interference Detection and Start of C/I Measurement* panel sets the conditions for switching over between Transmitter Scan and interference measurement. The conditions can be set independently for serving cells that operate at constant frequency *(Frequency Hopping Off* column) or in frequency hopping mode *(Frequency Hopping On* column). An interference measurement is started as soon as both the measured RxLev and RxQual values exceed a threshold for a sufficient number of samples within a certain period of time (see Fig. 6-166 *below*).

RxLev	Minimum received signal level required for an interference situation. The value can be entered either as a RxLev *(Steps)* or as an absolute level *(dBm)*. The relation between RxLev steps and received signal levels is listed in chapter 8.
RxQual	Minimum RxQual value (i.e. maximum received signal quality) required for an interference situation. The RxQual values are listed in chapter 8. Alternatively, a minimum Frame Erasure Rate (FER) detected by the test mobile can be specified.
Monitoring Int. ...	Period of time for the evaluation of the trigger conditions for both RxLev and RXQual. The monitoring interval is a moving time interval ranging up to the current measurement time.
Detect. Samples..	Minimum percentage of measurement points within the monitoring interval (see above) fulfilling the trigger conditions for both RxLev and RxQual. A minimum percentage of 3% or larger is required.

Note:
RxLev and RxQual can be evaluated over a full SACCH block (RXLEV_FULL, RXQUAL_FULL) or over a subrange comprising 12 TDMA frames (RXLEV_SUB, RXQUAL_SUB). In cases where the BTS signals show strong variations in time the ..._SUB values provide a better measure of the actual signal quality. Therefore, if the mobile provides the RXLEV_SUB and RXQUAL_SUB values, they are automatically used to check the threshold conditions.

The trigger criteria are illustrated in the following diagram (no measurement example, all points are fictitious):

The *Monitoring Interval* covers 10 measurement points,

If the minimum percentage of points fulfilling the trigger conditions *(Detected Samples...)* is set to 80, an interference measurement is triggered at the trigger time indicated.

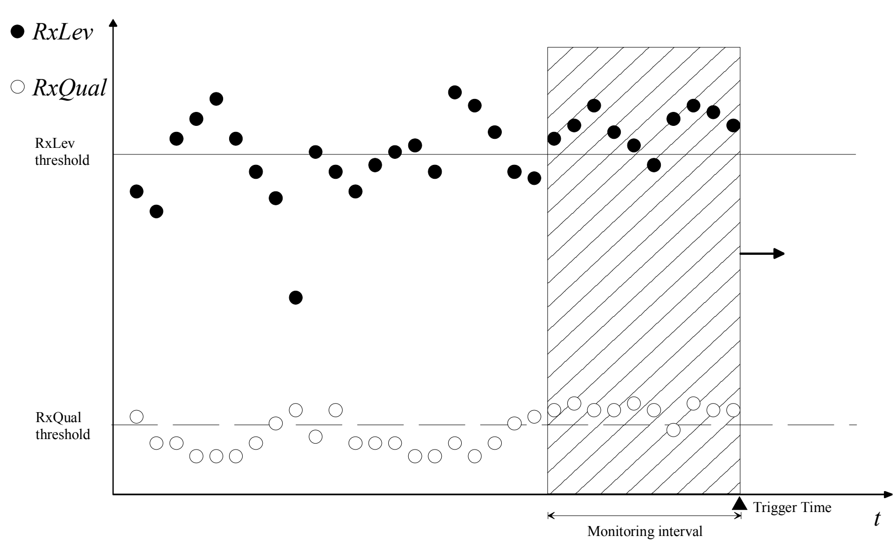


Fig. 6-166 C/I Trigger conditions

The definition of the dimensionless power levels RxLev and quality levels (actually “error levels”) RxQual is equal for all three GSM bands; see tables in chapter 8.

The trigger conditions are displayed in the *K6 Trigger View;* see chapter 5.

Note:
As an alternative to constantly monitoring the trigger conditions, it is possible to initiate or stop an interference measurement any time irrespective of the coverage situation. See *K6 Trigger View* in chapter 5.

Network

Selects the GSM band of the network. The interference measurement (measurement of the FCCHs on a BTS C0 channel; see chapter 1) can be performed in all bands and channels of the network, even if a dual-band network is selected.

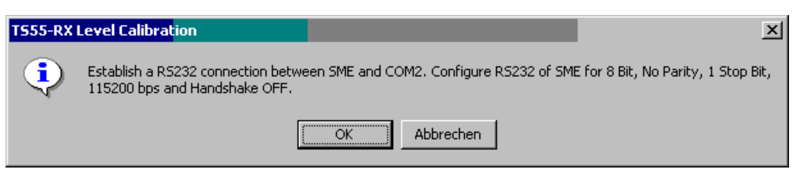
Frequency Correction

The input field in the *Frequency Correction* panel defines a period (in seconds) after which the frequency of the test receiver is corrected.

Receiver

Selects the test receiver used to perform the Transmitter Scan. Either an ESVx or a R&S Single Board Receiver (SBR or TS55-R2; TS55-Rx radio button) can be used. The ESVx receiver is connected via IEC/IEEE bus interface; see section *Resources Configuration* on p. 6.148 ff. The IEC/IEEE bus address can be set in an input field.

The *Level Cal* checkbox enables a C/I level calibration of the selected test receiver (ESVx or R&S Single Board Receiver); see section *IF and Level Calibration for C/I Measurements* on p. 6.175 ff. The calibration is started as soon as the driver configuration menu is closed by clicking the *OK* button. A message indicates that a R&S SME signal generator must be connected to COM 2:



Transmitter Scan

Selects the channels to be scanned during the C0 scan (if activated in the *C/I Measurement Selection* tab) and Transmitter Scan. The range depends on the GSM band selected; see tables in chapter 8. An arbitrary combination of single channels and continuous channel ranges (separated by a hyphen, e.g. 750-830) can be entered. Each channel or channel range must be terminated with a semicolon.

The signal levels in the individual channels can be monitored during the measurement, see sections *K6 TS View* and *K7 Transmitter Scan View* in chapter 5. Moreover, it is possible to further restrict the channel selection for the Transmitter Scan during the measurement; see *Channel Map* panel in the *K7 Transmitter Scan View Configuration* menu.

The *File Directory* indicates where the Transmitter Scan and C0 scan files (see chapter 1) are stored. The “...” button opens an *Open File* dialog to select a new directory.

R&S GSM Demodulator

The *R&S GSM Demodulator* is used to extract the *System information type 1, 2, 3* and *4* from the *Transmitter Scan* signal. It is included in option ROMES-GS.

The driver can be installed by selecting *GSM – R&S GSM Demodulator* in the *ROMES Hardware Configuration* menu (see section *Driver Installation* on page 6.1 ff.).

BTS identification without demodulator

Without the *R&S GSM Demodulator* the assignment of the *Transmitter Scan* signals to a particular BTS is based on a comparison of the received power, BCC, NCC, TDMA frame number and time offset T51 with the corresponding BTS parameters from the operator list and from previous measurement results. The system performs a plausibility check and assumes a BTS to be identified if the probability that the parameters match exceeds a certain threshold. If frequency planning has changed, or if new BTS that are not yet in the operator list have been integrated into the network, no assignment is possible.

Principle of GSM Demodulator

In addition to the quantities listed above, the *R&S GSM Demodulator* provides the *System information type 1* and *3*, yielding the *Cell Identity* (CI), *Location Area Identification* (LAI) and channel occupation. With these values, a BTS can be uniquely identified and its BCC and channel occupation stored in the operator list can be updated.

Identifying new BTSs

Furthermore, a new BTS which is not in the operator list can be identified and added to a BTS list file using the results of the *R&S GSM Demodulator* and a position estimate calculated from the measured time offsets at different measurement locations.

It is even possible to start without any BTS list and generate the complete database automatically. Loading the most recent and complete BTS list is still recommended for several reasons:

- The list may contain interferers which are not measured by a *Transmitter Scan*.
- The list contains exact position values, which reduces the confidence interval for the time offset.

Configuration Menus

ROMES provides a configuration menu for the *R&S GSM Demodulator* driver that is opened by clicking the *GSM Demodulator K7[1]* command line in the *Configuration* menu. The command line is available as soon as the driver has been loaded.

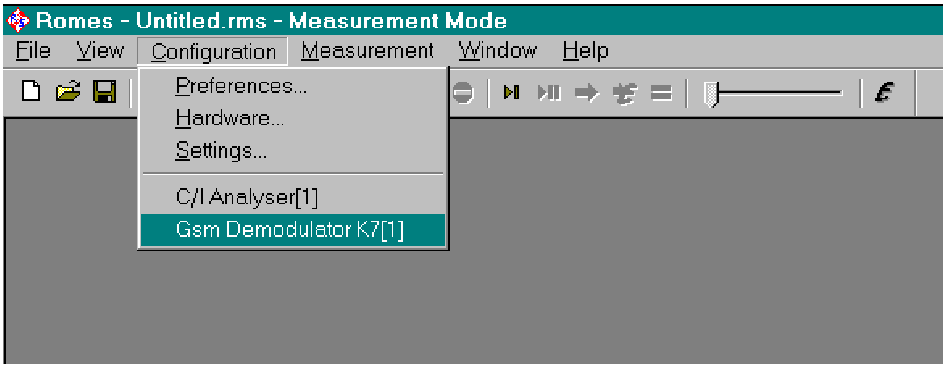


Fig. 6-167 Accessing the *R&S GSM Demodulator* driver configurations

The *R&S GSM Demodulator* driver configuration menu contains two tabs to select the types of system information to be demodulated and display information on the test receiver driver.

Settings

The *Settings* tab of the *GSM Demodulator* driver configuration menu shows all *System Information types* available for demodulation. The demodulated parameters can be monitored in the *GSM Views,* e.g. the *GSM System Information View.*

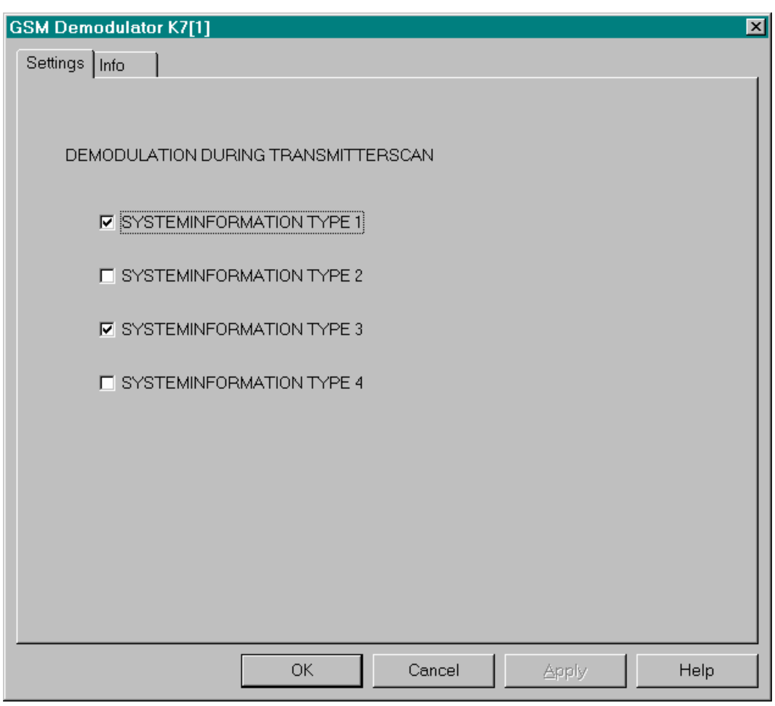


Fig. 6-168 Driver settings of the GSM Demodulator

To use the information from the *System Information* for the assignment of the *Transmitter Scan* values to the database, the *Systype 3* box must be checked.

For an automatic update and creation of a BTS in the database, the *Systype 1* and *Systype 3* boxes must be checked.

Contents

7 Data Processing 7.1

Saving Data with ROMES 7.2

Exporting Data 7.3

Export Procedure 7.3

Export Info 7.6

Export Configuration Menus 7.7

User-defined ASCII format (*.ASC) 7.7

Values Tab 7.7

Option Tab 7.8

Blocks Tab 7.12

Info Tab 7.13

Example File 7.13

CI Analysis Files (*.TXT) 7.15

MapInfo Interchange Format (*.MIF) 7.16

Importing *.MIF files to MapInfo 7.18

DOS binary format (*.MES) 7.19

NT3 ASCII format (*.NT3) 7.20

NQA ASCII format (*.NQA) 7.21

Protocol format (*.PRO) 7.22

Metafile format (*.SRS, *.SER) 7.23

Export via MS Windows Command Line 7.24

BTS / Node B List Formats 7.26

Extensible BTS List (*.txt) Format 7.27

Old BTS List (*.txt) Format 7.29

Example for Base Station Lists (Old *txt Format) 7.32

ASCII Table Description (*.ATD) Format 7.33

Attributes 7.35

Column Names 7.36

Missing entries 7.37

Speeding up the File Import 7.37

User-Defined List Format 7.38

C0 Scan Export Files 7.41

Obtaining Screenshots 7.42

Evaluation of NQA Data with TS9954 NQA 7.43

Network Quality Analysis 7.43

Measurement Parameters 7.43

The NQA Data Package 7.43

Call Class and Status 7.45

Installation and Use of the NQA Software 7.46

Installing the Software 7.47

Starting and Operating TS9954 NQA 7.49
Worksheets 7.51
Header 7.51
Call Statistics....7.52
RxQual 7.53
RxQual (Range) 7.53
RxLev 7.54
PWR-Time 7.55
HO Info....7.56
SysResptime 7.57
Call Resptime....7.58
Noisy 7.59
SucRate 7.59
SucRate 100% 7.60
SucRate (switch.) 7.62
Special Functions 7.63
Default Values....7.64
Language and Logo 7.64
DATA Table 7.64
Printing 7.65
Modification of the Worksheets....7.65

7 Data Processing

The following chapter describes the various options offered for saving and exporting measurement data.

The steps taken for data acquisition and for the data analysis are independent in principle. ROMES uses its own standard format for measurement files (*.CMD files) but offers various options for printing results or interchanging the data with other applications:

- The *.CMD file can be directly used by an appropriate .cmd evaluation and post-processing software.
- The contents of a view can be printed to a file or hardcopy using the *Print* options in the *File* menu (see chapter 3).
- The *.CMD data can be converted into other file formats and exported.
- A screenshot of the whole screen or part of the screen (= active window) can be generated.

Saving Data with ROMES

Data Recording

If a measurement is started via *Start recording* (see chapter 3), the recorded data is automatically saved under the selected file name with the extension *.CMD. Only this format provides the *Replay* feature. The *.CMD format is also supported by other software tools.

Care has to be taken when starting a measurement via *Start measurement* (see chapter 3) without recording. In this case the system asks you to enter a measurement file name. This name will be used at the moment you start recording. If you do not record any data, the file will be deleted and not be stored as an empty file after the measurement is terminated.

Attention:
If you select an existing measurement file it will be deleted if no data is recorded and overwritten if data is recorded.

Export

For further evaluation with other applications, e.g. with the *TS9954* NQA evaluation software, the required data formats must be generated via the *Export* function.

Save Workspace

The *Save Workspace* and *Save Workspace as* functions in the *File* menu and the corresponding floppy disk icon in the tool bar are only used for saving workspace files (*.RMS).

Exporting Data

The export of measurement files is carried out in several steps:

- Selection of the target file format and directory
- Selection of the measurement CMD file
- Export configuration (selection of signal parameters, export options)
- Generation of the export file

The export process is described in the following section. The configuration menus depend on the selected export file format; they are described on page 7.7 ff.

Export Procedure

Measurement data files (*.CMD) can be exported via the *Export CMD File* command in the *File* menu.

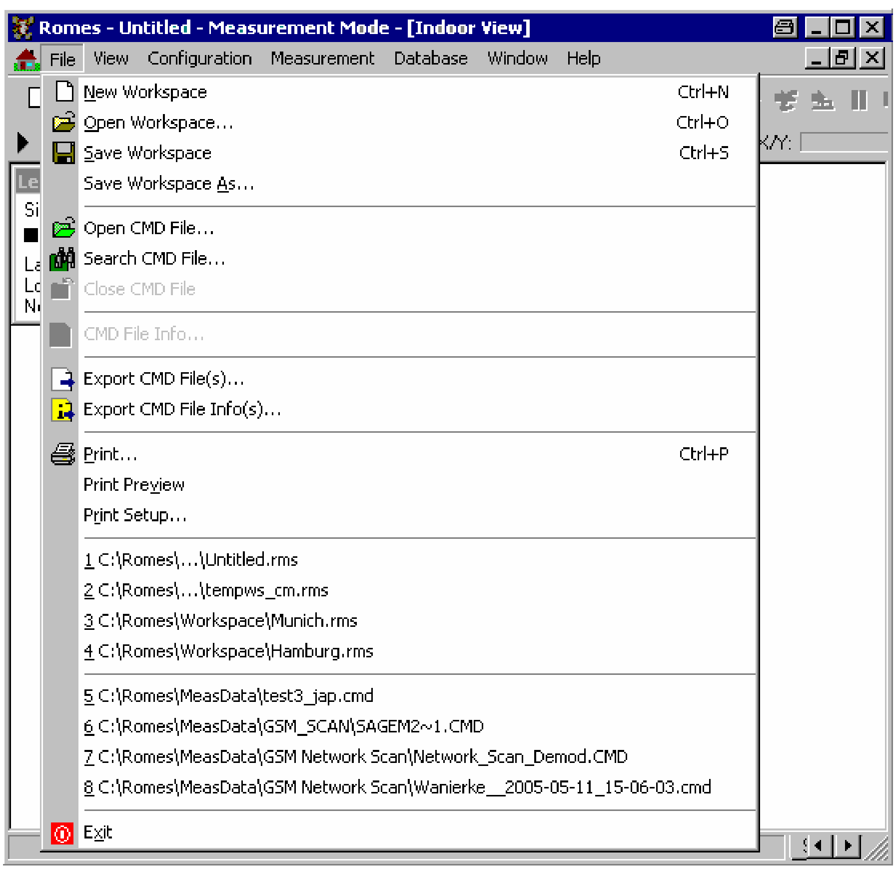


Fig. 7-1 Export CMD File...

The Export CMD File command opens the *Export measurement data* dialog. With this dialog, an arbitrary measurement file can be converted and stored to a file in a *target directory* and with one of the *export formats* offered.

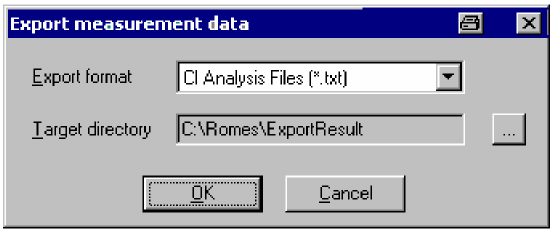
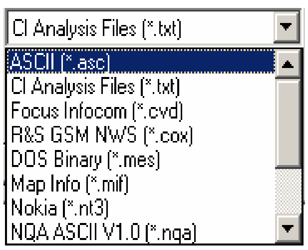


Fig. 7-2 Export measurement data

Export format

The *Export format* pull-down list offers the file formats for the target files. Which formats are available depends on your system options:



ASCII (.ASC)*
ASCII tables, e.g. for import into an MS Excel chart; see p. 7.7 f.

CI Analysis Files (.TXT)*
List of interferers identified in a C/I analysis; see p. 7.15 f.

R&S GSM NWS (.cox)*
For GSM Network Scan data acquired with the R&S TSMU. The format is identical with the *.cox format for C0 scan export files described on p. 7.41. Note that an empty GSM network data base (*.ndb) must be loaded before scan data is exported to a *.cox file. It is recommended to monitor the export messages in the *Message View* while a data export is in progress.

DOS Binary (.MES)*
DOS binary format for TS9954 evaluation software; see p. 7.19 f.

Map Info (.MIF)*
MapInfo Interchange Format for evaluation in MapInfo; see p. 7.16 f.

Nokia (.NT3)*
Special ASCII format, see p. 7.20 f.

NQA ASCII V1.0 (.NQA)*
Network Quality Analysis ASCII; see p. 7.21 f.

NQA ASCII V2.0 (.NQ2)*
Network Quality Analysis ASCII; recommended format for MS Excel 8.0 and higher; see p. 7.21 f.

PRO (.PRO)*
Protocol format, used by some third-party tools for the evaluation of CW data; see p. 7.22 f. .

Metafile (.SER)*

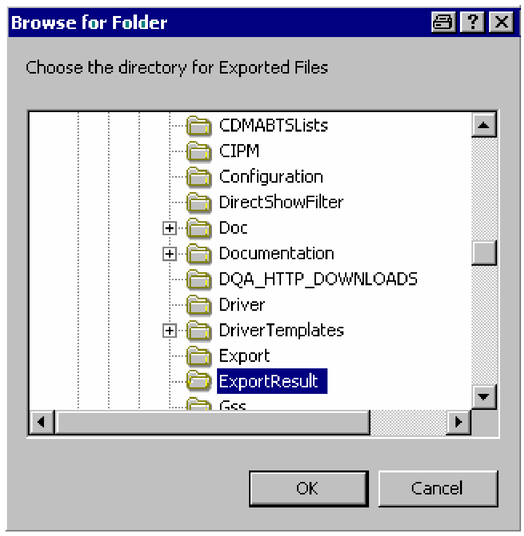
Metafile format, extended version; see p. 7.23 f.

Metafile (.SRS)*
Metafile format; see p. 7.23 f.

These formats are explained in the following sections.

Target directory

The *Target directory* field shows the current target directory for the export file. The directory can be changed via the browse (...) button on the right side. A *Browse for Folder* dialog is opened:



Directory tree
Overview of all available directories. A selected directory is highlighted and represented by a changed icon.

OK
Close the *Change directory* dialog using the selected directory as the export target directory.

Cancel
Close the Change directory dialog discarding any changes.

OK

Export a measurement file with the format and target directory selected. The *OK* button opens a standard *Open* file dialog (see *Open Workspace* command in chapter 3) where the measurement file(s) to be exported is (are) selected, followed by the *Export Configuration* menu for the selected file format. The configuration menus depend on the export format; they are described in the following sections (p. 7.7).

Several CMD files can be selected simultaneously (use the *Shift* or *Ctrl* key) and exported to several target files. If a CMD file is already open (e.g. because an *Open CMD File* command was executed before starting the file export), the open file is selected by default. Otherwise, an arbitrary CMD file can be selected in the *File Open* dialog.

The names of the export files are assigned automatically; the extension of the exported *.cmd file is simply replaced by the selected export format. It is possible to modify the default export file names using a *File Pre/Suffix*; see description of the *Export Configuration* menu. The *Export Info* window logs the file creation process:

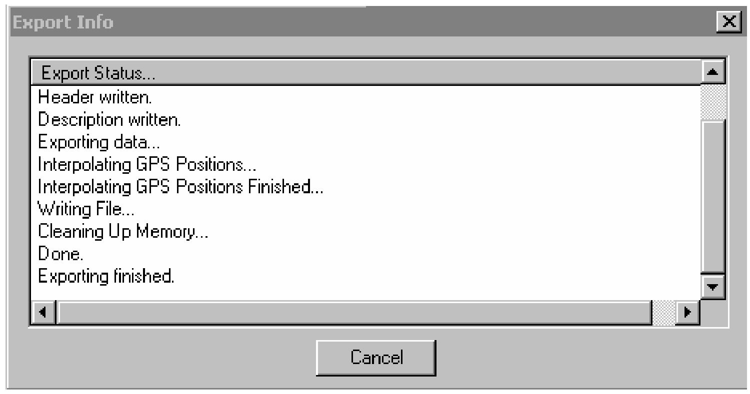


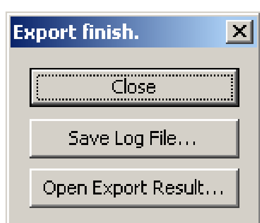
Fig. 7-3 Export Info

Cancel

Cancel the file export and close all corresponding dialogs.

Export Info

After successful termination of the file export, or after its interruption by means of the *Cancel* button, the following message box is displayed:



Close

Terminates the file export without saving the logging info to a file or opening the result.

Save Log File…

Saves the logging information shown in the *Export Info* window in a text (*.TXT) file to be specified in a *File Open* dialog and terminates the file export.

Open Export Result…

Open the generated export file using the standard application for the export file type. If no standard application is defined for the export file type, use MS Windows Explorer to assign an appropriate application (e.g. Notepad, MS Excel,…). To assign an application, open the context menu for the file and select *Properties – General – Opens with... – Change*.

TIP

In general it is more convenient to select (open) a CMD file before the file export (Export CMD File). An open CMD file does not have to be selected again during the export and the file header appears in the Open file dialog.

Export Configuration Menus

Every export format is assigned its own *Export configuration* menu which is opened automatically during the file export, see previous section. In contrast to other configuration menus (e.g. for views), the *Export configuration* menus can not be accessed unless a file is being exported. Therefore, switchover between the menus for different export formats is not possible. However, all selections and settings made in a particular *Export configuration* menu are saved and can be re-used.

User-defined ASCII format (*.ASC)

With the *.ASC format, a user-defined ASCII measurement data table, useful e.g. to import the data into an MS Excel chart can be created. The file starts with a header, containing all useful information about the tour, see example file at the end of this section. The *ASCII Export* configuration dialog contains three tabs:

Values Tab

The *Values* tab offers a list of all parameters in the selected measurement file (*.CMD).

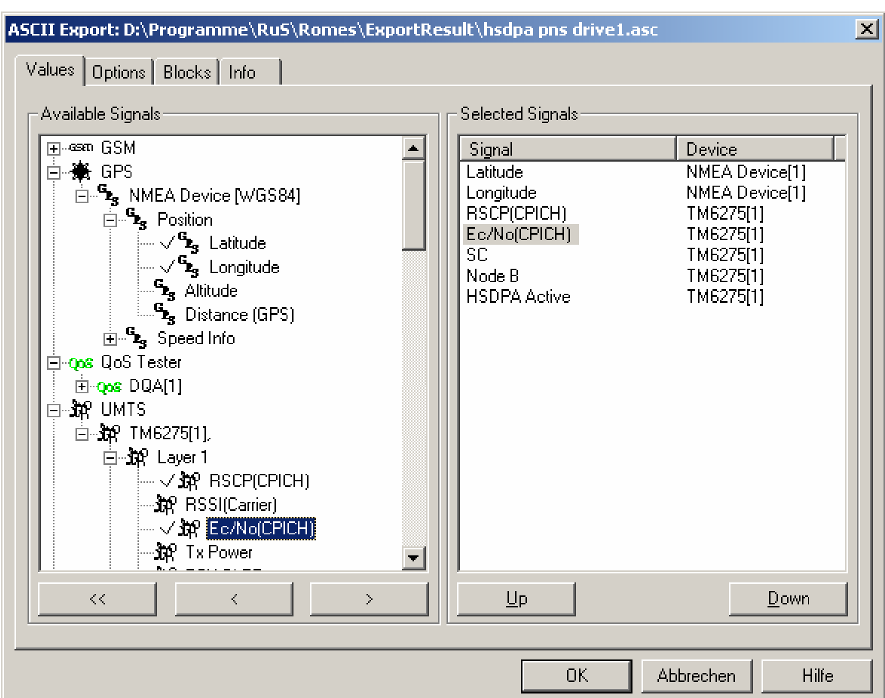


Fig. 7-4 ASCII Export configuration: Values

Available Signals Data tree (see chapter 1) showing all available signal parameters (hierarchy level 4 of the data tree).

Selected Signals List of all signal parameters selected for display.

The order of the list can be changed using the two buttons below. Each selected signal forms a column in the ASCII file; the order of columns is equal to the order of signals in the *Selected Signals* list.

Option Tab

In the *Option* tab, the data selection can be refined by imposing additional selection criteria to the exported signal values. This is suitable (or even inevitable) to handle large amounts of data.

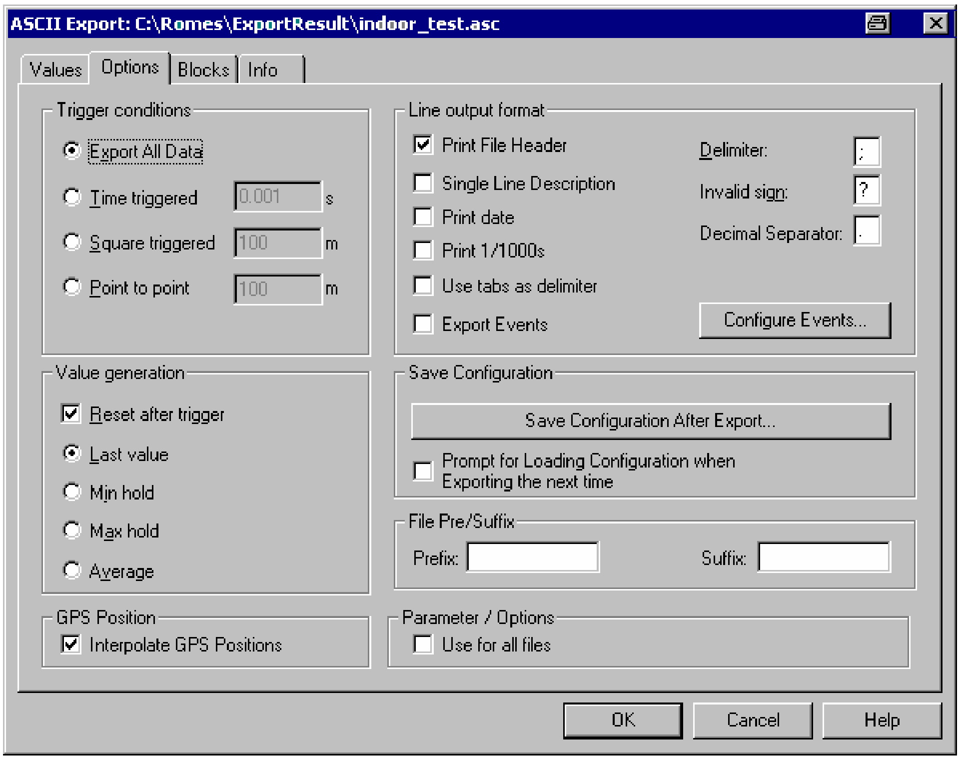


Fig. 7-5 ASCII Export configuration: Options

Trigger conditions

The *Trigger conditions* panel defines a parameter interval in which exactly one value per output signal is written to the target export file.

Export All Data
No reduction of the original data; the unchanged values are exported.

Time triggered
A time interval between 0.001 s and 60 s is specified.

Square triggered
A square surface with a side length between 1 m and 10000 m is specified

The Square Trigger period is not distance-related but depends on the actual position in a field of squares. A value is generated whenever a square is left. As a consequence, the last square does not contribute to the export file.

The amount of data collected used for export value generation and the time between two trigger events may differ extremely from one square to another: In the B square of the figure below,*Fig. 7-6*, very much time is spent and a lot of data may be collected, but in C, D and E this is obviously different. The number of data points actually measured in a square does not have any influence on the length of the export file.

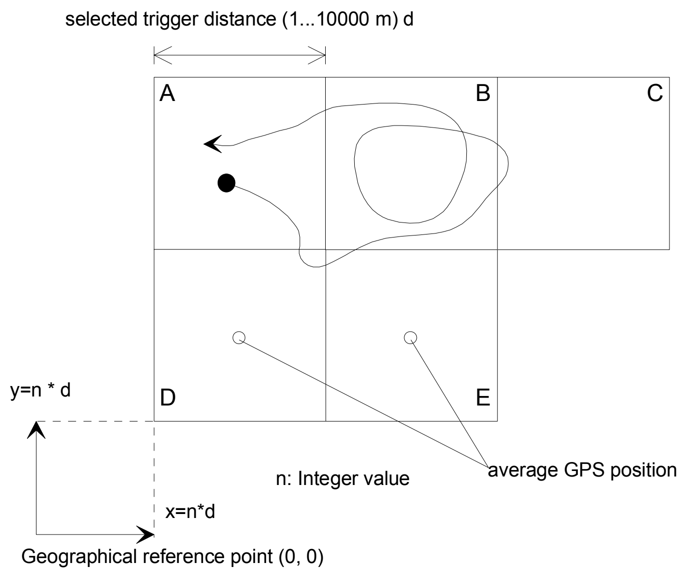


Fig. 7-6 Square Trigger condition

If large squares are defined, it is not recommended to use the time stamp in combination with the average GPS position to determine the vehicle speed, as this will lead to a high error rate.

Point to point
A driven distance between 10 m and 1000 m is specified.

Value generation

The *Value generation* panel defines how the value exported in a trigger period is calculated.

Reset after trigger
If the box is checked the buffer is cleared after each trigger period. If not, the export value (i.e. the last value, minimum, maximum, or

average, whichever is selected) in each trigger period is stored in the buffer. If only invalid values are detected in one trigger period, the buffer value (i.e. the value of the previous trigger period) is exported.

Last value

If only invalid values are detected in one trigger period, the last valid value is exported

Min hold

The minimum value within one trigger period is exported

Max hold

The maximum value within one trigger period is exported

Average

The average value within one trigger period is exported.

GPS Position

If *Interpolate GPS Positions* is checked, ROMES calculates the position of each measurement record by linear interpolation of the closest position data provided by the GPS receiver. Otherwise, a position remains valid until a new GPS result is available.

GPS position data are updated about once per second. Interpolating the positions is suitable, especially if the measurement rate of the other test devices is much larger than 1/s (e.g. CW receivers), or at high speed of the test vehicle.

Line output format

The *Line output format* panel defines the format of an ASCII table line:

Print File Header

If the box is checked, the file header information is included in the target file. The file header comprises the information retrieved with the *File – CMD File Info…* command (see chapter 3).

Single Line Description

If the box is checked, the description of all parameters is written into a single line, the entries are separated by the *Delimiter* that is used for the data. This option is suitable for an import of the target file into MS Excel, where each parameter description forms a table heading.

If the box is unchecked, each parameter description is written into a separate line.

Print date

If the box is checked, the date will be added to the beginning of every data line.

Print 1/100 s

The 1/100 s data will be added to every data line start.

Use tabs as delimiter

Two signals in the export file are separated by tabs; the *Delimiter* field below is disabled.

Export Events

Events included in the measurement file are included in the export file.

Delimiter

This character separates the values of two signals in the export file. The *Delimiter* field is disabled if the *Use tabs as delimiter* option is checked.

Invalid sign

The invalid sign shows that no valid value was detected.

Decimal Separator

This character should be different from the *Delimiter* to avoid conflicts when post-processing the exported data.

Configure Events

Opens the Available Events tab of the ROMES Configuration menu; see chapter 3, Configuration – Preferences – Available Events.

Save Configuration The *Save Configuration After Export* button opens a file *Save As…* dialog to save the current configuration in an ASCII export configuration file. ASCII export configuration files have the extensions *.rma and can be reused when exporting next time. If the box below the button is checked, the system prompts for loading the current configuration file when the ASCII export configuration menu is called up.

File Pre/Suffix Defines two text strings which can be used to modify the file names and distinguish several exported files. The prefix is inserted at the beginning of the file name, the suffix at the end:

<file name>.asc <prefix><file name><suffix>.asc

Parameter / Options If more than one file is selected for export, this click box offers to use the configuration settings for all of the selected files.

Blocks Tab

The *Blocks* tab shows a list of all blocks in the measurement file and selects the blocks to be exported. Measurement files recorded with ROMES V3.22 and higher can be divided into several blocks; see description of *Replay Jump to Next Block* command in chapter 3. The *Blocks* tabs are analogous for all export formats and will be omitted in the following.

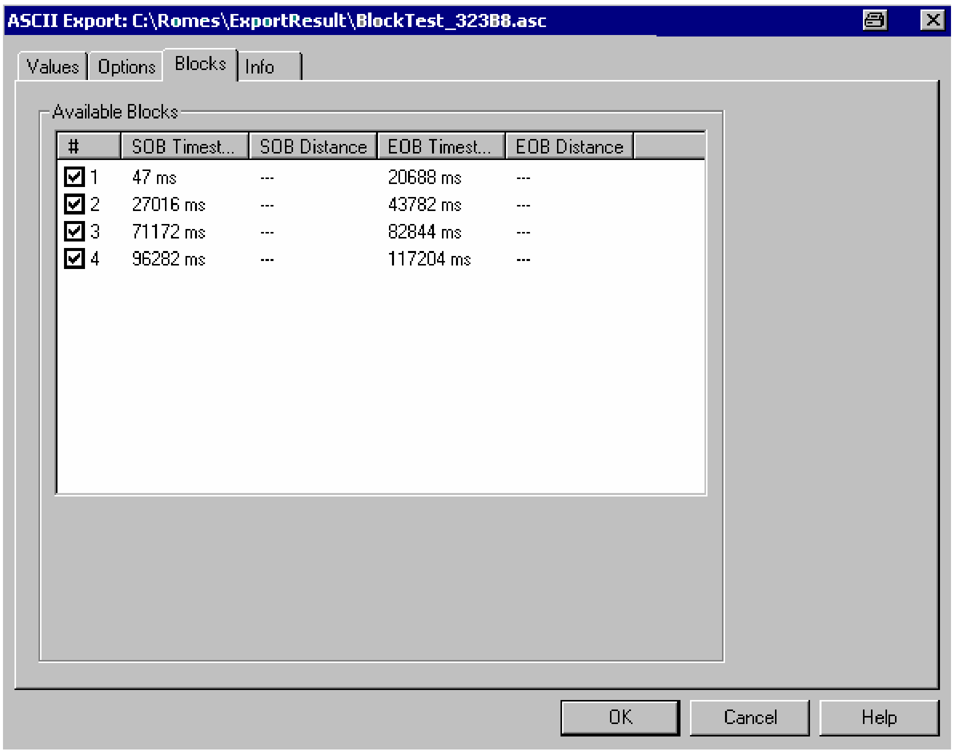


Fig. 7-7 ASCII Export configuration: Info

Info Tab

The *Info* tab shows information on the current ASCII export software module. The *Info* tabs are analogous for all export formats and will be omitted in the following.

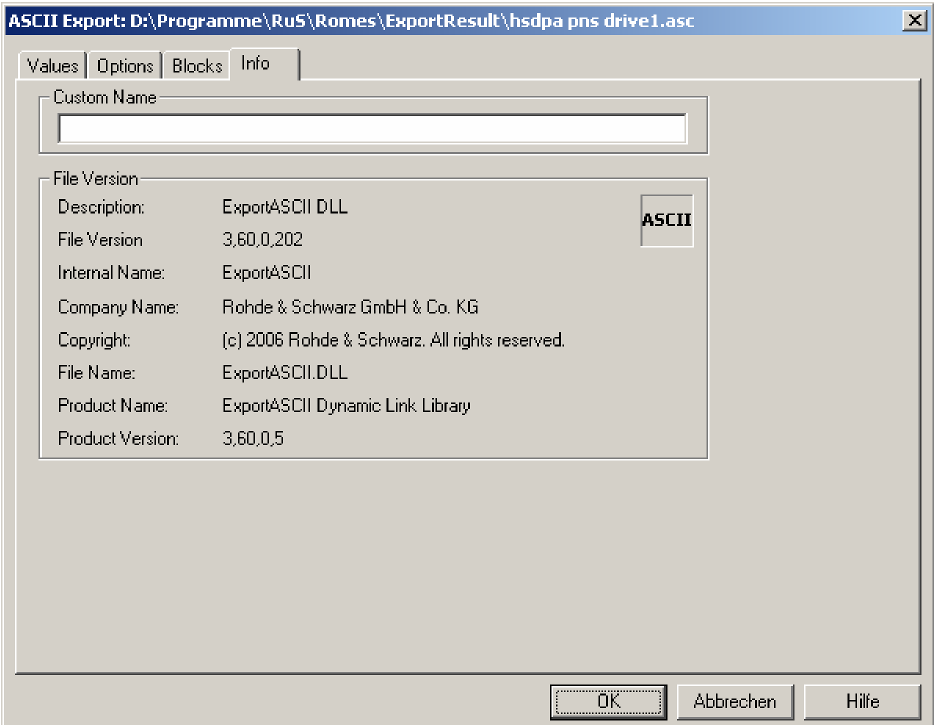


Fig. 7-8 ASCII Export configuration: Info

Example File

<u>Example for an ASCII export file:</u> (OT290, 1 GSM/GPRS Mobile)

```
[Measurement Info, Ver. 3.53 Rev. 0 SP5]
Date:                     22.2.2006
Time:                     18:23:24

Comment:                  Test with AMR

Username:                 John Doe
Vehicle Name:             Testmobile
Vehicle ID:               M - RS 123
Num of Blocks:            1
Duration:                 00:03:50 (HH:MM:SS)

====================================================================

Drivers:
- NMEA Device[1]
- Test Tool OT290[1]

====================================================================

[GPS Ver 3.53]
Type:                               NMEA Device
Ellipsoid:                          WGS84
Nav.Proc.Version:not available
```

```
Sig.Proc.Version:not available
Driven area:51.233633 (Lat. up left)
                                       6.750633 (Long. up left)
                                       51.232250 (Lat. bottom right)
                                       6.752883 (Long. bottom right)

====================================================================

[Test Tool OT290 [1], Ver 3.53]
Type:                                  Sagem GPRS (Firmware JY3,Bj 315)
GSM Net:                               GSM900/DCS1800
Meas. Mode:                            Normal
IMEI:                                  08202501
Auto Dial Timing:
 Call Window:                          60 sec
 Call Duration:                        40 sec
 Max. Access Time:                     15 sec
Call Window Offset:                    0 sec
Type of Call:                          Voice Call
NQA Rx Source:                         Full
RxLev Calibration:                     No
Antenna name:                          Default_Antenna
Cable loss [dB]:                       0.00
Antenna gain [dBi]:                    0.00
Cellbar Flag:                          Normal
CBCH:                                  not decoded
GPRS Mobile:                           Yes
Forcing Settings: Multi Slot Class:    No Forcing
 Coding Scheme:                        No Forcing
 GPRS Auto Attach:                     No Forcing
 MS Class:                             No Forcing
 GSM Power Class:                      No Forcing
 DCS Power Class:                      No Forcing
 EFR:                                  Off
GSM/GPRS QoS Actions Evaluation
 1. GSM Handover:
  Timeout: 10000 ms
 2. Location Area Update:
  Timeout: 10000 ms
 3. GPRS Attach:
  Timeout: 10000 ms
 4. GPRS Detach:
  Timeout: 10000 ms
 5. Activate PDP Context:
  Timeout: 10000 ms
 6. Deactivate PDP Context :
  Timeout: 10000 ms
 7. Routing Area Update:
  Timeout: 10000 ms

Handover Analyzer
 Enabled:                       No

Port Settings
1. Port:
    Type: Trace
    Name: COM1

====================================================================

[EXPORT OPTIONS]
Exported by version:                   3,60,0,207
Trigger type:                          All Data is Exported
Delimiter:                             ;
Invalid Sign:                          ?
Created during multiple file export:   no
Parameter selection:                   copied from other file
```

```
[DESCRIPTION]
Timestamp [hh:mm:ss]
GSM\Server Report\MCC : [1]
GSM\Server Report\MNC : [1]
GSM\Server Report\LAC : [1]
GSM\Server Report\CI : [1]
GSM\Measurement Report\BCCH [ChanNr] : [1]
GSM\Measurement Report\BSIC : [1]
GSM\Measurement Report\RxLev Full [dBm] : [1]

[DATA]
18:23:30;?;?;?;31129;830;37;-84
18:23:32;262;3;33919;31129;830;37;-81
18:23:34;262;3;33919;31129;830;37;-80
18:23:36;262;3;33919;31129;830;37;-77
...
```

CI Analysis Files (*.TXT)

The interference signals detected and stored in a measurement file, analyzed with ROMES-GS *(Mobile Interference Measurement),* and unambiguously assigned to a base station can be stored to an ASCII file with the extension *.TXT. A C/I analysis file only contains the interferers clearly identified by ROMES-GS; it is empty for *.CMD files that haven't been analyzed before.

The CI analysis file contains the following information:

CI of the serving cell (SC) *(SC CI)*, name of the serving cell/sector name *(SC Name),* geographic coordinates of the SC base station *(SC Longitude, SC Latitude),* measured channel number and type *(Measured Channel, SC Channel Type),* frequency hopping of the SC base station on or off *(FH),* measured power of the SC in dBm *(SC Power (dBm)),* geographic coordinates of the interference measurement position *(I-Meas Lon, I-Meas Lat),* calculated distance of the measurement position from the SC base station *(Distance I-Meas <–> SC (km)),*

CI of the interferer cell *(I-BTS CI)*, name of the interferer cell/sector name *(I-BTS Name),* interferer type *(I-BTS Channel Type),* calculated distance of the measurement position from the interferer base station *(Distance I-Meas <–> I-BTS (km)),* measured power of the interferer in dBm *(I-BTS Power (dBm)),* carrier to interference ratio *(C/I (dB)), Length of Interference (km)*,

general information on the measurement file and time *(Meas. File Name, Time of Interference, Start Time of Transmitter Scan, Meas. Time of I-BTS, Comments).*

CI analysis files can be used to save the interferer information in readable form and process it in applications other than ROMES. They are not intended to be re-imported into ROMES because the data is already included in the *.CMD files.

MapInfo Interchange Format (*.MIF)

MIF is a particular ASCII file format that stores graphical information to be displayed in a MapInfo table. The *MIF Export* configuration dialog contains four tabs. The *Blocks* and *Info* tabs are analogous to the *ASCII Export* tabs; see p. 7.12 ff.

The *Values* tab of offers a list of all parameters in the selected measurement file (*.CMD).

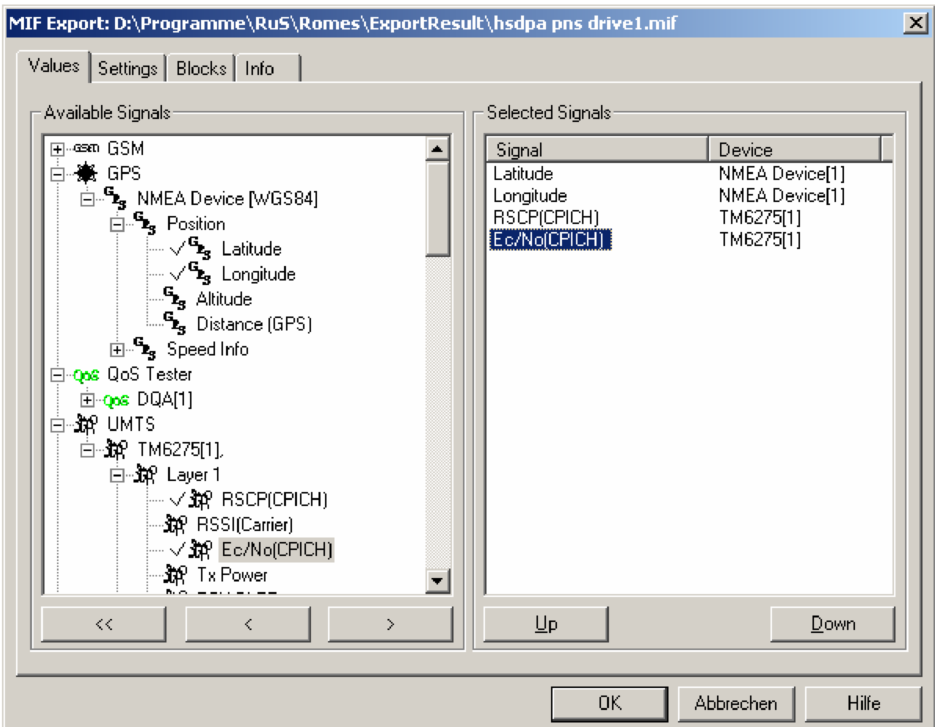
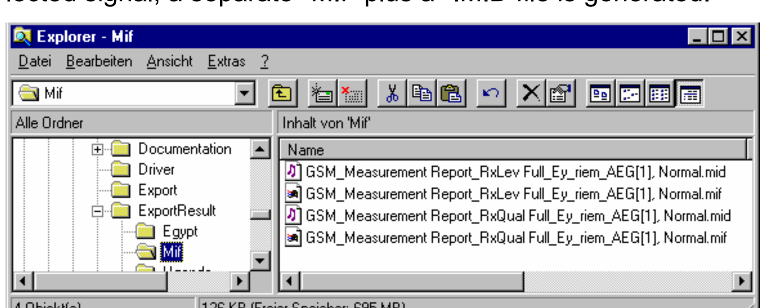


Fig. 7-9 MIF Export configuration: Values

Available Signals Data tree (see chapter 1) showing all available signal parameters (hierarchy level 4 of the data tree).

Selected Signals List of all signal parameters selected for display.

The order of the list can be changed using the two buttons below. For each selected signal, a separate *MIF plus a *.MID file is generated.



The *.MIF file contains a file header followed by the geographic coordinates of each exported data point and the code for the symbols to be used for display in MapInfo; see description of *Settings* tab below. This file can be imported into MapInfo as described in section *Importing *.MIF files to MapInfo* on p. 7.1.

The *.MID file contains two columns for the exported signal values and a general signal, e.g. the time stamp associated to each signal value.

The *Settings* tab selects the symbols to display the data in MapInfo and the data to be exported to the *.MIF file.

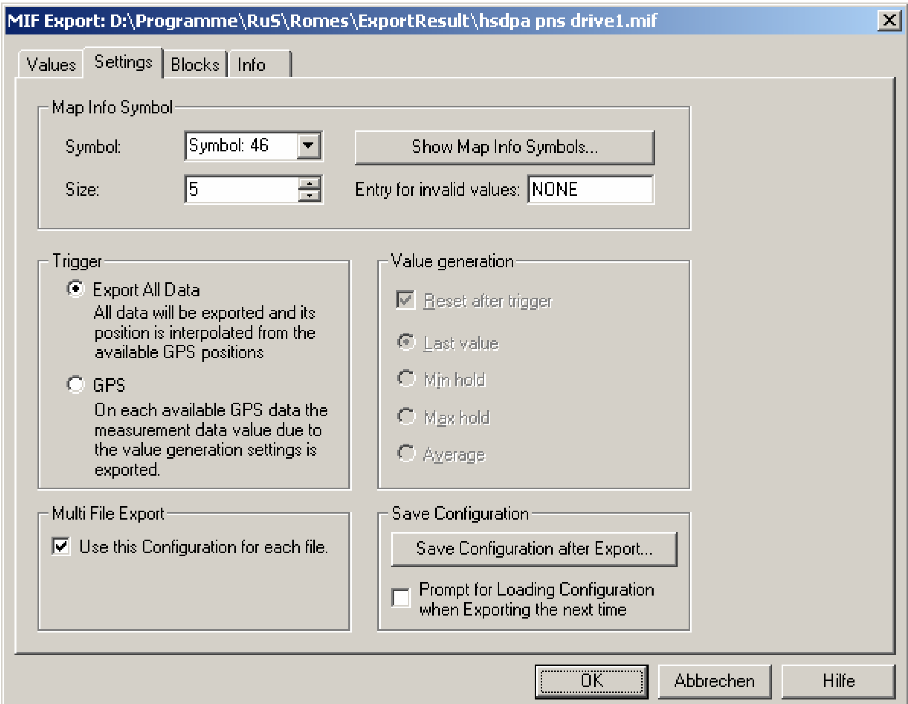
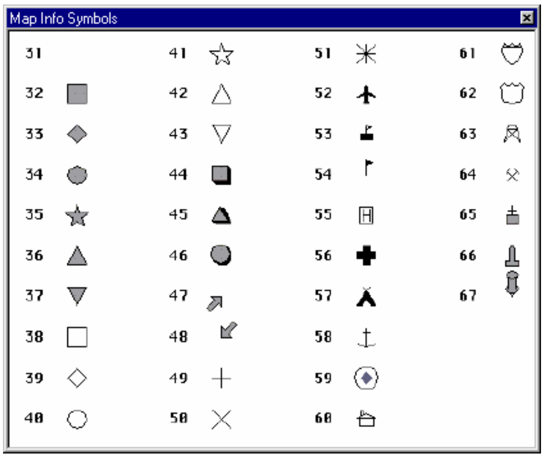


Fig. 7-10 MIF Export configuration: Settings

MapInfo Symbol

Selects the symbol to display the data in a MapInfo view and the symbol size. The symbols can be defined with their code number *(Symbol)* and *Size* or selected from a list that is opened on clicking the *Show Map Info Symbols...* buttons.



Trigger

Defines which values in the selected signals are exported and how the geographical coordinates assigned to the exported values are calculated. The following alternative options are provided:

Export All Data

Export all values of the selected signals to the *.MIF file. Use an appropriate interpolation method to determine the position of each value from the GPS data available in the measurement file.

GPS

Export one signal value for each GPS position stored in the measurement file using the *Value Generation* settings; see below.

Value generation Defines how the signal value assigned to a definite GPS position is calculated. The panel is active only if the *GPS* trigger condition is set. One trigger period corresponds to the time between two consecutive GPS positions.

Reset after trigger

If the box is checked the buffer is cleared after each trigger period. If not, the export value (i.e. the last value, minimum, maximum, or average, whichever is selected) in each trigger period is stored in the buffer. If only invalid values are detected in one trigger period, the buffer value (i.e. the value of the previous trigger period) is exported.

Last value

If only invalid values are detected in one trigger period, the last valid value is exported

Min hold

The minimum value within one trigger period is exported

Max hold

The maximum value within one trigger period is exported

Average

The average value within one trigger period is exported. This option is not applied to parameters where averaging does not make sense, e.g. channel numbers or station codes.

Multi File Export If the box is checked the current *MapInfoSymbol, Trigger* and *Value generation* settings are also used for future *.MIF export files. Otherwise, ROMES will reset the settings to default after the current file export.

Save Configuration The *Save Configuration After Export* button opens a file *Save As…* dialog to save the current configuration in a MIF export configuration file. MIF export configuration files have the extensions *.rma and can be reused when exporting next time. If the box below the button is checked, the system prompts for loading the current configuration file when the MIF export configuration menu is called up.

Importing *.MIF files to MapInfo

The .MIF file can be imported to MapInfo and converted to a MapInfo table file (*.TAB) to be viewed in a MapInfo table. This involves several steps:

1. Open MapInfo and select the *Import* command in the *Table* menu.
2. In the *Import File* dialog opened, select the file type *MIF and the *.MIF file to be imported and press *Open* to start the file import.
3. In the *Import into Table* dialog opened, select a name and directory for the *TAB file to be created and press *Save*.

By default, the *TAB file is stored in the same directory and uses the same file name as the *MIF file.

4. In the *File* menu, select *Open Table* to display an *Open Table* dialog and select the created *TAB file.
5. To display all data points stored in the *.MIF file, use the *View Entire Layer* command in the *Map* menu.

For more information refer to the MapInfo help.

DOS binary format (*.MES)

The MES format is used for the former TS9954 evaluation software. There are some important rules for creating a MES file:

- Distance-triggered CW data contained in the measurement file are ignored. The same is true for other data not specified in the MES format definition (i.e. ETACS).
- In this format, only one mobile can be evaluated per file. So the system generates as many different export files as there are mobiles used in the measurement (*.MES1, *.MES2, ...).
- If there is only one mobile, the file name will not be changed but only the extension will change from *.CMD to *.MES. Otherwise, the MS Windows file extension will be set to *.MESx where x = 1 to <max. mobile nr.>

Examples:

Original file with three mobiles:	TEST.CMD	TESTMOBILES.CMD
Exported files:	TEST.MES1	TESTMOBILES.MES1
	TEST.MES2	TESTMOBILES.MES2
	TEST.MES3	TESTMOBILES.MES3
DOS file names:	TEST~1.MES	TESTMO~1.MES
	TEST~2.MES	TESTMO~2.MES
	TEST~3.MES	TESTMO~3.MES

The TS9954 evaluation software is a 16 bit application. So even if you run it under a newer operating system, you will always see the DOS file name.

The *MES Export* configuration dialog contains three tabs. The *Blocks* and *Info* tabs are analogous to the *ASCII Export* tabs; see p. 7.12 ff. The *CW Options* tab provides the export settings for CW data. The controls are grayed if the measurement file contains no CW data.

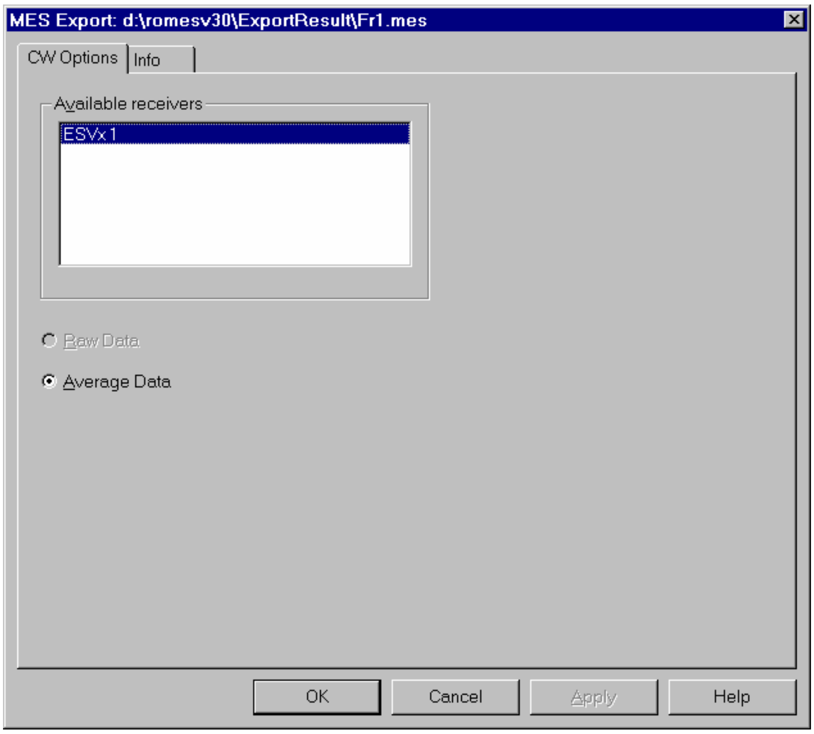


Fig. 7-11 MES Export configuration

Available receivers List of test receivers used. (At present, only one receiver can be used; in contrast to the *SRS export, a scanning mobile is not treated as a test receiver).

Data If the measurement file contains CW data, either the raw data (i.e. all data measured, if available in the current measurement file) or the data averaged according to a suitable criterion (see section *Test Receivers* in chapter 6) can be exported. The latter option will considerably reduce the amount of data.

Note:

To make the exported data accessible for the TS9954 evaluation software, you have to use the correct path structure: ***<drive>:\TS9957\<area>.DIR\MEASDATA*** *with the evaluation software located in* ***<drive>:\TS9957*** *. You can copy the export data to an existing area or create a new area with the corresponding function in the TS9954 software.*

NT3 ASCII format (*.NT3)

NT3 is a particular ASCII format developed for specific customer requirements which can be used to export distance triggered CW data. If an attempt is made to export a measurement file that does not contain distance triggered CW data to *.NT3 format, an error message pops up. A detailed format description can be obtained from Rohde & Schwarz on request.

The *Nokia Export* configuration dialog contains three tabs. The *Blocks* and *Info* tabs are analogous to the *ASCII Export* tabs; see p. 7.12 ff. The *Configuration* tab provides the export settings for an *.NT3 file.

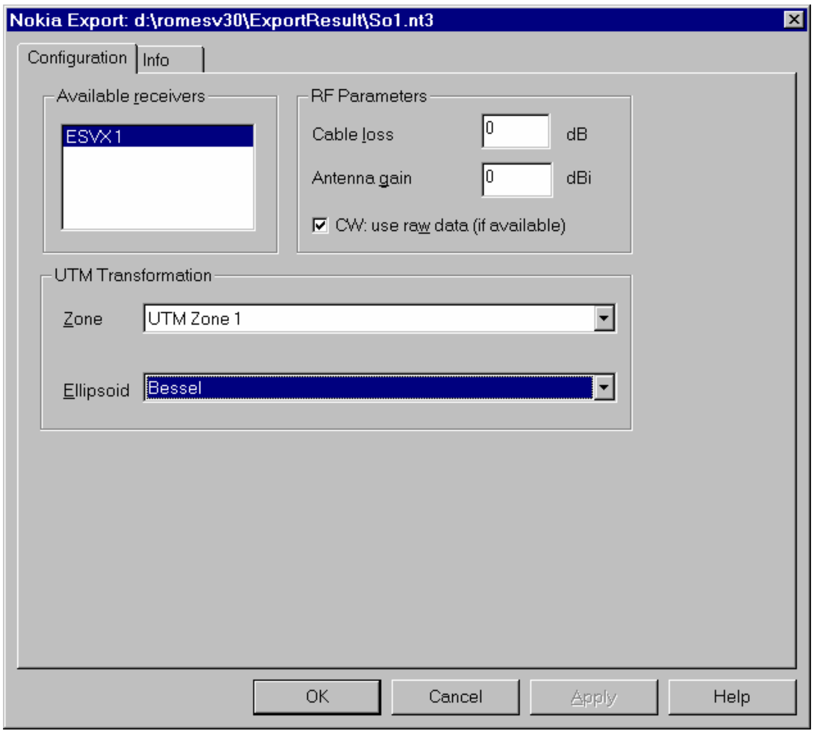


Fig. 7-12 Nokia Export configuration

Available receivers List of test receivers used. (At present, only one receiver can be used; in contrast to the *SRS export, a scanning mobile is not treated as a test receiver).

RF parameters The RF parameter panel defines a cable loss and antenna gain which will be taken into account for the signal values exported.

CW: use raw data (if available) If the box is checked, the raw data (i.e. all data measured, if available in the current measurement file) are exported. Alternatively, the data averaged according to a suitable criterion (see section *Test Receivers* in chapter 6) are exported. The latter option will considerably reduce the amount of data.

UTM Transformation The UTM Transformation panel defines the Universal Transversal Mercator Projection (UTM) parameters (see chapter 8):

*Zone*UTM zone 1 to 60 where the measurement was performed.

*Ellipsoid***Type of parametrization of the earth** (Bessel, Hayford, Krassowskij, WGS84)

NQA ASCII format (*.NQA)

The NQA (**N**etwork **Q**uality **A**nalysis) ASCII format is used with the *TS9954 NQA* evaluation software. This software offers an extended analysis of GSM data allowing, e.g., to combine the NQA view with the complete MS Excel functionality. For detailed information see section *Evaluation of NQA Data with TS9954 NQA* on p. 7.43 ff. The following program and file format versions are available:

NQA format version	TS9954 NQA version	MS Excel version

V1.0 (*.NQA)	V2.10	V5.0 or higher
	V3.00, V3.01	V8.0 or higher
V2.0 (*.NQ2, recommended format)	V3.00, V3.01	V8.0 or higher

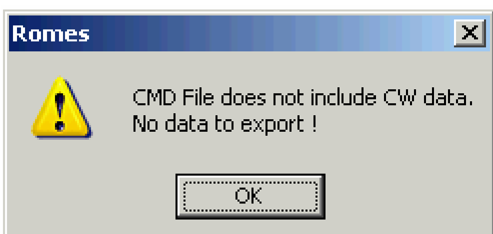
To generate and evaluate NQA data, a GSM mobile must be used and both *NQA* and *Autodialing* must be enabled in the corresponding hardware driver configuration menus (see chapter 6). If the selected measurement file contains no NQA data, an error message will appear when you try to use the *.NQA export format.

Protocol format (*.PRO)

The protocol format is used by various third-party tools for the evaluation of CW measurement data

CW measurement data shows the measurement frequency of a test receiver *(R&S ESVx*, *R&S ESPI, R&S SBR, R&S TS55-R2, R&S TSMx,* see test receiver driver description in chapter 6), that operates in *Manual Tracking* mode.

If an attempt is made to export a measurement file that does not contain CW data to *.PRO format, an error message pops up:



The *PRO Export* configuration dialog contains three tabs. The *Blocks* and *Info* tabs are analogous to the *ASCII Export* tabs; see p. 7.12 ff. The *PRO Export Configuration* tab provides the export settings for a *.PRO file.

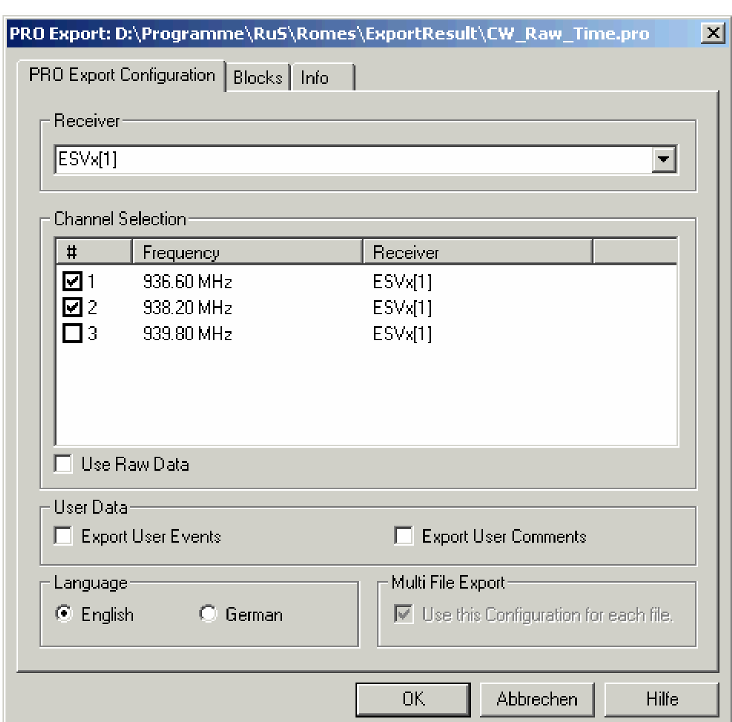


Fig. 7-13 Pro Export configuration.

Receiver List of test receivers used.

Channel Selection The channel selection is analogous to the other test receivers. For a description of the Band definition and Frequency list refer to the *Channel selection* paragraph in chapter 6).

Use Raw Data If the box is checked, the raw data (i.e. all data measured, if available in the current measurement file) are exported. Alternatively, the data averaged according to a suitable criterion (see section *Test Receivers* in chapter 6) are exported. The latter option will considerably reduce the amount of data.

User Data Here the export of manually triggered *User Events* and *Comment Events*, as defined on the *Available Events* tab in the *ROMES Configuration* menu is controlled:

Export User Events If the box is checked, the user events defined in the are included in the export *.PRO file.

Export User Comments If the box is checked, the user comments defined in the are included in the export *.PRO file.

Language Export only messages in the specified language (e.g. German: Kanal / Gewinn, English: channel / gain). Some evaluation tools require a specific language, which can be set here.

Multi File Export If several files are selected for export and the box is checked, the current *Receiver, Channel* and *Language* settings are used for all *.PRO export files. If only one file is selected for export, ROMES will reset the settings to default after the current file export.

Metafile format (*.SRS, *.SER)

SRS is a special ASCII format that is necessary for evaluating the measurement data with the MSI PLANET (Version 2.6 and higher) and SAFCO OPAS system. SER is an extended version of SRS; for questions of compatibility ask the manufacturer of your evaluation software.

There are some important rules for creating a SRS or SER file:

- All data not specified in the SRS/SER format definition (i.e. ETACS or DAB) will be ignored.
- The SRS/SER format specification allows only one scanning device including CW data from ESVx devices. If ESVx data is included, all other scan data will be ignored. If more than one scanning GSM mobile is included, the data of the first mobile will be exported and all other scan data ignored.
- Exporting GSM Scan Data: It is highly recommended not to activate the *Decode BSIC* feature (see RS TM driver section) in conjunction with the SRS export format, however, it can be activated in conjunction with the SER format.

The *SRS/SER Export* configuration dialog contains three tabs. The *Blocks* and *Info* tabs are analogous to the *ASCII Export* tabs; see p. 7.12 ff. The *SRS/SER Export Options* tab provides the export settings for an *.SRS or *.SER file.

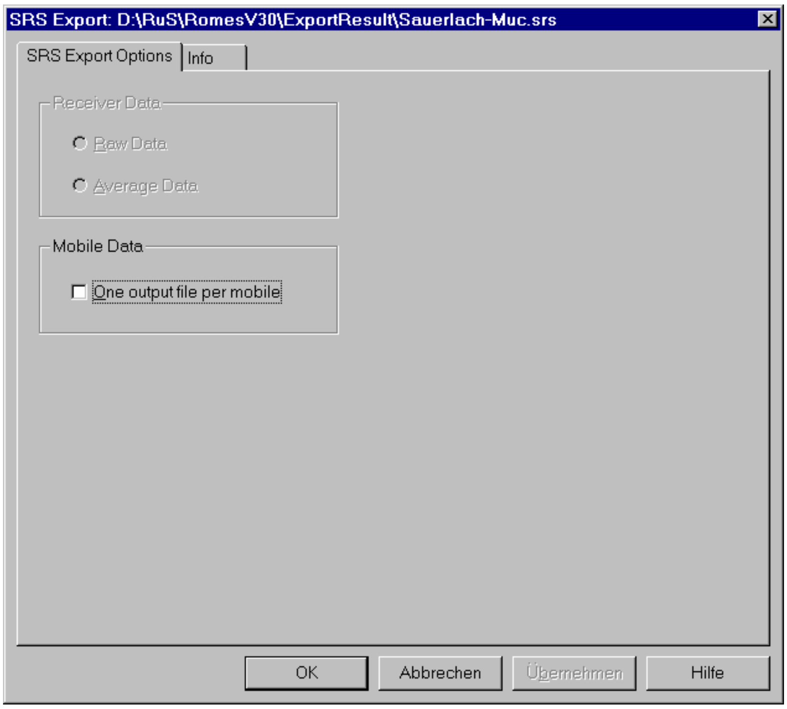


Fig. 7-14 SRS/SER Export Options

Receiver Data If the measurement file contains CW data, either the raw data (i.e. all data measured, if available in the current measurement file) or the data averaged according to a suitable criterion (see section *Test Receivers* in chapter 6) can be exported. The latter option will considerably reduce the amount of data.

Mobile Data If the box is checked, and if the measurement file contains data from several mobiles, a separate export file is created for every single mobile. The files are automatically numbered *.SRS1, *.SRS2, ..., *.SRSn (analogous for SER), where n is the number of mobiles. If the box is not checked, all data is written to one file *.SRS or *.SER.

Export via MS Windows Command Line

If you actually do not intend to perform any measurement or replay on your system, but just want to export some measurement files, you may do this also from the command line (except for user-defined ASCII format *.ASC).

General command line export syntax:

[C:\ROMES\]ROMES.exe [[/mes] [/srs] [/nqa] <file(s) *.CMD> [/o output filenames][/r report file]]

Note: *Wildcards (*, ?) are not allowed.*

If the paths of the used files (ROMES.exe, *.cmd) are reported to the system by the PATH=... command in the AUTOEXEC.BAT, you do not need to add them to the file names.

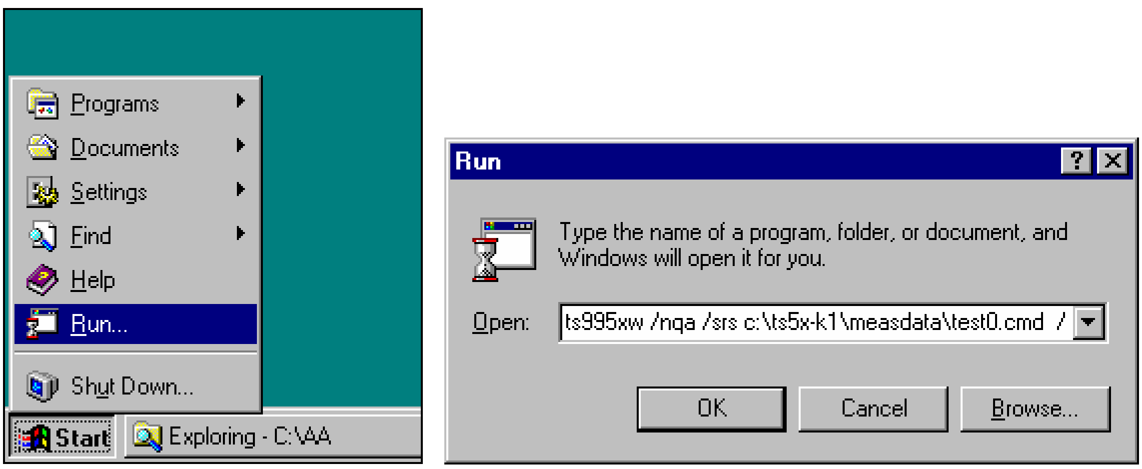
To export the data, one of the formats [/mes], [/srs], [/ser], [/nt3], [/mif], [/pro], [/asc], [/nqa] or [/nq2] must be selected. Multiple selection is allowed.

If an input file name has no related output file name after the /o switch, the input file name will be used for the output file.

If more output file names than input files are specified, the spare output files are ignored. If less output files than input files are specified, the *n* given output file names are used for the first *n* input files. The names of remaining files are unchanged, only the default extension is used.

If the /r option is used, all text output (e.g. error messages) produced during export is diverted into a report file. If no report file name is specified, the default name *error.txt* will be used.

Enter the MS Windows command line into the input field of the *Run* dialog box which is accessible from the *Start* menu:



You can also start from the DOS box. Here you may also use a batch file, if desired. If you do so, start every new line with the CALL command, otherwise only the first line of the batch file will be executed.

BTS / Node B List Formats

BTS (base transceiver station) and UMTS Node B data are imported via the *Configuration of Software Modules* menu (see *Configuration – Settings* command in chapter 3) from a BTS / Node B list file. BTS list files are ASCII files characterized by one of the extensions *.txt, *.atd, *buf or *.vig. Information on the base stations can be indicated e.g. in the *Alphanumeric View, Measurement Report,* or *Route Track* views (see chapter 4). An example for a base station list is shown on page 7.32.

File formats

The formats *.buf and *.vig are customized, fixed formats and not intended for general use. *.atd and the two *.txt versions are BTS list file formats which can be configured as described in the following sections. The information in all BTS files is arranged in a table. Each column of the table corresponds to a BTS parameter, each line to a particular BTS sector.

- The extensible *.txt format is available for ROMES software versions ≥ V3.20. The BTS parameters in the file can be selected at will; their number and order is described in a header line.
- The old *.txt format is available for ROMES software versions < V3.20 but will be also supported in future versions. Compared to the extensible *.txt format, the old format uses a header line with a different syntax and a number of mandatory BTS parameters in a fixed order.
- The *.atd format is available for ROMES software versions < V3.20 but will be also supported in future versions. The names of the BTS parameters in the file are fixed. This file format can be used also for UMTS Node B list files.

Starting with ROMES software V3.20, it is recommended to use the new flexible and extensible *.txt format for GSM BTS list files; see section *Extensible BTS List (*.txt) Format below*. This extensible file format is also used as an export format for GSM data from an internal network data base (*.ndb) file (see *Configuration – Settings* command in chapter 3). The *.atd format must be used for UMTS Node B network data bases.

Alternatively, it is possible to write a DLL file defining an new, user-defined BTS list format; see section *User-Defined List Format* on p. 7.38 ff.

Use in a Carrier-to-Interference measurement

In a Carrier-to-Interference measurement the date of the file is used as a measure for the validity and relevance of the given data: The older the file the less reliable the BTS data is considered to be.

Identification of base stations

The assignment of different sectors to a particular BTS in a Carrier-to-Interference measurement is based on the measured geographical position of each sector: Up to three sectors with a distance of less than 5 meters are considered to belong to the same base station. It is assumed that the 51-multiframes (T_{51} frames) of all sectors of the BTS are time-synchronized, i.e. that the starting time of their M51 multiframe is the same. In the case of asynchronous sectors or a number of sectors larger than three, individual clock codes are required; see below.

Update of the BTS data base

The BTS list data base can be updated by adding a new BTS list file; see description of *Configuration – Settings* command in chapter 3. In the update process base stations that are already included in the data base are replaced, and new base stations are added to the data base. Two BTSs are considered to be identical if both their geographical position and the clock codes of their sectors match.

Clock codes

Up to three sectors with a distance of less than 5 meters are considered to be time-synchronized if their clock codes are equal. A maximum of three sectors with the same position and the same clock codes are allowed.

If a the BTS list data base and the added BTS list file contain the same BTS with different clock codes, the system will erroneously assume that the BTS in the list file is new and add it to the data base for a second time. In order to avoid such a situation an automatically generated clock code should never be used. To clearly indicate whether two base stations are identical and whether or not their sectors are time-synchronized we recommend the following choice:

- If the sectors are not synchronized, use the Cell Identity (CI) of the individual sectors as clock codes.
- If the sectors are synchronized, use the smallest of the CIs of all sectors as a common clock code.

This problem is reduced when option is the *R&S GSM Demodulator* driver included in ROMES-GS is loaded. Once the Cell Identity (CI) and the complete Location Area Information (LAI) is available the comparison is taken using these values.

Extensible BTS List (*.txt) Format

The extensible *.txt format is the standard GSM BTS list format for ROMES software versions ≥ V3.20. It is also used as an export format for GSM data from an internal network data base (*.ndb) file (see *Configuration – Settings* command in chapter 3). For older software versions it is recommended to use the old *.txt format described in section *Old BTS List (*.txt) Format* on p. 7.29 ff.

The extensible *txt format provides the advantage that BTS parameters can be selected at will; their number and order is described in a header line containing an arbitrary number of descriptors. Consecutive descriptors are separated by exactly one tab or semicolon and introduced by a hash sign #, e.g.:

#BTS_Name; #C0; #BCC; #NCC; #CI; #Lon; #Lat

In order to interpret and process the BTS parameters correctly ROMES must be able to clearly identify the meaning of the descriptors. To this end a list of keywords has been defined; see *Table 7-1 below*. A descriptor is assigned to a keyword if the leading characters of the descriptor are identical to the keyword. The comparison of descriptors and keywords is not case-sensitive; blanks preceding a # are ignored.

Example:
The descriptors #Longitude, #LON oder #LoNgit in degrees are equivalent. ROMES assigns all these descriptors to the keyword #Lon and interprets the values in the associated column as geographical longitude values.

Each of the table rows below the header line contains the parameters of one BTS sector. All numbers must be entered in decimal format. Like in the header table rows must be separated by tabs (ASCII code: 0x09) or semicolons; lines are separated by a line feed (CR/LF ASCII code:0x0D/0x0A). The following example shows a valid *.txt file:

```
#SectorName   ; #Longitude;  #Latitude;#BCC;#BCCH
Base station 11;  11.672931;  47.921935;   4;  790
Base station 4 ;  11.684844;  47.940659;   7;  784
Base station 17;  11.635992;  47.992432;   4;  799
```

Table 7-1 Keywords for the extensible *.txt format

Keyword	Description	Remarks
#Lon	Geographical Longitude	Format: Decimal with dot, e.g. 11.34179
#Lat	Geographical Latitude	Format: Decimal with dot, e.g. 47.89407
#BCC	BTS Color Code	0 to 7 decimal
#NCC	Network Color Code	0 to 7 decimal
#CI	Cell Identity	1 to 65535 decimal
#LAC	Location Area Code	
#MNC	Mobile Network Code	
#MCC	Mobile Country Code	
#BTS #SEC #Nam	Name of a BTS sector	e.g. BTS_Name e.g. Sector Name e.g. Name of BTS
#C0 #BCCH	Channel no. of the C0 carrier/BCCH	
#Cx #TCHx	Channel no. of the TCHs	x = 1 to 63
#CC #Clk #Clock	Clock code	1 to 65535 decimal. Up to three sectors with a distance of less than 5 meters are considered to be synchronized if their clock codes are equal. A maximum of three sectors with the same position and the same clock codes are allowed.
#Power #EIRP	Transmitter output power/ antenna power	Equivalent Isotropically Radiated Power
#Ant	Antenna type	0 omnidirectional 1 directed (120° sectors)
#Dir	Direction of maximum transmitter power	Direction in °, 0..360, North = 0°, East=90°
#SyncCode	Synchronization code	Sectors with identical Sync Codes are grouped to facilitate the calculation of the statistical time deviation. For each group of identical Sync Codes the statistical drift is calculated and used in the interference analysis. The measurement accuracy can be augmented in cases where different types of BTS show a different drift behavior, by differentiating the BTSs using different Sync Codes.
#Lay #Hir	Layer of the BTS in the network	Relevant for handovers.
#Man #Pro #Ven	Manufacturer of the BTS	0 unknown 1 Motorola 2 Siemens 3 Nokia 4 Ericsson 5 Lucent

The following keywords/descriptors are generated when data in a network data base (*.ndb) file are exported to a BTS list file (see description of *Configuration – Settings* command in chapter 3). They are usually not part of a user-defined *txt file.

Table 7-2 Keywords for *.ndb export

Keyword	**Description**	**Remarks**
#MainErrDir	Main direction of position error	Direction in °, 0..360, North = 0°, East=90°
#PosErr1	Position error in main direction in meters	
#PosErr2	Position error orthogonal to the main direction in meters	
#SourceST1	Source for BTS data from *System Information Type 1*	Values: INVALID, BTS_LIST, USER_EDIT, MEASURED
#SourceST3	Source for BTS data from *System Information Type 3*	Values: INVALID, BTS_LIST, USER_EDIT, MEASURED
#ValidityST1 #ValST1	Validity for BTS data from *System Information Type 1*	Values: IIS_VALID, TO_BE_VERIFIED
#ValidityST3 #ValST3	Validity for BTS data from *System Information Type 3*	Values: IIS_VALID, TO_BE_VERIFIED
#TimeSector	Time for the last check of entered values for a sector in s since 1970	E.g. time of the measurement or time of last change of BTS list files.
#TimeST1	Time for the last check of *System Information Type 1* values for a sector in s since 1970	
#TimeST3	Time for the last check of *System Information Type 3* values for a sector in s since 1970	

Old BTS List (*.txt) Format

The old *.txt BTS list format is available for ROMES software versions < V3.20 but will be also supported in future versions. Compared to the extensible *.txt format (see section *Extensible BTS List (*.txt) Format* on p. 7.27 ff.), the old format uses a header line with a different syntax and a number of mandatory BTS parameters in a fixed order.

The header line of the file contains the descriptors for the BTS parameters. It is possible to use arbitrary descriptors (exception: \n indicates the end of a line and must not be used as a descriptor), however, the assignment of many BTS parameters to table columns is fixed and the order of many rows must not be changed (see *Table 7-3 below*). The descriptors are not introduced by a hash sign. The following example shows a valid header line:

Name	Longitude	Latitude	BCC	BCCH	TCH1	TCH2	TCH3	TCH4	TCH5	TCH6	
TCH7	TCH8	TCH9	TCH10	TCH11	TCH12	TCH13	TCH14	TCH15	CI	NCC	ClkCode
Power	Antenna	Direction	FixVal	LAX	MNC	MCC	TCH16	TCH17	...	\n	

Each of the table rows below the header line contains the parameters of one BTS sector. Numbers must be entered in decimal format. Table rows must be separated by tabs (ASCII code: 0x09) or semicolons; the end of a line is indicated by an \n, and lines are separated by a line feed (CR/LF ASCII code:0x0D/0x0A).

Table 7-3 BTS List

Label	Format	Description
Name	1..23 ASCII Chars	Unique identification of the sector
Longitude	[+,-]#[#][#][.[#][#][#][#][#][#][#]]	Geographical longitude in degrees, -360.0000000° ... +360.0000000°
Latitude	[+,-]#[#][.[#][#][#][#][#][#][#]]	Geographical latitude in degrees, -90.0000000° ... +90.0000000°
BCC	#	BCC 0..7, decimal
BCCH	#[#][#]	C0 Carrier 1...124 or 512...887
TCH1	#[#][#]	C1 Carrier 1...124 or 512...887, or 0, if not available
TCH2	#[#][#]	"
TCH3	#[#][#]	"
TCH4	#[#][#]	"
TCH5	#[#][#]	"
TCH6	#[#][#]	"
TCH7	#[#][#]	"
TCH8	#[#][#]	"
TCH9	#[#][#]	"
TCH10	#[#][#]	"
TCH11	#[#][#]	"
TCH12	#[#][#]	"
TCH13	#[#][#]	"
TCH14	#[#][#]	"
TCH15	#[#][#]	"
CI	#[#][#][#][#]	Cell Identity, 1...65535, decimal
NCC	#	NCC 0...7, decimal
ClkCode	###	Clock code: 1..65534, decimal If no clock code is assigned, the internal default value of 65535 is used. For sectors differing by less than 5 meters in position and identical clock code (e.g. default), synchronous transmission of the SCHs is assumed (normal). If the sectors of a BTS work asynchronously or if several BTSs use the same location, individual clock codes must be given for each sector (special).
Power	#[#][.[#][#]]	EIRP power in dBm, 5 dBm .. 66 dBm
Antenna	#	Antenna type: 0: omnidirectional 1: 120° Sector
Direction	#[#][#]	Direction in °, 0..360, North = 0°, East=90°

Label	Format	Description
Sync Code	#[#][#]	Synchronization identification: 1..25 decimal Sectors with identical Sync Codes are grouped to facilitate the calculation of the statistical time deviation. If no value is given a default value of 0 is used. For each group (of identical Sync codes) the statistical drift is calculated and used in the interference analysis. The measurement accuracy can be augmented in cases where different types of BTS show a different drift behavior, by differentiating the BTSs using different Sync Codes.
FixVal	#	Denotes how many of the following data fields LAC, MNC and MCC are defined for this sector. These data fields must be in the given order.
LAC	#[#][#][[#][#]	Location are code. Value 65535 if not available.
MNC	#[#][#]	Mobile network code. Value 65535 if not available. If available, the MNC overwrites the default value, which can be given in the *DB Settings/Query – Init* dialog.
MCC	#[#][#]	Mobile country code. Value 65535 if not available. If available, the MNC overwrites the default value, which can be given in the *DB Settings/Query – Init* dialog.
TCH16	#[#][#]	Traffic channel 16, values 1...124 or 512...887, or 0, if not available
...	#[#][#]	Every entry for one sector denotes an additional traffic channel.

Number 0..9

[...] optional value

All fields up to the *Direction* field are mandatory, further values only extend the measurement result. However, in order to use the additional data given by the K7 driver, the LAC, MNC and MCC must be specified for each sector.

Example for Base Station Lists (Old *txt Format)

Using MS-Excel (Tab-separated file m u s t be saved in ASC/TXT format !!)

Name	Lon	Lat	BCC	C0	C1	C2	C3		C14	C15	CI	NCC	CC	Power	Ant	Dir
Station1/Cell1/90	14.123354	48.196572	0	84	51	33	0	filled with zeroes and TABs	0	0	3356	3	3356	38	1	90
Station1/Cell2/210	14.123354	48.196572	2	96	10	0	0		0	0	3367	3	3367	38	1	210
Station1/Cell3/330	14.123354	48.196572	2	101	0	0	0		0	0	3361	3	3361	38	1	330
MUC_Cent1	13.95700	47.843251	4	91	46	13	0		0	0	3477	3	3451	44	1	60
MUC_Cent2	13.95700	47.843251	1	111	70	8	0		0	0	3451	3	3451	44	1	180
MUC_Cent3	13.95700	47.843251	3	106	11	0	0		0	0	3460	3	3451	44	1	300
Example/Omni_1	14.934562	48.798645	7	83	17	4	14						3411	48	0	0

Cells are synchronous

Cells are asynchronous

Omni-directional cell

SyncCode - Field discarded

ASC/TXT format (separated by semicolon)

Name; Lon; Lat; BCC; C0; C1; C2; C3; C4; C5; C6; C7; C8; C9; C10; C11; C12; C13; C14; C15; CI; NCC; CC; Power; Ant; Di

Station1/Cell1/90; 14.123354; 48.196572; 0; 84; 51; 33; 0; 0; 0; 0; 0; 0; 0; 0 ; 0 ; 0; 0; 0; 3356; 3; 3356; 38; 1; 90 <CR>
Station1/Cell2/210; 14.123354; 48.196572; 2; 96; 10; 0; 0; 0 ; 0 ; 0 ; 0; 0 ; 0 ; 0 ; 0 ; 0 ; 0; 0; 3367; 3; 3367; 38; 1; 210 <CR>
Station1/Cell3/330; 14.123354; 48.196572; 2; 101; 0; 0; 0; 0; 0; 0; 0; 0; 0 ; 0 ; 0; 0; 0; 3361; 3; 3361; 38; 1; 330<CR>
MUC_Cent1; 13.95700; 47.843251; 4; 91; 46; 13; 0; 0; 0; 0; 0; 0; 0 ; 0 ; 0 ; 0; 0; 0; 3477; 3; 1; 44; 1; 60<CR>
MUC_Cent2; 13.95700; 47.843251; 1; 111; 70; 8; 0; 0 ; 0 ; 0 ; 0; 0; 0; 0 ; 0 ; 0 ; 0 ; 0; 0; 3451; 3; 1; 44; 1; 180<CR>
MUC_Cent3; 13.95700; 47.843251; 3; 106; 11; 0; 0; 0 ; 0 ; 0 ; 0 ; 0 ; 0 ; 0 ; 0 ; 0 ; 0 ; 0; 0; 3460; 3; 1; 44; 1; 300<CR>
Example/Omni_1; 14.934562; 48.798645; 7; 83; 17; 4; 14; 0 ; 0 ; 0 ; 0; 0 ; 0; 0 ; 0 ; 0 ; 0 ; 0; 0; 3411; 3; 3411; 48; 0; 0<CR>

ASC/TXT format (separated by tabs)

Name	Lon	Lat	BCC	C0	C1	C2	C3	....	C14	C15	CI	NCC	CC	Power	Ant	Dir<CR>
Station1/Cell1/90	14.123354	48.196572	0	84	51	33	0		0	0	3356	3	3356	38	1	90<CR>
Station1/Cell2/210	14.123354	48.196572	2	96	10	0	0		0	0	3367	3	3367	38	1	210<CR>
Station1/Cell3/330	14.123354	48.196572	2	101	0	0	0		0	0	3361	3	3361	38	1	330<CR>
MUC_Cent1	13.95700	47.843251	4	91	46	13	0	filled with zeroes and TABs	0	0	3477	3	1	44	1	60<CR>
MUC_Cent2	13.95700	47.843251	1	111	70	8	0		0	0	3451	3	1	44	1	180<CR>
MUC_Cent3	13.95700	47.843251	3	106	11	0	0		0	0	3460	3	1	44	1	300<CR>
Example/Omni_1	14.934562	48.798645	7	83	17	4	14		0	0	3411	3	3411	48	0	0<CR>

Tab characters

Tab characters

ASCII Table Description (*.ATD) Format

ATD (ASCII Table Description) files control the import of ASCII tables, in particular BTS / Node B lists, into ROMES V3.0 and higher versions. In ROMES V3.20 and higher versions, it is recommended to use the extensible *.txt format described in section *Extensible BTS List (*.txt) Format* on p. 7.27 ff. to import data into a GSM network data base. However, the *.atd format must be used for UMTS Node B data bases.

Since ROMES allows flexible import of different ASCII table formats, a description format is required to explain the table attributes. This format (*.ATD) is a plain text file, which can be edited with any text editor (e.g. Notepad) that does not insert format commands into the text (like MS Word does into the *.doc format files). The table attributes can be defined at will, however, ROMES uses fixed names to identify the parameters in the individual columns (see paragraph on *Column Names* on p. 7.36).

Note:
*Example *.atd files are provided in the BTSLists and NodeBLists subdirectories of the ROMES program directory.*

Example of an ATD file

```
[Main]
Type=ATD
[Table1]
Name=CellData
File=celldata.txt
Columns_Size=5
Columns0_Name=BTS_Name
Columns0_Type=utFixedChar
Columns0_Size=25
Columns0_boIndexed=1
Columns0_boPrimaryKey=1
Columns1_Name=Longitude
Columns1_Type=utDouble
Columns1_boIndexed=1
Columns2_Name=Latitude
Columns2_Type=utDouble
Columns2_boIndexed=1
Columns3_Name=BCC
Columns3_Type=utTInt
Columns3_boIndexed=1
Columns4_Name=C0
Columns4_Type=utSInt
```

Entry	Required/ Optional	Remarks
[Main]	req.	
Type=ATD	req.	
[Table{TableIndex}] TableIndex: index of table (> 0)	req.	More than one tables can be imported using one ATD file; table index is one-based, thus the first table entry is [Table1]; TableIndex numbers have to be in consecutive order; the tables after a gap will not be used.
Name={TableName} TableName: name of the table, as it should be imported and appear inside ROMES; use only letter characters, numbers and ‚_' to form a valid table name;	req.	**Attention!** **SQL keywords used as ASCII table or column names cause an error when the ASCII file is loaded.**
File={FilePath} FilePath: relative or absolute file path of the ASCII table file; relative path root is the location of the ATD file, this means a mere file name without directory has to be located in the same directory as the ATD file	req.	Examples: File=c:\data\cells.txt File=..\cell.asc
Columns_Size={NumOfColumns} NumOfColumns: Number of columns of this table (>0)	req.	The table must contain at least NumOfColumns column entries; if more column entries exist, only the first NumOfColumns will be used.
Columns{ColumnIndex}_{Attrib} column attribute entry; ColumnIndex: index of column (zero based) the attribute belongs to; Attrib: attribute of column as specified below;	-	Multiple of these attribute entries belong to one column with the same index.
Columns{ColumnIndex}_Name= {ColumnName} ColumnName: name of column, as it should be imported and appear in the data tree; use only letter characters, numbers and ‚_' to form a valid column name;	req.	**Attention!** **SQL keywords used as ASCII table or column names cause an error when the ASCII file is loaded.** **The column names must be unique to be identified by the measurement system; see list on p. 7.36.**
Columns{ColumnIndex}_Type = {ColumnType} ColumnType: data type of the column (refer to reference table below)	req.	
Columns{ColumnIndex}_Size = {TypeSize} TypeSize: size of fixed size data	req. for fixed size data;	Specify it only for types „utFixedChar" and „utFixedArray"; the maximum size is 4000 Bytes.
Columns{ColumnIndex}_ boIndexed={IndexedFlag} IndexedFlag: 0 or 1; indicating if column will have an index (1) or not (0)	opt.; default 0	Selections will be much faster if columns used as search criteria are indexed; thus index columns which are often used as selection or join criterion! Indexed columns need slightly more disk space.
Columns{ColumnIndex}_ boPrimaryKey={PrimaryKeyFlag} PrimaryKeyFlag: 0 or 1; indicating if column is used as primary key (1) or not (0)	opt.; default 0	all columns with primary key flag set will form the primary key; only one record with the same primary key may exist inside the database, otherwise an exception will be thrown during import; (this can be used to ensure consistent data even when appending data to an already existing table); primary keys may also have an advantageous influence on selection performance.

The following ASCII table is compatible with the example *.atd file listed above:

```
Cell1:1     12.774     50.038     2     814
Cell2:1     12.397     49.991     1     ?
Cell2:2     12.397     49.991     2     807
```

The records are separated by <NewLine>, the columns by <TAB>.

The last line must also be terminated with <NewLine>, otherwise it will be ignored!

If an attempt is made to import an ASCII table which does not match the ATD description file, an error message describing the kind and position of the erroneous statement(s) is produced. The error messages are self-explanatory.

Attributes

The attributes must correspond to the type specified in the table description according to the following type reference:

Table 7-4 Attributes in an *.atd file

Type Identifier	Description	Range / Representation in ASCII table file
utInt	1 byte integer	–128 ... 127
utSInt	2 byte integer	–32 768 ... 32 767
utLInt	4 byte integer	–2 147 483 648 ... 2 147 483 647
utFloat	4 byte floating point	3.4E-38 ... 3.4E+38 (7 digits) (decimal or scientific notation)
utUInt	1 byte unsigned integer	0 ... 255
utUSInt	2 byte unsigned integer	0 ... 65 535
utULInt	4 byte unsigned integer	0 ... 4 294 967 295
UtDouble	8 byte floating point	1.7E-308 ... 1.7E+308 (15 digits) (decimal or scientific notation)
utFixedChar	Character string of fixed size as specified by ‚size‘ attribute.	In single quotes or without: ['string'] or [string] (first way is more secure); an empty string has always to be represented by ''; the string may be shorter than the given size, but must not exceed it.
utDynChar	Character string of variable size (variant by record).	Refer to utFixedChar, except that there is no size limitation other than the 4000 Bytes maximum.
utFixedArray	Array of fixed size as specified by ‚size‘ attribute.	Hexadecimal literal, e.g. 0x341a5bc2 for a 4 Bytes vector; all ‚size‘ bytes have to be specified.
utDynArray	Array of variable size (variant by record);	Hexadecimal literal, e.g. 0x341a5bc2 for a 4 Bytes vector.
utBlob	Large array of variable size (variant by record); may be bigger than 4000 Bytes.	Not supported in version 3.0 !

Column Names

The column names in an ATD file must be unambiguous in order to be clearly identified by the test system. In analogy to the conventions in the *.txt files the following names may be used for GSM BTS data bases (see also *Table 7-3* on p. 7.30 and BTS list example on page 7.32):

Column Name	Type	Range	Description
UniqueId	utULInt	0 to 4 294 967 295	Unique Identifier of the BTS sector for the database (The easiest way of providing a UniqueID is to use the line (record) number)
Longitude	utDouble	–180 to 180	Longitude of the position of the BTS
Latitude	utDouble	–90 to 90	Latitude of the position of the BTS
BTS_Name	utFixedChar	–	Name of BTS sector
BCC	utTInt	0 to 7 decimal	BTS Color Code
C0	utSInt	See chapter 8	C0 carrier channel number
C1 to C15	utSInt	See chapter 8	Cn carrier channel number
CI	utLInt	1 to 65535 decimal	Cell Identity
NCC	utTInt	0 to 7 decimal	Network Color Code
CC	utLInt	1 to 65535 decimal	Clock Code
Ant	utLInt	–	Antenna type
Power	utFloat	See chapter 8	EIRP power
MNC	utUSInt	0 to 999	Mobile Network Code
MCC	utUSInt	0 to 999	Mobile Country Code
LAC	utUSInt	1 to 65533 and 65535	Location Area Code
2GNC	utDynChar	–	GSM neighbor cell list for neighborhood analysis (option R&S ROMES-U1). MCC, MNC, LAC, CI for each neighbor cell, a # character separates two cells, e.g. 262,1,1234, 5678#262,1,1234,5679#262,1,1234,5680
3GNC	utDynChar	–	UMTS neighbor cell list for neighborhood analysis (option R&S ROMES-U1). MCC, MNC, LAC, CI for each neighbor cell, a # character separates two cells, e.g. 262,1,1234, 5678#262,1,1234,5679#262,1,1234,5680

The columns MNC through *3GNC* are required for the UMTS neighborhood analysis; see description of the *UMTS Neighborhood Analyzer View* in chapter 4.

			(The easiest way of providing a UniqueID is to use the line (record) number)

The following names may be used for UMTS Node B data bases:

Column Name	Type	Range	Description
UniqueId	utULInt	0 to 4 294 967 295	Unique Identifier of the Node B sector for the database (The easiest way of providing a UniqueID is to use the line (record) number)
PosLongitude	utDouble	–180 to 180	Longitude of the position of the Node B in degrees
PosLatitude	utDouble	–90 to 90	Latitude of the position of the Node B in degrees

NodeB_Name	utDynChar	–	Name of Node B sector
CellID	utULInt	–	Cell Identity
SC	utUSInt	0 to 8176	Scrambling Code. It must be in the range of 0…8176, and SC modulo 16 has to be equal to 0
ARFCN	utUSInt	8 000 to 12 000	Channel Number
IsDirected	utUTInt	0 to 1	1: Antenna is directed 0: Antenna is omni directional
Direction	utUSInt	0 to 360	Direction of the directed antenna in degrees
Power	utDouble	–10 to 100	Power of CPICH in dBm
CellIDNeighborsList	utDynChar	–	Information about the cell identities of the neighbor cells; list of numbers separated by # characters , e.g. 67#861#14558.
MNC	utUSInt	0 to 999	Mobile Network Code
MCC	utUSInt	0 to 999	Mobile Country Code
LAC	utUSInt	1 to 65533 and 65535	Location Area Code
2GNC	utDynChar	–	GSM neighbor cell list for neighborhood analysis (option R&S ROMES-U1). MCC, MNC, LAC, CI for each neighbor cell, a # character separates two cells, e.g. 262,1,1234, 5678#262,1,1234,5679#262,1,1234,5680
3GNC	utDynChar	–	UMTS neighbor cell list for neighborhood analysis (option R&S ROMES-U1). MCC, MNC, LAC, CI for each neighbor cell, a # character separates two cells, e.g. 262,1,1234, 5678#262,1,1234,5679#262,1,1234,5680

In UMTS Node B data bases, the columns *UniqueID* to *Power* are mandatory. Column *CellID-NeighborsList* is optional but is also recognized by the measurement system. If it is provided, ROMES checks for differences between the entries and the real network. Each time that the UMTS test mobile fails to detect the signal from one of the neighbor cells in the list, a *Neighbor List Alarm* is generated. The alarms can be displayed e.g. in the *UMTS Network Analyzer View;* see description in chapter 4.

The columns MNC through *3GNC* are required for the UMTS neighborhood analysis; see description of the *UMTS Neighborhood Analyzer View* in chapter 4.

In general, ROMES is not able to process data in columns with user-defined names other than the ones listed above. The UniqueID parameter is explained in section *Speeding up the File Import below*.

Missing entries

If a value to be entered in the ASCII table file is not available, a question mark *(?)* can be used instead. ROMES interprets question marks as missing entries, the corresponding table cells in the views and dialogs of the application are left empty.

Speeding up the File Import

ROMES has to assign numbers to all lines of the BTS lists every time the list is opened. This time-consuming line numbering can be bypassed by adding the *UniqueID* column to the BTS list. The *UniqueID* entries (e.g. 1, 2, 3, ...) can be added with a tool like MS Excel.

Example for the modification of the ATD file:

Columns12_Name=UniqueID

Columns12_Type=utLInt

Columns12_Size=4

Columns12_boIndexed=1

Columns12_boPrimaryKey=0

Important Note:
All numbers in the UniqueID column must be unique. Any number that is used more than once will cause problems. So it is recommended to use a unique scheme like the line numbers from MS Excel to fill the UniqueID column.

User-Defined List Format

Instead of using the *.txt and *.atd formats described in the previous sections, it is also possible to define new formats for the base station list. To be distinguished from the standard BTS list formats the user-defined list files must have extensions different from *.txt or *.atd. Additionally, a dynamic link library (DLL) with the name "GSS_K6_Import_xxx.dll“ must be written, where "xxx“ is the extension of the format file.

The DLL must contain a class (e.g. "Import“), derived from the following abstract class AsciiImport:

```
class AsciiImport
{
public:
enum NEXT_LINE_STATUS {SECTOR_VALID, SECTOR_INVALID,    END_OF_FILE, SKIP_SECTOR};

 AsciiImport(){};
 virtual ~AsciiImport(){};

 // Open the file "pFilename":
 virtual bool Start(char* pFilename) = 0;

 // load next sector:
 virtual NEXT_LINE_STATUS NextSector(char** ppErrorString) = 0;

 // number of the sector in the Ascii file
 virtual unsigned int* GetSectorNr() = 0;

 virtual char *GetSectorName() = 0;           // Name
 virtual double* GetLongitude() = 0;          // Longitude
 virtual double* GetLatitude() = 0;           // Latitude
 virtual unsigned short* GetBCC() = 0;        // Base station color code
 virtual unsigned short* GetChannelArray(int index) = 0;
                                                // index = 0 points to the C0 carrier
   // index points to TCH index
 virtual unsigned int* GetCI() = 0;           // Cell Identity
 virtual unsigned int* GetNcc() = 0;          // National color code
 virtual unsigned int* GetClockCode() = 0;    // ClockCode
 virtual double* GetPower() = 0;              // EIRP
 virtual unsigned int* GetAntennaType() = 0;  // Antenna type
 virtual double* GetDirection() = 0;          // Direction of the antenna
 virtual unsigned int* GetSyncCode() = 0;     // Synchronisation Identification
```

```
 virtual unsigned short* GetLAC() = 0;   // Location area code
 virtual unsigned short* GetMNC() = 0;   // Mobile network code
 virtual unsigned short* GetMCC() = 0;   // Mobile country code

};
```

(The file is installed in the *Installation* subdirectory of the main directory.)

The function "bool Start(char* pFilename)“ opens the ASCII file. The return value is "true“ if the file could be successfully opened. If the return value is "false“ the program returns to the calling menu.

Each call of the funcion „NEXT_LINE_STATUS NextSector(char** ppErrorString)“ loads the next sector, or the first one if it is called after "Start(char* pFilename)“ has been called. When the return value is "END_OF_FILE“, the DLL is deallocated and the loading of the operator information is considered to be finished.

The return value "SECTOR_INVALID“ is used to indicate an error in loading the sector. An error message is displayed including a message in a character string, to which "ppErrorString“ points. The memory of this character string must be defined and allocated in the DLL and the content of this string can be specified arbitrarily. After that error message the loading of the operator information is stopped and the sectors already loaded are canceled.

The return value “SKIP_SECTOR” can be used to skip a sector if, e.g., the sector contains some invalid data and should not be loaded. However, the program does not stop loading the base station list but reads the next sector instead. A message will be written into the file *CtoI_Reports.txt* stored in the *Test-Files* subdirectory.

The return value SECTOR_VALID implies that the sector has been loaded successfully. In this case there must be access to its data, described in table *Table 7-3*, *BTS List*, on page 7.30 via the remaining functions pointing to them. The name of the sector, as well as its geographical position, BCC and C0 carrier (obtained by the value of GetChannelArray(0)) as well as the sector number are mandatory, the remaining values are for additional information. In case that some of the latter are not included in the sector information, the corresponding access functions must return the NULL pointer. The sector number is necessary for ROMES-GS to monitor possible inconsistencies in the data.

The declaration of exported DLL functions is realized via the file "Import_xxx.def“:

```
LIBRARY IMPORT_xxx.DLL

DESCRIPTION "Reading the operator info of the BTS stations"

EXPORTS

ImportConstruction@1

ImportDestruction@2
```

where xxx has to be replaced by the file extension.

„ImportConstruction“ is a function which takes no arguments. It allocates memory for the class "Import“ and returns a pointer to this memory. "ImportDestruction“ is a function taking a reference to a pointer to "Import“ as an argument and deleting the allocated memory. The return value of this function is of type "void“.

The following example of the corresponding *DLLStart.cpp* is a possible realization of the **.txt* format file:

```
# include "ImportTxt.h"

ImportTxt* ImportConstruction()

{
```

```
 return (new ImportTxt());
}

void ImportDestruction(ImportTxt* & Import)
{
 if(Import != NULL)
  delete Import;
}
```

where "ImportTxt.h" is the header file declaring the class.

C0 Scan Export Files

If a Carrier-to-Interference (C/I) analysis is performed and the C0 analysis is active (see description of C/I driver in chapter 6), then a C0 scan export file (*.cox) file is automatically generated at the end of the measurement. The *.cox file is an ASCII file which can be opened and evaluated with standard tools, e.g. with MS Excel. The entries are separated by semicolons:

Scan;	T1970[Sec	Latitude[	Longitude	ARFCN;	Pow[dBm	NCC;	BCC;	CI;	LAC;	MNC;	MCC;	ST3_Source
1;	105844483	48.763000	11.234000	11;	-106.2;	;	;	;	;	;	;	-
1;	105844483	48.763000	11.234000	12;	-103.8;	;	;	;	;	;	;	-
1;	105844483	48.763000	11.234000	13;	-112.3;	;	;	;	;	;	;	-
1;	105844483	48.763000	11.234000	14;	-107.8;	;	;	;	;	;	;	-
1;	105844483	48.763000	11.234000	16;	-109.6;	;	;	;	;	;	;	-
1;	105844483	48.763000	11.234000	15;	-100.1;	7;	1;	279;	31568;	1;	262;	T-Scan
1;	105844483	48.763000	11.234000	15;	-100.7;	7;	1;	279;	31568;	1;	262;	T-Scan

Each row in the C0 scan export file corresponds to a scanned C0 signal on a specific GSM channel (ARFCN). The rows contain the following information:

Scan	Sequence number for the C0 scan, comprising a sequence of channels selected in the driver menu.
T1970 [Sec]	Time of the channel measurement in s since 1970.
Latitude [deg], Longitude [deg]	Geographic coordinates of the measurement position.
ARFCN, Pow [dBm], Pow [dBm]	Absolute Radio Frequency Channel Number (see tables in chapter 8) of the GSM channel and measured power of the C0 carrier. In the driver menu, channels below a specified power threshold can be excluded from the measurement.
NCC, BCC	Network Color Code and BTS Color Code demodulated from the signal. If the code numbers are not available, the system was not able to identify the signal: The measured power is the total channel power and therefore an upper limit for the actual C0 carrier power.
CI, LAC, MNC, MCC	Cell Identity, Location Area Code, Mobile Network Code and Mobile Country Code. These code number are part of the System Information Type 3; they are either demodulated from the C0 signal (with option *R&S GSM Demodulator)* or determined by comparing the power, BCC and timing of the measured signal with the entries in the BTS data base (see description of the *Measurement Process* in chapter 1). The source of the data is indicated in the last column *(ST3_Source)* of the table.
ST3_Source	Source of the parameters that are part of the System Information Type 3 (CI, LAC, MNC, MCC); see above:

T-Scan
: Parameters demodulated during the scan, with option *R&S GSM Demodulator*

NDB
: Parameters obtained from a comparison with the data in the network data base

–
: Parameters not available

Obtaining Screenshots

ROMES fully supports the *Print* functionality familiar from many other MS Windows applications. The contents of all views can be printed to a file or sent to a printer; an extended selection of print options is available. In addition, all pages can be previewed before they are sent to the printer.

If you still wish to obtain an accurate copy of your application screen, there are two ways to obtain screenshots:

- Copy the whole screen to the clipboard (***<PrtSc>***) or
- Copy the active window to the clipboard (***<Alt> + <PrtSc>***)

Note:
In ROMES, the active window is always the frame application, not the individual views which are so-called child windows.

Now you can switch to another MS Windows application (***<Alt> + <TAB>***), like MS Word or MS Power-Point, and insert the shot via ***<Shift> + <Insert>***. From this application you may also obtain hardcopies. All the screenshots in this documentation have been created this way.

If the *Clipboard viewer* is active, you can save your screenshots from there in the *.CLP format to disk and use it later. Some graphic tools like the shareware Jasc PaintShopPro® are able to load the *.CLP format and convert it into another format.

You may also copy the *.CLP files to another Windows system, start the clipboard viewer and load the file into the other clipboard.

Note:
*If both operating systems differ very much in the graphic card settings (resolution and number of colors used), it might be possible that the target system is not able to deal with the *.CLP files. In this case modify the settings of the target system and try again.*

Evaluation of NQA Data with TS9954 NQA

TS9954 NQA is an evaluation software for NQA data supplied with each *Export to NQA/NQ2* option (ROMES-G1). The software is based on Microsoft® Excel. The NQA data are loaded into an MS Excel folder with several worksheets providing tables and graphical diagrams. The worksheets can be modified using the full MS Excel functionality and stored to files.

Network Quality Analysis

The Network Quality Analysis data (NQA data) are the result of automatically performed telephone calls between the measuring GSM Test Mobile Station (TMS) and a fixed landline partner station. Each call is analyzed and the results are saved to a data file.

For each performed call a data package will be added to the generated NQA data file ("*.NQA", "*.NQ2").

Measurement Parameters

To generate the NQA data file, both *NQA* and *Autodialing* must be enabled in the GSM driver configuration menus. The *NQA* and *Autodialing* tabs of the driver configuration menu provide parameters to define conditions and limits for the different call classes; see detailed information in chapter 6.

The measurement parameters used in the test are indicated in the *Header* MS Excel sheet which is the first sheet displayed when the TS9954 NQA MS Excel table *Nqa-mak.xls* is opened. See section *Header* on p. 7.51 ff.

The NQA Data Package

After the end of each performed call a NQA data package containing the following parameters is generated:

Table 7-5 NQA parameters

Number	NQA parameter	Available in MS Excel sheet DATA*) as	Explanation
1	Time	Time	HH:MM:SS
2	Position Latitude	---	**+** = North / **-** = South
3	Position Longitude	---	**+** = East / **-** = West
4	Class	Class	0 = Good Call 1 = Blocked Call 2 = Dropped Call 3 = No Service 4 = Start_of_Call 5 = *reserved* 6 = Start Of Dialing

Number	NQA parameter	Available in MS Excel sheet DATA*) as	Explanation
5	Status	Status	0x0001 = Noisy 0x0002 = Excess_HO 0x0004 = Roaming 0x0010 = Delayed 0x0020 = RxLev_Noisy (only with *Noisy*) 0x0040 = RxQual_Noisy (only with *Noisy*)
6	Blocking Cause	Bl Cause	Reason for *Blocked Call*
7	AVG PWR	Avg	Average transmitting power
8	RxQual Total	RxQ Total	Number of *RxQual* values
9...16	RxQual distribution	RxQ1...RxQ8	Distribution values of *RxQual*
17	RxLev Total	RxLev Total	Number of *RxLev* values
18...26	RxLev distribution	RxLev1...9	Distribution values of *RxLev*. Coding: 0 = RxLev of [0...10], dBm: <=-100 1 = RxLev of]10...15], dBm:]-100...-95] 2 = RxLev of]15...20], dBm:]-95...-90] 3 = RxLev of]20...25], dBm:]-90...-85] 4 = RxLev of]25...30], dBm:]-85...-80] 5 = RxLev of]30...35], dBm:]-80...-75] 6 = RxLev of]35...45], dBm:]-75...-65] 7 = RxLev of]45...50], dBm:]-65...-60] 8 = RxLev of]50...63], dBm: >-60
27	HO Attempt	HO Attempt	Number of *Handover* attempts
28	HO Success inter	HO Suc inter	Number of successful InterCell Handover attempts
29...36	HO Success distribution	HO Suc d1... ...HO Suc d8	Distribution values
37	HO Success intra	HO Suc intra	Number of successful IntraCell Handover attempts
38	SysResptime	SysResptime	Time between *Service Request* and *Assignment Command* in 1/18 seconds
39	CallResptime	CallResptime	Time between *Service Request* and *Alerting* in 1/18 seconds
40	EffectiveCallDuration	EffCall	Measured Call Duration in 1/18 seconds
41	Initial CI	Initial CI	*Cell Identity* at *Start of Call*
42	Final CI	Final CI	*Cell Identity* at *End of Call*
43	MCC	MCC	Mobile Country Code
44	MNC	MNC	Mobile Network Code
45	Mobile No.	Mobil Nr	Mobile number in the Measurement system

*) See section *DATA Table* on p. 7.64 ff.

Call Class and Status

For each call a *Class* and *Status* value is generated. The meaning of the values is listed in the following code table:

Class	0 = Good Call 1 = Blocked Call 2 = Dropped Call 3 = No Service 4 = Start_of_Call 5 = *reserved* 6 = Start Of Dialing
Status	Bit 0 = Noisy Bit 1 = Excess_HO Bit 2 = Roaming Bit 4 = Delayed Bit 5 = RxLev_Noisy (only with *Noisy*) Bit 6 = RxQual_Noisy (only with *Noisy*)

The *Class* parameter can own only one of the listed states at the same time, while *Status* consists of several bits and may contain any combination of values, with the exception of bit 5 and 6 (only with *Noisy*, bit 0).

The calls can be categorized in terms of the *Class* and the *Status* parameters. The following table shows the most important combinations used by TS9954 NQA. It is also shown as a legend in the description of every worksheet containing class/status combined parameters used in formulas; see section *Worksheets* on p. 7.51 ff.

Class

Status

	Good (0)		**Blocked (1)**	**Dropped (2)**		**No Service (3)**
	CallResp-time >... s	CallResp-time <=...s		CallResp-time >... s	CallResp-time <=...s	
not Noisy 0xXXX**0**	**GR**	**G**	**BC**	**DR**	**D**	**NC**
Noisy 0xXXX**1**	**GRN**	**GN**		**DRN**	**DN**	

Example:

DRN means a *Dropped Call* has been classified as *Noisy* and its *Call Response Time* is beyond a certain limit.

The *Call Class* is the most important NQA parameter of the NQA data. The following classes are defined.

Class = Start of Dialing A NQA data package with *Class* = *Start of Dialing* is generated every time the *Autodialing* function dials a number. The *Idle Time* to be set in the *Autodialing* tab of the driver configuration menu delays the beginning of the dialing relative to the start of the measurement or the last call. After the *Idle Time* a dial sequence is started and a *Start of Dialing* event is generated.

Class = Start of Call A NQA data package with *Class* = *Start of Call* is generated every time dialing is finished and a call is established by the *Autodialing* function.

Class = Good Call

A NQA data package with *Class = Good* is generated every time the successfully started call (ALERTING and/or CONNECT reached) is terminated by the system after the time defined by *Call Duration* in the *Autodialing* tab of the driver configuration menu has passed.

The package is generated after the first of the three messages DISCONNECT, RELEASE or CHANNEL RELEASE.

Class = Blocked Call

Class = Blocked is generated every time that

An idle message was detected during call setup but the call was not canceled. This happens in all cases where a call setup was performed at least up to the layer-3 message SERVICE REQUEST, but not up to ALERTING / CONNECT, and where no DISCONNECT, RELEASE or CHANNEL RELEASE was executed or....

The call was canceled, call setup was not performed up to ALERTING and/or CONNECT or...

A dial command has been sent to the mobile, but because of insufficient coverage no call could be established: The NQA machine remains IDLE. On the next dialing the system recognizes that no call could be established and one *Blocked call* is added.

Class = Dropped Call

Class = Dropped is generated every time that

An established call is cancelled before the *Call duration* set in the *Autodialing* tab has passed or...

An established call is terminated not to order. A NQA data package will be generated when an *Idle or Error (No Service)* state is detected after a call was completely established and the *Call Duration* has not passed yet.

Class = No Service

Class = No Service is generated every time the system wants to dial but the mobile is out of service.

If the mobile remains out of service the time interval between two subsequent *No service* calls is equal to the *Call duration* plus the *Idle time*, both set in the *Autodialing* tab.

Installation and Use of the NQA Software

The Network Quality Analysis software TS9954 NQA is an MS Excel application. All functions and formula have been developed using this product. TS9954 is available in different versions that are compatible with different MS Excel versions:

- TS9954 NQA version V2.1 for MS Excel V5.0 or higher
- TS9954 NQA version V3.0x for MS Excel V8.0 or higher

The version number of the software is displayed in the upper left corner of the *Header* sheet; see section *Header* on p. 7.51 f. The application files of both versions and the used file formats are listed in the following table.

Table 7-6 Comparison of TS9954 NQA V2.1 and V3.0x

	TS9954 NQA V2.1	**TS9954 NQA V3.0x**
Required MS Excel Version	V5.0 or higher	V8.0 or higher
Operating system	Windows 3.1 (16-bit application)	Newer Windows systems (32-bit application)
Data file formats	*.NQA, see p. 7.21	*.NQA, *, NQ2 (recommended), see p. 7.21
Max. number of mobiles	3	16
Application files	**NQA-MAK.XLS** Application startup file, containing basic settings and program functions. This file is hidden in MS Excel but can be unhidden and edited; see section *Special Functions* on p. 7.63 ff. **MOB1-NQA.XLT** MS Excel sheet with all charts and parameter tables for the evaluation of the mobile 1 data. **MOB2-NQA.XLT** MS Excel sheet with all charts and parameter tables for the evaluation of the mobile 2 data. **MOB3-NQA.XLT** MS Excel sheet with all charts and parameter tables for the evaluation of the mobile 3 data.	**NQA-MAK.XLS** Application startup file, containing basic settings and program functions, including the settings for language and logo. This file is hidden in MS Excel but can be unhidden and edited; see section *Special Functions* on p. 7.63 ff. **MOB-NQA.XLT** MS Excel template with all charts and parameter tables for the evaluation of all mobile data. This template is multiplied according to the number of mobiles included in the loaded measurement data.

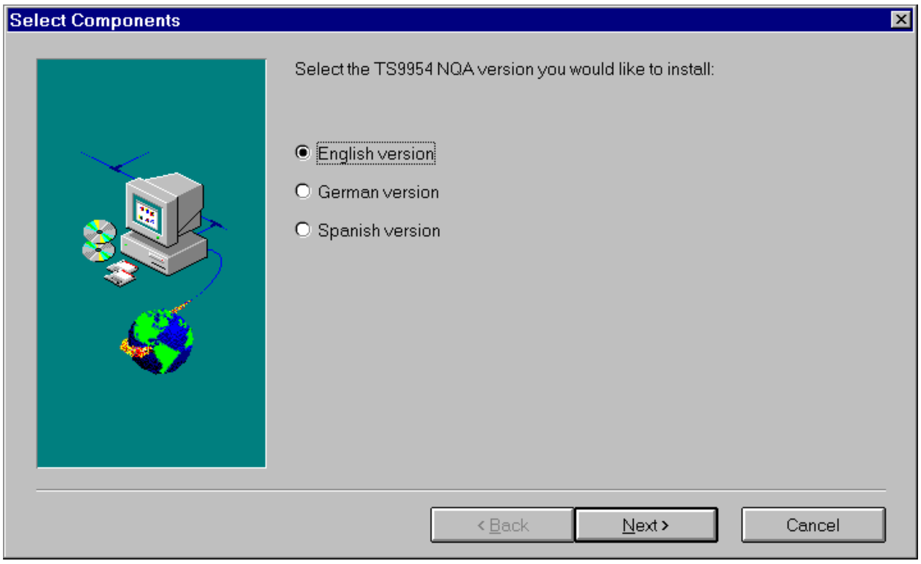
Note:
Unless otherwise stated the information given in the following sections holds for TS9954 NQA V3.0x. However, it is also valid for TS9954 NQA V2.1 with minor modifications. In particular, all worksheets provided are identical in both versions.

Installing the Software

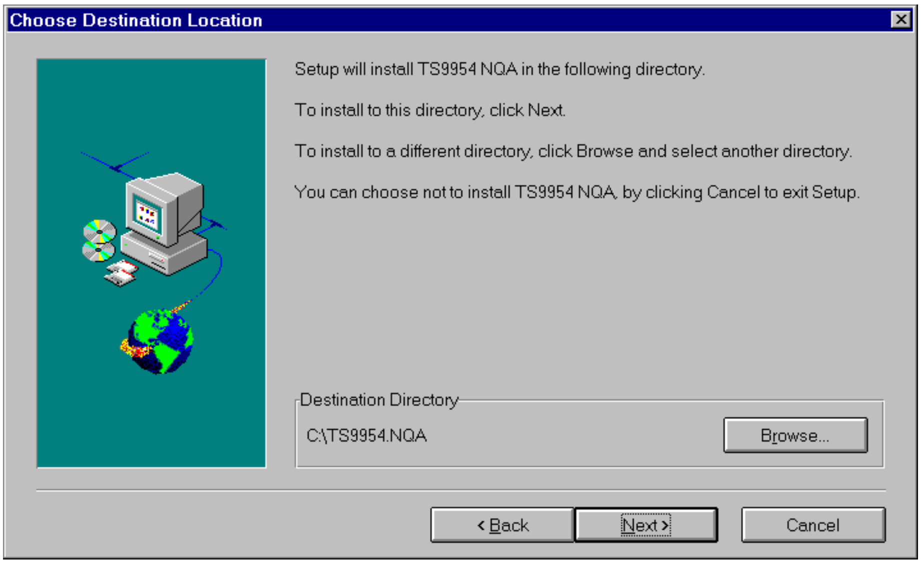
Installation of TS9954 NQA is menu-guided. We point out the essential steps.

1. Copy the installation version into a directory and run the setup file *Setup.exe* (double-click or use the *Run* command in the Windows *Start* menu).

The setup program opens a blue *Setup* screen and a dialog to select the preferred language:



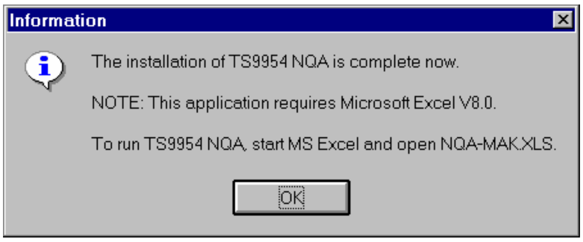
2. Click one of the three radio buttons to select your language and click *Next* > to continue.



The language can still be changed after the software is installed; see section *Language and Logo* on p. 7.64 ff.

3. In the *Choose Destination Location* dialog, use the *Browse* button to select a directory for the application files NQA-MAK.XLS and MOB-NQA.XLT.
4. Click *Next* > to continue and finish the setup procedure.

The application displays the following message box:



5. Click OK to confirm the message and close the *Setup* screen.

Note:
All application files have to remain in the same directory and are necessary part of the application. Missing or renamed files will cause an error message File ... not found.

Starting and Operating TS9954 NQA

The installed application is simply started by loading the application file NQA-MAK.XLS into the appropriate MS Excel version. Doing this opens a dialog to select the NQA data file (*.NQA or *.NQ2; see *Table 7-6* on p. 7.47) to be analyzed. The NQA data file can be located in any directory of any drive accessible from the PC.

Loading the data can take some time, during which the current status is shown in the bottom line. Irrespective of the number of data files to be viewed and the number of mobiles included in each data file, the file NQA-MAK.XLS has to be loaded only once. It provides all necessary functions for the current MS Excel session.

NQA-MAK.XLS generates a separate MS Excel folder for every mobile analyzed. The folders are divided into several individual worksheets; see section *Worksheets* on p. 7.51 ff. The worksheets can be modified and extended using the full MS Excel functionality; for information refer to the MS Excel help system. To facilitate data handling and switchover between different folders the application adds some functionality to MS Excel:

File – Read NQA Data ... In the *File* menu, the additional command *Read NQA Data* is added. This command calls up an *Open NQA Data File* dialog to select and open a new NQA data file .

Loading a new NQA data file initiates a new evaluation, independent from the previous ones. MS Excel creates a new folder for each mobile in the new data file and numbers the folders in ascending order.

Window – MOBn-NAQm The *Windows* menu contains a list of all current folders. The names of the folders *MOBn-NAWm* are automatically generated when a NQA data file is opened:

n numbers the mobiles within a data file, starting with 1 (n ≤ 16).

m numbers the folders in order of their creation.

Two folders can have the same mobile number n but always differ by their folder number m. Selecting a folder activates it and displays either the worksheet that was active last time when the folder was opened or the (default) *Header* worksheet.

Saving Folders A folder can be saved to an MS Excel file using the *Save* or *Save As...* commands in the *File* menu. The default folder file name is NQA-MAK.XLS for software version 2.1 (see warning below) and MOB-NQAm.XLS (where m numbers the folders generated in a session) for software version 3.0x. Saved folder files can be reused and modified.

Caution!

Be sure not to overwrite the application files when saving your evaluated NQA charts ! In software V2.1, the default file name for saving a folder is identical with the name of the startup file NQA-MAK.XLS.

It is therefore recommended to keep a backup of the application files before starting the software for the first time.

The default values for the chart entries can be modified after unhiding NQA-MAK.XLS, which is hidden by default; see section *Special Functions* on p. 7.63 ff. The folder files are not write-protected and can be modified.

Worksheets

In software version V3.0x, NQA-MAK.XLS generates a separate MS Excel folder for every mobile analyzed; see section *Starting and Operating TS9954 NQA* on p. 7.49 ff. The folder is divided into several individual worksheets. The worksheets can be activated by clicking the tabs across the bottom of the MS Excel main application window:

The *Header* worksheet is opened by default. All worksheets contain the data for one mobile.

In software 2.1 one folder for up to three mobiles is created. The *Header* sheet describes all mobiles ; the other worksheets are mobile-specific. Besides, the contents and use of the worksheets does not depend on the software version.

Note:
Many of the worksheets contain pie charts or bar charts to visualize the distribution of a quantity. Clicking a point inside a diagram opens dialog boxes to customize the diagram or one of its elements. For more information refer to the MS Excel What's this...? help.

Header

This sheet contains general information about the measurement tour, the mobile used and the NQA settings:

C:\TS9954\DD2MU3.DIR\MEASDATA\DD2MU302.NQA		*NQA data filename*
03/18/02		*Date*
14:09:06		*Time*
DEMOCASE		*Operator*
		Comment line 1
		Comment line 2
		Comment line 3
		Comment line 4
	Mobile 1	
Name:	AEG9020_104	*Mobile Name*
FW Version:	2.00	*Mobile Firmware Vers.*
Mobile Configuration:	GSM	*Net type*
MCC:	262	*Mobile Country Code* (Three-digit number, e.g. 262 for Germany)

MNC:	01	*Mobile Network Code ((Two-digit number, e.g. 01 = D1 Net (GSM 900), 02 = D2 Net (GSM 900), 03 = E Net (DCS 1800) in Germany))*
Call Delay [sec]:	10	
Call Duration [sec]:	10	*(*Parameter set in the *Autodialing* tab of the driver configuration menu)
HO Maxcnt:	2	*(*Parameter set in the *NQA* tab of the driver configuration menu)
Call Delay Limit [sec]:	10	(Identical with the *Blocked Call Delay* parameter set in the *NQA* tab of the driver configuration menu)
RxLev Threshold:	20	... ***Error! Bookmark not defined.***
RxLev Exceed:	50	... ***Error! Bookmark not defined.***
RxQual Threshold:	5	... ***Error! Bookmark not defined.***
RxQual Exceed:	50	... ***Error! Bookmark not defined.***

Call Statistics

This sheet displays the number of calls for each call class and the relative frequency of call classes:

Good	Blocked	Dropped	No Service
58,8%	2,0%	39,2%	0,0%
117	4	78	0

+ Pie chart showing the relative frequency of call classes.

Column	Row	Meaning	Formula (see legend below)
Good	abs	Number of calls with Class = Good (0)	G+GR+GN+GRN
Blocked	abs	Number of calls with Class = Blocked (1)	BC
Dropped	abs	Number of calls with Class = Dropped (2)	D+DR+DN+DRN
No Service	abs	Number of calls with Class = No Service (3)	NC
Good	rel	Ratio of Good calls to Sum of all calls	(G+GR+GN+GRN) / all calls
Blocked	rel	Ratio of Blocked calls to Sum of all calls	BC / all calls
Dropped	rel	Ratio of Dropped calls to Sum of all calls	(D+DR+DN+DRN) / all calls
No Service	rel	Ratio of NoService calls to Sum of all calls	NC / all calls

Status \ Class	Good (0)		Blocked (1)	Dropped (2)		No Service (3)
	CallResp-time >... s	CallResp-time <=...s		CallResp-time >... s	CallResp-time <=...s	
not Noisy 0xXXX0	GR	G	BC	DR	D	NC
Noisy 0xXXX1	GRN	GN		DRN	DN	

RxQual

This sheet displays information about the distribution of RxQual values measured by the mobile phone and transferred to the test system. In GSM networks the mobile provides a new RxQual value about every 480 ms.

RxQual	0	1	2	3	4	5	6	7
relative	68,9%	4,8%	3,7%	4,4%	4,4%	3,4%	1,7%	9,0%
absolute	4352	302	231	275	275	214	105	566

+ Bar chart showing the relative frequency of all RxQual values.

Column	Row	Meaning
RxQual 0	abs	Number of RxQual = 0 values
RxQual 1	abs	Number of RxQual = 1 values
RxQual 2	abs	Number of RxQual = 2 values
RxQual 3	abs	Number of RxQual = 3 values
RxQual 4	abs	Number of RxQual = 4 values
RxQual 5	abs	Number of RxQual = 5 values
RxQual 6	abs	Number of RxQual = 6 values
RxQual 7	abs	Number of RxQual = 7 values
RxQual 0	rel	Ratio of RxQual = 0 values to total number of recorded RxQual values
RxQual 1	rel	Ratio of RxQual = 1 values to total number of recorded RxQual values
RxQual 2	rel	Ratio of RxQual = 2 values to total number of recorded RxQual values
RxQual 3	rel	Ratio of RxQual = 3 values to total number of recorded RxQual values
RxQual 4	rel	Ratio of RxQual = 4 values to total number of recorded RxQual values
RxQual 5	rel	Ratio of RxQual = 5 values to total number of recorded RxQual values
RxQual 6	rel	Ratio of RxQual = 6 values to total number of recorded RxQual values
RxQual 7	rel	Ratio of RxQual = 7 values to total number of recorded RxQual values

RxQual (Range)

This sheet contains information about the distribution of RxQual values in different ranges of the RxQual scale (ranging from 0 to 7). In GSM networks the mobile provides a new RxQual value about every 480 ms. The three default RxQual ranges are 0 to 3, 4, and 5 to 7.

RxQual	0 to 3	4	5 to 7					
relative	81,6%	4,4%	14,0%					
absolute	5160	275	885					

+ Pie chart showing the relative frequency of RxQual values in the current ranges.

Up to 8 ranges can be defined in the table below the pie chart. Overwriting a number in the white cells changes the results in the upper table and the pie chart. Clicking the *Default* cell restores the default ranges. These ranges are stored in the NQA-MAK.XLS file; see section *Special Functions* on p. 7.63 ff.

Default	B1	B2	B3	B4	B5	B6	B7	B8
from	0	4	5					
to	3	4	7					

Column	**Row**	**Meaning**
RxQual 0...3	abs	Number of RxQual = 0...3
RxQual 4	abs	Number of RxQual = 4
RxQual 5...7	abs	Number of RxQual = 5...7
...	...	...
RxQual 0...3	rel	Ratio of RxQual = 0...3 values to total number of recorded RxQual values
RxQual 4	rel	Ratio of RxQual = 4 values to total number of recorded RxQual values
RxQual 5...7	rel	Ratio of RxQual = 5...7 values to total number of recorded RxQual values
...	...	...

RxLev

This sheet contains information about the distribution of RxLev values in different ranges of the RxLev scale (ranging from 0 to 63). In GSM networks the mobile provides a new RxLev value about every 480 ms.

+ Bar chart showing the relative frequency of all RxLev values in the current ranges.

RxLev / dBm	<=-100	]-100...-95]	]-95...-90]	]-90...-85]	]-85...-80]	]-80...-75]	]-75...-65]	]-65...-60]	>-60
relative	0,3%	1,7%	3,4%	5,4%	9,9%	14,2%	31,0%	15,5%	18,7%
absolute	18	113	218	350	643	920	2011	1007	1211

Column	Row	Meaning
<=-100	abs	Number of RxLev = 0
]-100...-95]	abs	Number of RxLev = 1
] -95...-90]	abs	Number of RxLev = 2
] -90...-85]	abs	Number of RxLev = 3
] -85...-80]	abs	Number of RxLev = 4
] -80...-75]	abs	Number of RxLev = 5
] -75...-65]	abs	Number of RxLev = 6
] -65...-60]	abs	Number of RxLev = 7
>-60	abs	Number of RxLev = 8
<=-100	rel	Ratio of RxLev = 0 values to total number of recorded RxLev values
]-100...-95]	rel	Ratio of RxLev = 1 values to total number of recorded RxLev values
] -95...-90]	rel	Ratio of RxLev = 2 values to total number of recorded RxLev values
] -90...-85]	rel	Ratio of RxLev = 3 values to total number of recorded RxLev values
] -85...-80]	rel	Ratio of RxLev = 4 values to total number of recorded RxLev values
] -80...-75]	rel	Ratio of RxLev = 5 values to total number of recorded RxLev values
] -75...-65]	rel	Ratio of RxLev = 6 values to total number of recorded RxLev values
] -65...-60]	rel	Ratio of RxLev = 7 values to total number of recorded RxLev values
>-60	rel	Ratio of RxLev = 8 values to total number of recorded RxLev values

PWR-Time

This sheet contains information about the average transmitter output power of the mobile and the system times.

	Avg-PWR	Avg-PWR [dBm]	Mobile Configuration
Min	6	18	GSM1800
Max	0	30	
Avg	1,59		
Std. dev.	1,81		

	SysResptime	CallResptime	EffectiveCallDuration
Min	4,83	6,56	3,11
Max	8,83	11,22	15,22
Avg	5,71	7,69	10,47
Std. dev.	0,39	0,47	1,48

Column	Row	Meaning
Avg-PWR (The average transmitter output power Avg-PWR is expressed in Power Control Level (PCL) units; see PCL tables in chapter 8.)	Min	Maximum of the average PWR values of all Good (0) or Dropped (2) calls
	Max	Minimum of the average PWR values of all Good (0) or Dropped (2) calls
	Avg	Average of the average PWR values of all Good (0) or Dropped (2) calls
	Std. dev.	Standard deviation of the average PWR values of all Good (0) or Dropped (2) calls

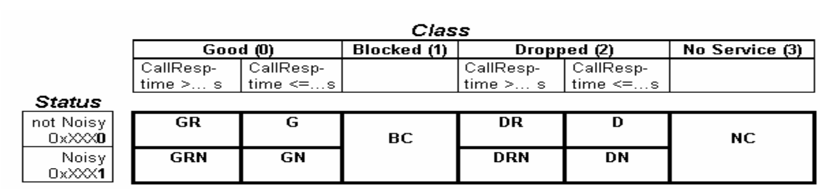
Column	Row	Meaning
Avg-PWR [dBm] (The average transmitter output power Avg-PWR [dBm] is derived from the PCLs (Avg-PWR) as follows: GSM900: Avg-PWR [dBm] = 43 - 2* Avg-PWR GSM1800/1900: Avg-PWR [dBm] = 30 - 2* Avg-PWR)	Min	Maximum of the average PWR values of all Good (0) or Dropped (2) calls in [dBm]
	Max	Minimum of the average PWR values of all Good (0) or Dropped (2) calls in [dBm]
Mobile Configuration		Taken from *Header* sheet : *Mobile Configuration* of the actual mobile
SysResptime (Calculation: SysResptime [sec] = System response time / 18)	Min	Minimum SysResptime of all Good (0) or Dropped (2) calls
	Max	Maximum SysResptime of all Good (0) or Dropped (2) calls
	Avg	Average SysResptime of all Good (0) or Dropped (2) calls
	Std. dev.	Standard deviation of the SysResptime of all Good (0) or Dropped (2) calls
CallResptime (Calculation: CallResptime [sec] = Call response time / 18)	Min	Minimum CallResptime of all Good (0) or Dropped (2) calls
	Max	Maximum CallResptime of all Good (0) or Dropped (2) calls
	Avg	Average CallResptime of all Good (0) or Dropped (2) calls
	Std. dev.	Standard deviation of the CallResptime of all Good (0) or Dropped (2) calls
EffectiveCallDuration (Calculation: EffectiveCallDuration [sec] = Effective call duration / 18)	Min	Minimum EffectiveCallDuration of all Good (0) or Dropped (2) calls
	Max	Maximum EffectiveCallDuration of all Good (0) or Dropped (2) calls
	Avg	Average EffectiveCallDuration of all Good (0) or Dropped (2) calls
	Std. dev.	Standard deviation of the EffectiveCallDuration of all Good (0) or Dropped (2) calls

HO Info

This sheet contains a statistical evaluation of all recorded handover attempts and handovers.

	absolute	relative	relative
Sum of Calls	195		
Sum of HO trials	111	100%	
Successful HOs	111	100%	100%
InterCell	75		68%
IntraCell	36		32%
Trials/Call Min	0		
Trials/Call Max	2		
Trials/Call Avg	0,57		

Column	Row	Meaning	Formula (see legend below)
abs	Sum of calls	Number of Good (0) or Dropped (2) calls	G+GR+GN+GRN+D+DR+DN+DRN
abs	Sum of HO trials	Total number of handover attempts in all Good (0) or Dropped (2) calls	
abs	Successful HOs	Total number of all InterCell and IntraCell handovers in all Good (0) or Dropped (2) calls	
abs	InterCell	Total number of all successful Intercell handovers in all Good (0) or Dropped (2) calls	
abs	IntraCell	Total number of all successful Intracell handovers in all Good (0) or Dropped (2) calls	
abs	Trials/Call Min	Minimum Number of handover attempts during a Call in all Good (0) or Dropped (2) calls	
abs	Trials/Call Max	Maximum Number of handover attempts during a Call in all Good (0) or Dropped (2) calls	
abs	Trials/Call Avg	Ratio of Sum of HO trials to Sum of calls	
rel	Sum of HO trials	100 %	
rel	Successful HOs	Ratio of Successful HOs to HO attempts	
rel	Successful HOs	100 %	
rel	InterCell	Ratio of InterCell HOs to successful HOs	
rel	IntraCell	Ratio of IntraCell HOs to successful HOs	



SysResptime

This sheet contains information about the distribution of the System Response Time values :

t/s	[0...2[	[2...4[	[4...6[	[6...8[	[8...10[	[10...12[	[12...14[	[14...16[	[16...18[	[18...
relative	0,0%	0,0%	83,1%	16,4%	0,5%	0,0%	0,0%	0,0%	0,0%	0,0%
absolute	0	0	162	32	1	0	0	0	0	0

+ Bar chart showing the relative number of calls with a System Response Time in the defined ranges.

The ranges can be defined in the table below the bar chart. Overwriting a number in the white cells changes the results in the upper table and the pie chart. Clicking the *Default* cell restores the default ranges. These ranges are stored in the NQA-MAK.XLS file; see section *Special Functions* on p. 7.63 ff.

Column	Row	Meaning
[0...2 [	abs	Number of calls with SysResptime/18 in the range 0 ... 2 in all Good (0) or Dropped (2) calls
[2...4 [	abs	...
[4...6 [	abs	...
[6...8 [	abs	...
[8...10 [	abs	...
[10...12 [	abs	...
[12...14 [	abs	...
[14...16 [	abs	...

[16...18 [	abs	...
[18...	abs	...
[0...2 [	rel	Ratio: Number of calls with SysResptime/18 in the range of 0 ... 2 divided by the Sum of all Good (0) or Dropped (2) calls
[2...4 [	rel	...
[4...6 [	rel	...
[6...8 [	rel	...
[8...10 [	rel	...
[10...12 [	rel	...
[12...14 [	rel	...
[14...16 [	rel	...
[16...18 [	rel	...
[18...	rel	...

Call Resptime

This sheet contains information about the distribution of the Call Response Time values :

t/s	[0...2[	[2...4[	[4...6[	[6...8[	[8...10[	[10...12[	[12...14[	[14...16[	[16...18[	[18...
relative	0,0%	0,0%	0,0%	78,3%	21,2%	0,5%	0,0%	0,0%	0,0%	0,0%
absolute	0	0	0	159	43	1	0	0	0	0

+ Bar chart showing the relative number of calls with a Call Response Time in the defined ranges.

The ranges can be defined in the table below the bar chart. Overwriting a number in the white cells changes the results in the upper table and the pie chart. Clicking the *Default* cell restores the default ranges. These ranges are stored in the NQA-MAK.XLS file; see section *Special Functions* on p. 7.63 ff.

Column	Row	Meaning
[0...2 [	abs	Number of calls with CallResptime/18 in the range 0 ... 2 in all Good (0) or Dropped (2) calls
[2...4 [	abs	...
[4...6 [	abs	...
[6...8 [	abs	...
[8...10 [	abs	...
[10...12 [	abs	...
[12...14 [	abs	...
[14...16 [	abs	...
[16...18 [	abs	...
[18...	abs	...
[0...2 [	rel	Ratio: Number of calls with CallResptime/18 in the range of 0 ... 2 divided by the Sum of all Good (0) or Dropped (2) calls
[2...4 [	rel	...
[4...6 [	rel	...
[6...8 [	rel	...
[8...10 [	rel	...
[10...12 [	rel	...
[12...14 [	rel	...
[14...16 [	rel	...
[16...18 [	rel	...
[18...	rel	...

Noisy

This sheet gives information about the *Noisy* calls:

	absolute	relative
Total Calls	213	100%
Noisy Calls	8	3,8%
Noisy RxLev	8	3,8%
Noisy RxQual	2	0,9%

Column	Row	Meaning	Formula (see legend below)
abs	Total Calls	Number of Good (0) or Dropped (2) calls	G+GR+GN+GRN + D+DR+DN+DRN
abs	Noisy Calls	Number of Noisy calls among the Good (0) or Dropped (2) calls	GN+GRN +DN+DRN
abs	Noisy RxLev	Number of RxLev Noisy calls among the Good (0) or Dropped (2) calls	Subset RxLev Noisy of (GN+GRN +DN+DRN)
abs	Noisy RxQual	Number of RxQual Noisy calls among the Good (0) or Dropped (2) calls	Subset RxQual Noisy of (GN+GRN +DN+DRN)
rel	Total Calls	100 %	100 %
rel	Noisy Calls	Ratio of Number of Noisy calls among all Good (0) or Dropped (2) calls to Sum of all Good (0) or Dropped (2) calls	(GN+GRN +DN+DRN) / (G+GR+GN+GRN + D+DR+DN+DRN)
rel	Noisy RxLev	Ratio of Number of RxLev Noisy calls among all Good (0) or Dropped (2) calls to Sum of all Good (0) or Dropped (2) calls	(Subset RxLev Noisy of (GN+GRN +DN+DRN)) / (G+GR+GN+GRN + D+DR+DN+DRN)
rel	Noisy RxQual	Ratio of Number of RxQual Noisy calls among all Good (0) or Dropped (2) calls to Sum of all Good (0) or Dropped (2) calls	(Subset RxQual Noisy of (GN+GRN +DN+DRN)) / (G+GR+GN+GRN+ D+DR+DN+DRN)

	Class					
	Good (0)		Blocked (1)	Dropped (2)		No Service (3)
Status	CallResp-time >... s	CallResp-time <=...s		CallResp-time >... s	CallResp-time <=...s	
not Noisy 0xXXX0	GR	G	BC	DR	D	NC
Noisy 0xXXX1	GRN	GN		DRN	DN	

SucRate

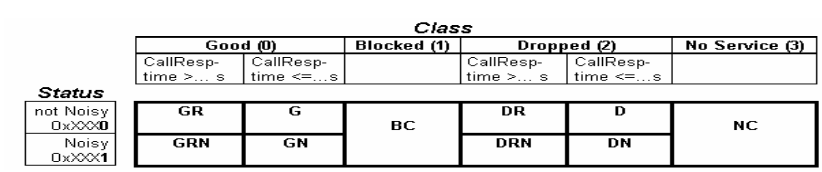
This sheet contains information about the Success Rate, i.e. the absolute and relative frequency of the different call classes. In contrast to the *SucRate 100%* (see p. 7.60) the SucRate is not normalized. A call may contribute to more than one call class, so the sum of Good, Dropped, Blocked, No Service and Noisy calls may exceed the total number of calls. In particular, the Noisy calls contribute to the Good as well as to the Dropped calls.

	absolute	relative
Total Calls	217	100%
Good	213	98,2%
Dropped	0	0,0%

Blocked	4	1,8%
No Service	0	0,0%
Noisy	8	3,7%

+ Bar chart showing the relative frequencies of Good, Dropped, Blocked, No Service, and Noisy calls.

Column	Row	Meaning	Formula (see legend below)
Abs	Total Calls	Sum of all Good (0), Dropped (2), Blocked (1) and No Service (3) calls, including the Noisy calls among the Good (0) or Dropped (2) calls	G+GR+GN+GRN+ D+DR+DN+DRN+ +BC+NC
Abs	Good Calls	Number of Good (0) calls	G+GR+GN+GRN
Abs	Dropped	Number of Dropped (2) calls	D+DR+DN+DRN
Abs	Blocked Calls	Number of Blocked (1) calls	BC
Abs	No Service	Number of No Service (3) calls	NC
Abs	Noisy	Number of Noisy calls among the Good (0) or Dropped (2) calls	GN+GRN+DN+DRN
rel	Total Calls	100 %	100 %
rel	Good Calls	Ratio of Good (0) Calls to Total Calls	(G+GR+GN+GRN)/ (G+GR+GN+GRN+ D+DR+DN+DRN+ BC+NC)
rel	Dropped	Ratio of Dropped (2) Calls to Total Calls	(D+DR+DN+DRN) / (G+GR+GN +GRN+ D+DR+DN+DRN+BC+NC)
rel	Blocked Calls	Ratio of Blocked (1) Calls to Total Calls	BC / (G+GR+GN+GRN+ D+DR+DN+DRN + BC+NC)
rel	No Service	Ratio of No Service (3) Calls to Total Calls	NC / (G+GR+GN+GRN + D+DR+DN+DRN+BC+NC)
rel	Noisy	Ratio of Noisy calls among the Good (0) or Dropped (2) Calls to Total Calls	(GN+GRN+DN+DRN) / (G+GR+GN+GRN+ D+DR+DN+DRN+BC+NC)



SucRate 100%

This sheet contains information about the normalized Success Rate. In contrast to the *SucRate* (see p. 7.59) the SucRate 100% is normalized in such a way that the sum of Good, Dropped, Blocked, No Service and Noisy calls plus the Good calls exceeding a definite Call Response Time is equal to the total number of calls. The Noisy calls and the calls exceeding a definite Call Response Time are not included in the Good calls.

Default	absolute	relative
Total Calls	217	100%

No Service		0	0,0%
Blocked		4	1,8%
Dropped		0	0,0%
CallResptime	>15s	0	0,0%
Noisy		8	3,7%
Good		205	94,5%

The CallResptime (Call Response Time) parameter can either be changed via keyboard or by clicking the *Default* button, which inserts the default value taken from the application file NQA-MAK.XLS; see section *Special Functions* on p. 7.63 ff.

+ Bar chart showing the relative frequencies of Total (100%), No Service, Blocked, CallRespTime, Noisy, and Good Calls.

Column	Row	Meaning	Formula (see legend below)
abs	Total Calls	Sum of all Good (0), Dropped (2), Blocked (1) and No Service (3) calls	G+GR+ GN+GRN+ D+DR+ DN+DRN+ BC+NC
abs	No Service	Number of No Service (3) calls	NC
abs	Blocked Calls	Number of Blocked (1) calls	BC
abs	Dropped	Number of Dropped (2) calls	D+DR+DN+DRN
abs	CallResptime > 15 s	Number of Good (0) calls with Call Response time exceeding the selected value	GR+GRN
abs	Noisy	Number of Good (0) calls with Call Response time below the selected value that are also Noisy	GN
abs	Good Calls	Number of Good (0) calls with Call Response time below the selected value that are not Noisy	G
rel	Total Calls	100 %	100 %
rel	No Service	Ratio: Number of No Service (3) calls divided by the Sum of all Good (0), Dropped (2), Blocked (1) and No Service (3) calls plus the Noisy calls among the Good (0) or Dropped (2) calls	NC / (G+GR+GN+GRN+ D+DR+DN+DRN+ BC+NC)
rel	Blocked Calls	Ratio: Number of Blocked (1) calls divided by the Sum of all Good (0), Dropped (2), Blocked (1) and No Service (3) calls plus the Noisy calls among the Good (0) or Dropped (2) calls	BC / (G+GR+GN +GRN+ D+DR+DN+DRN+ BC+NC)
rel	Dropped	Ratio: Number of Dropped (2) calls divided by the Sum of all Good (0), Dropped (2), Blocked (1) and No Service (3) calls plus the Noisy calls among the Good (0) or Dropped (2) calls	(D+DR+DN+DRN) / (G+GR+GN+GRN+ D+DR+DN+DRN+ BC+NC)
rel	Call Response Time > 10 s [1)]	Ratio: Number of Good (0) calls with Call Response time exceeding the selected value divided by the Sum of all Good (0), Dropped (2), Blocked (1) and No Service (3) calls plus the Noisy calls among the Good (0) or Dropped (2) calls	(GR+GRN) / (G+GR+GN+GRN + D+DR+DN+DRN+ BC+NC)
rel	Noisy	Ratio: Number of Good (0) calls with Call Response time below the selected value that are also Noisy, divided by the Sum of all Good (0), Dropped (2), Blocked (1) and No Service (3) calls plus the Noisy calls among the Good (0) or Dropped (2) calls	GN / (G+GR+GN+GRN+ D+DR+DN+DRN+ BC+NC)
rel	Good Calls	Ratio: Number of Good (0) calls with Call Response time below the selected value that are not Noisy, divided by the Sum of all Good (0), Dropped (2), Blocked (1) and No Service (3) calls plus the Noisy calls among the Good (0) or Dropped (2) calls	G / (G+GR+GN+GRN+ D+DR+DN+DRN+ BC+NC)

Status	Class: Good (0)		Blocked (1)	Dropped (2)		No Service (3)
	CallResp-time >... s	CallResp-time <=...s		CallResp-time >... s	CallResp-time <=...s	
not Noisy 0xXXX0	GR	G	BC	DR	D	NC
Noisy 0xXXX1	GRN	GN	BC	DRN	DN	NC

Each call is assigned exclusively to one single type of call. As some calls can possibly be assigned to more than one class, priorities must be assigned to the classes :

Priority	Call type	Formula
6	No Service	NC
5	Blocked	BC
4	Dropped	D+DR+DN+DRN
3	Call Response Time > 10 s	GR+GRN
2	Noisy	GN
1	Good	G

6 is the top priority, 1 is the lowest priority. Therefore, if a call is Dropped and Noisy at the same time, it will be classified as a *Dropped* call.

SucRate (switch.)

This sheet defines and evaluates a Success Rate with selectable contributions. The sheet provides switches to select the calls that are classified as successful calls.

Call Trials	Call SucRate
100%	100.0%

Filter	Dropped	Blocked	Noisy	No Service	Call Resp. Time	Syst. Resp. Time	
On/Off	Off	Off	Off	Off	Off (>10s)	Off (>10s)	
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**← Switch**

+ Bar chart showing the percentage of call trials and the user-defined Call Success Rate.

The parameter list for setting the switches S1 to S6 and the Response Times is located directly underneath the bar chart. The *Default* button assigns the default values taken from the *Default* sheet in NQA-MAK.XLS; see section *Special Functions* on p. 7.63 ff.

Column	Meaning	Formula (see legend below)
Call Trials = All Calls	Sum of the Good (0), Dropped (2), Blocked (1) and No Service (3) calls.	G+GR+GN+GRN+D+ DR+DN+DRN+BC+NC
Call Success Rate	Depending on the switch position, the single types of calls are subtracted from the total number of Call Trials.	See below

$$\text{Call Success Rate} = \frac{\text{All Calls} - \sum_{\textit{All Calls}} \text{Flag}}{\text{All Calls}}$$

The Call Success Rate is a number between 0% and 100%. The *Flag* is calculated for every single call according to the following formula:

Flag = (S1 ∩ Dropped) ∪ (S2 ∩ Blocked) ∪ (S3 ∩ Good ∩ Noisy) ∪
(S3 ∩ Dropped ∩ Noisy) ∪ (S4 ∩ No Service) ∪
(S5 ∩ Good ∩ Call Response Time > selected value) ∪
(S5 ∩ Dropped ∩ Call Response Time > selected value) ∪
(S6 ∩ Good ∩ System Response Time > selected value) ∪
(S6 ∩ Dropped ∩ System Response Time > selected value)

S1 to S6 are switches, to be set independently in the parameter list to either ON (1) or OFF (0). ∩ denotes an "AND" combination, ∪ denotes an "OR" combination.

<table>
<tr><th></th><th colspan="6">Class</th></tr>
<tr><th></th><th colspan="2">Good (0)</th><th>Blocked (1)</th><th colspan="2">Dropped (2)</th><th>No Service (3)</th></tr>
<tr><th>Status</th><th>CallResp-time >... s</th><th>CallResp-time <=...s</th><th></th><th>CallResp-time >... s</th><th>CallResp-time <=...s</th><th></th></tr>
<tr><td>not Noisy 0xXXX0</td><td>GR</td><td>G</td><td rowspan="2">BC</td><td>DR</td><td>D</td><td rowspan="2">NC</td></tr>
<tr><td>Noisy 0xXXX1</td><td>GRN</td><td>GN</td><td>DRN</td><td>DN</td></tr>
</table>

Examples: In the default setting where all switches S1 to S6 are set to OFF (0), the Call Success Rate is always 100%.

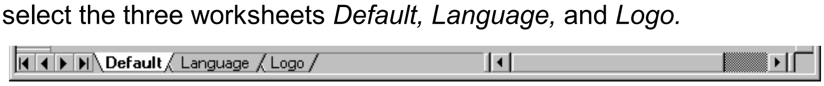
If only S1 is set to ON (1), all Dropped calls (DR + D + DRN + DN) are classified as being not successful. If the data set contains any Dropped calls, the Call Success Rate is smaller than 100%.

If only S3 is set to ON (1), all Dropped calls that are also Noisy (DRN + DN) are classified as being not successful; the Dropped calls that are not Noisy (DR + D) are still classified as being successful. If the data set contains any Dropped calls that are also Noisy, the Call Success Rate is smaller than 100%.

Special Functions

The evaluation software TS9954 NQA provides a number of additional functions to customize the worksheets, change the language and the logo, modify the data and print the contents of a worksheet.

The NQA-MAK.XLS file contains three sheets to edit default values and select the language and the logo displayed on top of each worksheet. Within MS Excel this file is hidden by default but can be displayed and edited using the *Window - Unhide* menu item. The file provides a folder with three tabs to select the three worksheets *Default, Language,* and *Logo.*



All three sheets are protected with a password that must be entered into a dialog window following the instructions displayed by MS Excel.

Note:

*The password to be used at the first time after installing TS9954 NQA is "**a**". After typing in "a" to access and modify a NQA-MAK.XLS sheet it is possible to renew the protection using another password or omit the password protection altogether.*

Default Values

The *Default* worksheet in the NQA-MAK.XLS file displays the following **Default values:**

RxQual (Range)	B1	B2	B3	B4	B5	B6	B7	B8
from (incl.)	0	4	5					
to (incl.)	3	4	7					

CallResptime	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
from (incl.)	0	2	4	6	8	10	12	14	16	18
to (excl.)	2	4	6	8	10	12	14	16	18	

SysResptime	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
from (incl.)	0	2	4	6	8	10	12	14	16	18
to (excl.)	2	4	6	8	10	12	14	16	18	

SucRate 100%	
CallResptime	>15s

SucRate (switch.)		On(1)/Off(0)
Dropped		**0**
Blocked		**0**
Noisy		**0**
No Service		**0**
CallResptime	>15s	**0**
SysResptime	>10s	**0**

The headers *RxQual (Range)* etc. denote the worksheets where the default values are used. A default value can be modified after double-clicking on the cell.

Language and Logo

The *Language* worksheet in the NQA-MAK.XLS file displays a German, English, and a Spanish dictionary. It is possible to select one of the three languages and modify the vocabulary.

In the *Logo* worksheet, it is possible to select a logo to be displayed on each worksheet and define its position.

DATA Table

When the NQA data files are loaded the data are evaluated and the results written into the DATA table. The DATA table provides easy access to the data and can be used to modify the data and create new charts.

Printing

All sheets have a pre-defined printing area set for DIN A4 landscape format. Hardcopies can be printed using the MS Excel printer settings. A print preview is available in the file menu or on clicking the corresponding button in the MS Excel toolbar.

Modification of the Worksheets

The *MOB1...* folder files (see section *Starting and Operating TS9954 NQA* on p. 7.49 ff.) are visible and not protected. They can be modified for your own personal requirements.

All functions used are standard MS Excel functions. Every experienced MS Excel user can modify and extend the formula. Knowledge about database, matrix and VBA macro functions are indispensable, knowledge in software programming is useful.

Sheet concept The sheets depend on each other, data links have been installed between them.

Hidden cells In some sheets several areas are hidden. These areas are used for matrix definitions and interim calculations.

Macros In the VBA macro a special item is to be found: It is not possible to detect missing mobile data before loading is finished, and copying functions on empty cells in this macro would lead to error messages. So, during this time, error messages are suppressed. When you face problems modifying the software, switch off this function.

The ‘Bit’ function contains an AND function for the comparison of two values. MS Excel compares on a bit by bit basis but returns a TRUE value as soon as two bits are found due to this result. Therefore this function is used twice in ‘NOISY’ evaluations to compare two set bits.

Contents

8 Installation Instructions and Background Information 8.1

ROMES Installation 8.1

Installing ROMES..8.3

Hardware Recognition: GPIB Drivers 8.4

Hardware Recognition: PCS Drivers 8.4

PCS Driver Settings 8.6

Operating ROMES without Local Admin Rights..8.7

File Sharing Settings..8.7

Registry Modifications..8.9

ROMES Tools...8.12

CMD File Repairer 8.12

BTS List Generator 8.13

DialUp Wizard 8.14

ROMES Configurator 8.16

Special Device Manager 8.17

Coordinate Systems..8.19

Gauß Coordinate Systems...8.19

The Gauß-Krüger System..8.20

The UTM System 8.20

The Coordinate System of the East European States 8.20

The Geographical Grid..8.20

The Decimal Grid 8.21

GSM: The Coded Channel 8.22

GSM Channels and Power Classes 8.23

UMTS Channels 8.31

The GPS Receiver..8.36

GPS Data Transmission..8.36

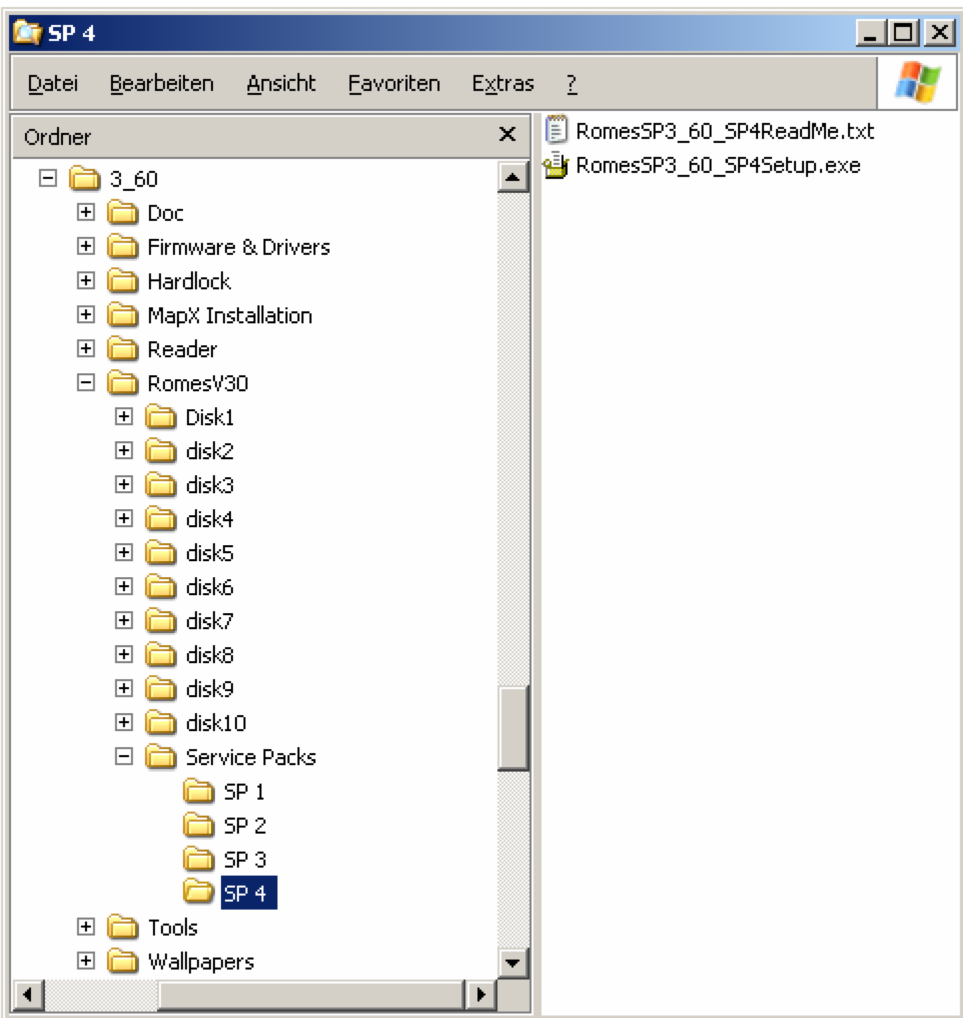
GSM Abbreviations 8.49

8 Installation Instructions and Background Information

This chapter explains how to install ROMES and third-party utilities that might be useful or necessary for the operation of some ROMES components and contains useful information on coordinate systems for geographical projections, GSM and GPS. Appended are lists of all terms and abbreviations used throughout this manual.

ROMES Installation

ROMES is an application software to be run on a controller with a MS Windows XP operating system. The application is supplied on a CD-ROM containing all program parts and utilities necessary for operation including the additional hardware drivers:



The CD is organized in several directories:

- *Doc* provides documentation on various devices of the measurement system, including the present ROMES operating manual in printable (*.pdf) version and a delta list of new features. Further information (readme files) can be found in the *Firmware and Drivers* directory.
- *Firmware and Drivers* contains driver software and documentation for various purposes; see *Table 8-1* below.
- *Hardlock* contains the hardlock driver and instructions for manually installing the driver (only relevant if the automatic installation fails).
- *IE6* contains an installation version of Microsoft Internet Explorer 6.0.
- *MapX Installation* contains an installation version of the third-party utility *Max X 5* that ROMES uses for the map projection in the *Route Track View.*
- *Reader* contains a German and an English version of Adobe Acrobat Reader.
- *RomesV30* contains the coverage measurement system ROMES including possible service packs. Please note that the service packs have to be installed manually. A service pack usually consists of an executable installer file and the associated release notes as a text file. The service pack can be installed from any location on the target computer, because the required ROMES installation directory is obtained from the MS Windows registry.
- *Tools* contains various utilities for ROMES as described on p. 8.12 ff.
- *Wallpapers* provides various screen background bitmaps.

Table 8-1 List of drivers and further utilities

Drivers for ...	**Purpose**	**Installation file**	**Reference**
DekTec FantASI DTU225	Decoder required for the TSM-DVB DVB-T receiver to watch the selected programm on TV monitor	*Firmware & Drivers\ DekTec FantASI DTU225*.zip*	*Firmware & Drivers\ DekTec FantASI DTU225\Readme.txt*
Digi Board	ISA plug-in card with 4 or 8 additional COM ports	*Firmware & Drivers\ Digi Board\AccelePort Xr - W2K & WXp\40002207_A.exe*	*Firmware & Drivers\ Digi Board\Readme.txt*
Edgeport USB to 8Serial Converter	Edgeport/8 301-1002-08 USB to 8x serial Converter	*Firmware & Drivers\ Edgeport USB to 8Serial Converter\ip4n5340.exe*	*Firmware & Drivers\ Edgeport USB to 8Serial Converter\Readme.txt*
EXSY PCI Serial	PCI plug-in card with 4 or 8 additional COM ports	*Firmware & Drivers\ EXSY PCI Serial...*.exe*	*Firmware & Drivers\ EXSY PCI Serial...\Readme.txt*
GPS Receiver	Various drivers for GPS receivers with USB interface	*Firmware & Drivers\ GPS Receiver\...\...*.exe*	*Firmware & Drivers\ GPS Receiver\...*.pdf*
IEEE Interface	GPIB bus driver for NI and R&S card	*Firmware & Drivers\ IEEE Interface...*.exe*	Section *Hardware Recognition: GPIB Drivers below.*
Motorola Mobile	Various utilities and USB drivers for Motorola test mobiles	*Firmware & Drivers\Motorola Mobile\...*	*Firmware & Drivers\Motorola Mobile\...*
Nokia Mobile	DKU2 (USB) driver for Nokia mobiles	*Firmware & Drivers\Nokia Mobile*.exe*	*Firmware & Drivers\Nokia Mobile\...*
PCS1_PCS2	Drivers for channel sounder cards PCS1 and PCS2	*Firmware & Drivers\PCS1_PCS2\Win2k...*	Section *Hardware Recognition: PCS Drivers below*

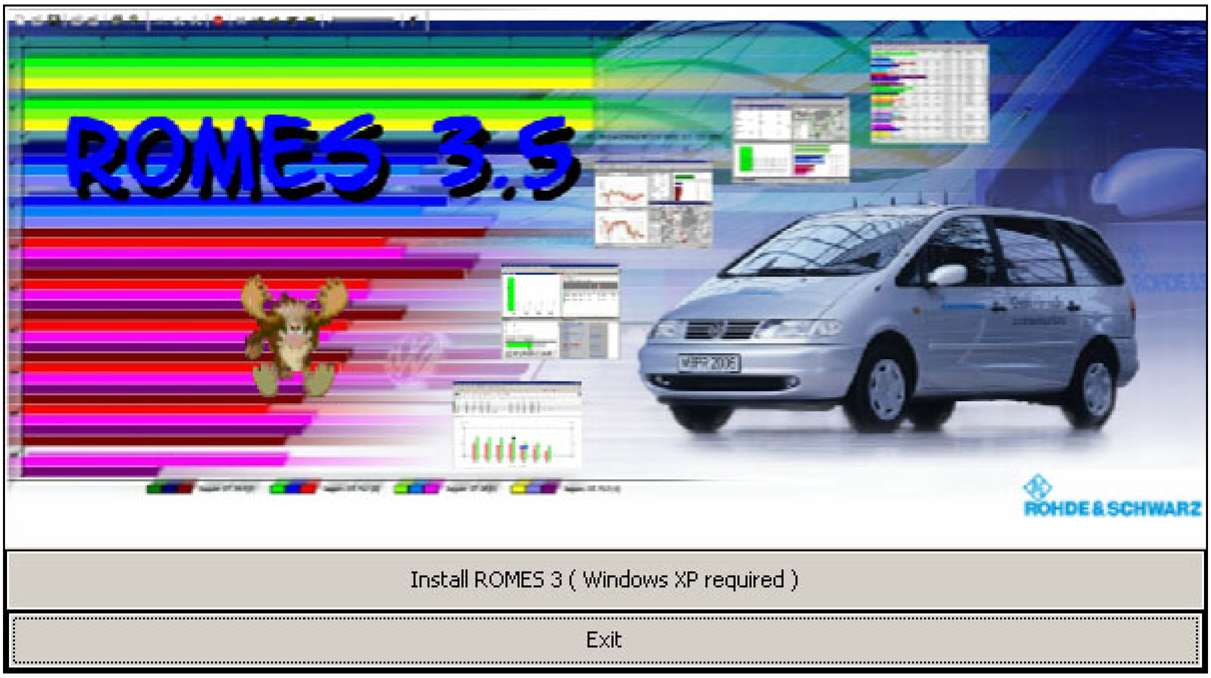
Qualcomm Chipset Mobiles	USB driver for Qualcomm mobiles	*Firmware & Drivers\Qualcomm Chipset Mobiles*.exe*	*Firmware & Drivers\Qualcomm Chipset Mobiles\..*, chapter 6 of this manual.
Quatech...	PCMCIA card for 4 additional COM ports	*Firmware & Drivers\Quatech QSP100 PCMCIA to 4Serial\Win2k_Xp*	
R&S RF Receivers, TSMx IEEE1394 driver	Current firmware, utilities and documentation for R&S RF test receivers, including the IEEE 1394 firewire driver for the TSMx	*Firmware & Drivers\R&S RF Receivers\<Type>...*	*Firmware & Drivers\R&S RF Receivers\<Type>....*, chapter 6 of this manual (*Test Receiver Drivers*).
Sagem Mobile	USB driver for Sagem OT290, required for use with Splitter Box only	*Firmware & Drivers\Sagem Mobile*.exe*	
Silicom Double Serial	Old PCMCIA card for 2 additional COM ports	*Firmware & Drivers\Silicom Double Serial*.exe*	*Firmware & Drivers\Silicom Double Serial\Readme.txt*
Sound Cards	Drivers for Sound Cards used for Speech Quality measurements (SQA)	*Firmware & Drivers\Sound Cards\...*.exe* (or **.zip*)	*Firmware & Drivers\Sound Cards\...*
Trigger Box	Firmware and Tools for the R&S Trigger Box	*Firmware & Drivers\Trigger Box\TriggerBoxSetup.exe*	*Firmware & Drivers\Trigger Box\Readme.txt*

Installing ROMES

Installation of the software is controlled by a setup program. All necessary settings are configured automatically during the installation process. Please take the following steps:

- Connect the external CD-ROM drive (if no internal CD-ROM drive is available on your controller).
- Turn on your controller and start your MS Windows operating system.
- If the program Hardcopy is running on your machine, stop this program.
- Insert the CD-ROM in your drive. Unless the autostart option is disabled on your operating system the setup routine on the CD-ROM starts automatically. Otherwise start the setup.exe program in the root directory of the CD-ROM.

The ROMES installation guide is opened:



- Click *Install ROMES 3...* and follow the instructions on the screen.
- If a corresponding message is displayed, restart your computer.
- If the software is not installed in the default directory *c:\Romes*, avoid using a directory name with a blank as e.g. *Program Files*.

Hardware Recognition: GPIB Drivers

ROMES provides GPIB driver files for the connection of a test receiver ESVx or ESPI to the controller via a National Instruments (NI) IEEE bus interface. Further drivers are provided for an R&S IEEE bus card (please also note the installation message displayed before the ROMES installation is terminated). All drivers are located in the *Firmware & Drivers\IEEE Interface* subdirectory of the CD-ROM and must be installed manually:

- Start the program *ni488216.exe* which copies the files necessary for the driver installation into a temporary directory.
- Use the default values for all settings, terminate the installation and shut down your controller.
- Install or plug in the the NI hardware (PCI/PCMCIA card).
- Restart your controller.
- Start MS Windows Explorer and right-click *Measurement and Automation – Devices and Interfaces – GPIB Interfaces.*
- In the context menu, click *NI-488.2 Getting Started Wizard* and follow the instructions in the dialogs.

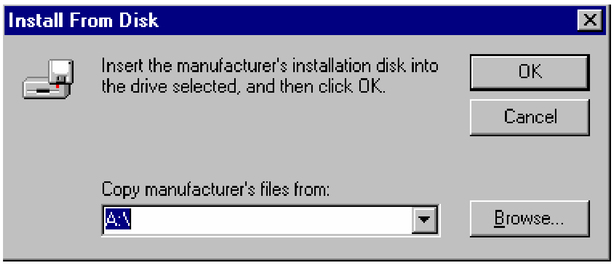
Hardware Recognition: PCS Drivers

Two additional drivers are needed for the channel sounder cards PCS1 and PCS2. The corresponding files are copied to the subdirectory *Install/Pcs1_PCS2* of the program directory, respectively. Besides, the installation is analogous to the installation of the GPIB driver (example: Windows95):

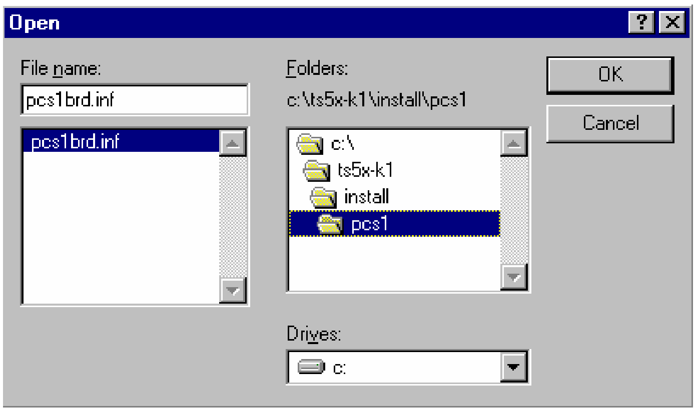
- Open the *Settings – Control Panel*.
- Click *Add New Hardware* to open the *Add New Hardware Wizard* dialog.
- Click *Next* to begin to install new hardware.

In the dialog opened, a system message „Do you want Windows to search for new hardware?" is displayed.

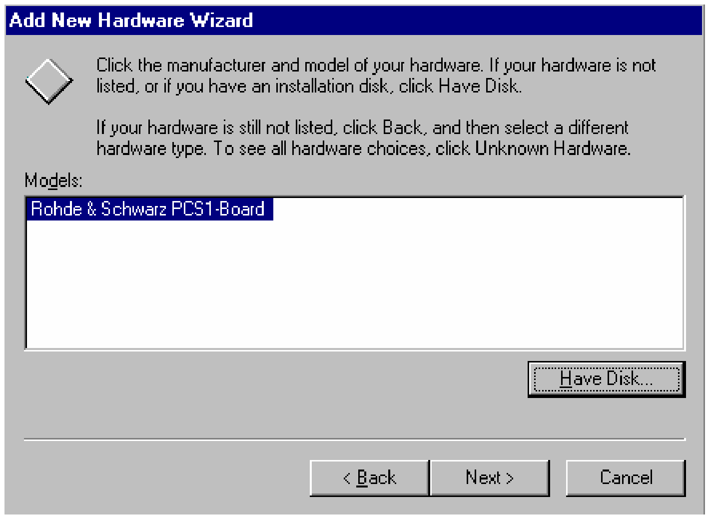
- Click *No,* then *Next* to open a new dialog containing the available *Hardware Types*.
- Double-click the question mark to go to the *Add New Hardware Wizard* dialog containing the *Manufacturers* list.
- Instead of selecting a manufacturer and model from the lists, click *Have Disk* to open the *Install from Disk* dialog:



- Click *Browse* and step to the directory containing the driver files:



- For driver PCS1, select the file *pcs1brd.inf* and click *OK.*
- In the resulting *Install From Disk* dialog, press *OK.*



➢ In the *Models* dialog field, select the *Rohde & Schwarz PCS1-Board*. Click *Next*.

A message indicating hardware conflicts might appear.

➢ Ignore the message, click *Next*. Do not press the *Start Conflict Troubleshooter* button in the resulting dialog, press the *Finish* button.

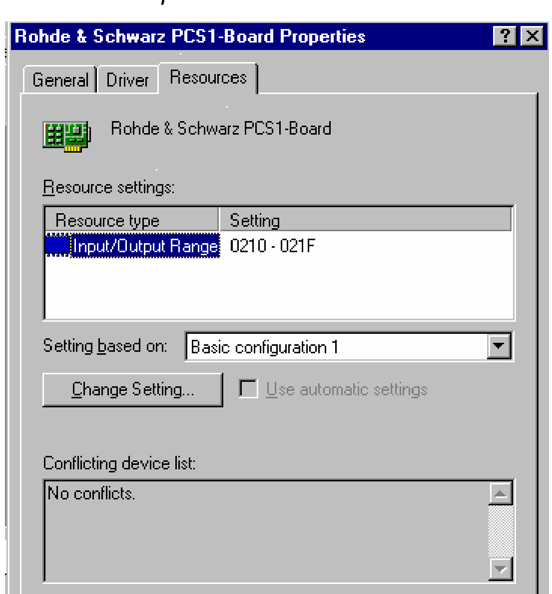
➢ Repeat the procedure for driver PCS2, corresponding to the installation file *pcs2.inf.*

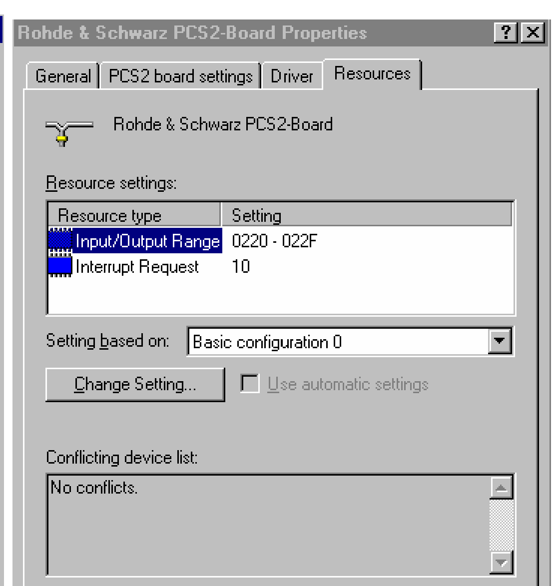
PCS Driver Settings

The PCS driver settings must be checked like the GPIB driver settings:

➢ Reopen the *Control Panel* and click *System*.

➢ In the *Device Manager* tab of the *System Properties* menu, select the PCS1 driver from the *AD Converter Board* entry and open the *Properties* menu. If selected, deselect the *Disable in this hardware profile* checkbox and switch to the *Resources* tab.





The driver settings must be as follows:

PCS1	PCS2
• No Interrupt • Input/Output range: 0210-021F • No DMA	• Interrupt 10, 11, or 12 • Input/Output range: 0220-022F • No DMA

If the interrupts needed are already occupied, their assignment must be changed.

- Repeat this procedure for the PCS2 driver, listed under the *RISC Board* entry in the *Device Manager* tab of the *System Properties* menu.
- Reboot the controller.

Operating ROMES without Local Admin Rights

In case you want to operate ROMES with a "Limited Account" (without Admin rights) it is necessary to perform the following steps to grant additional rights needed to ensure full functionality.

The steps described here are valid for the MS Windows XP operating system.

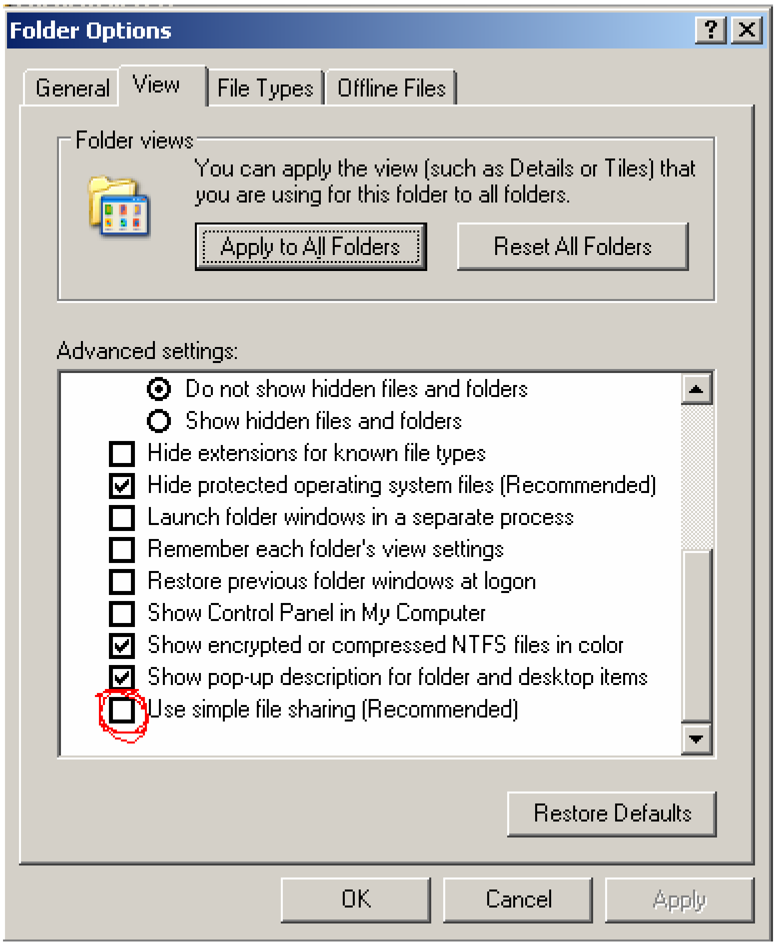
File Sharing Settings

The limited account user without local administration rights needs full file control for the following directories:

- Default ROMES directory (e.g. C:\RuS or C:\ROMES)
- MapInfo directory (e.g. C:\Programme\MapInfo)
- ROMES temporary directory for route track modules (C:\TEMP)

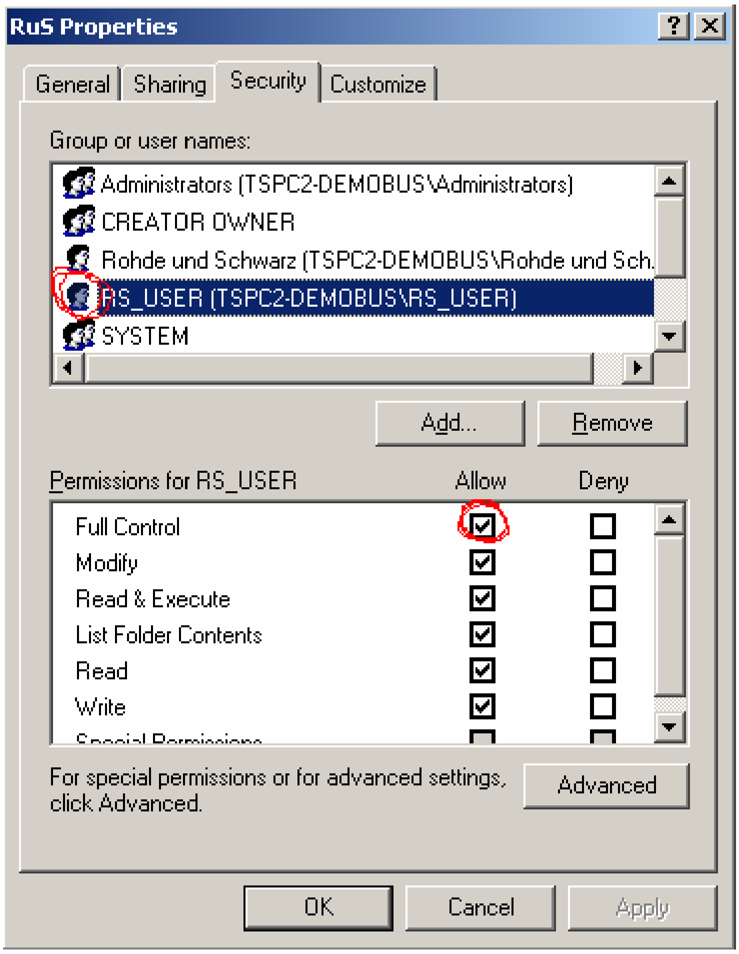
This involves the following steps:

1.) Open the Windows Explorer and select the menu item "Tools"->"Folder Options...". Select the tab "View" and scroll down until the "Use simple file sharing" list item is visible as shown below:



Deselect the "Use simple file sharing" checkbox and "Apply" the change.

2.) Back in the Windows Explorer, select the default ROMES directory (e.g. e.g. C:\RuS) and right-click it. In the resulting context menu, select the item "Properties", which leads to a dialog window for the selected directory. Click on tab "Security" to obtain a dialog similar to the one shown below:



In the upper list, select the user with limited account privileges (RS_USER in this example). Then select "Allow" in the "Full control" list item of the lower list. "Apply" the change. and repeat this step for all directories listed at the beginning of this section.

3.) When Step 2.) is completed, modify the registry as described below.

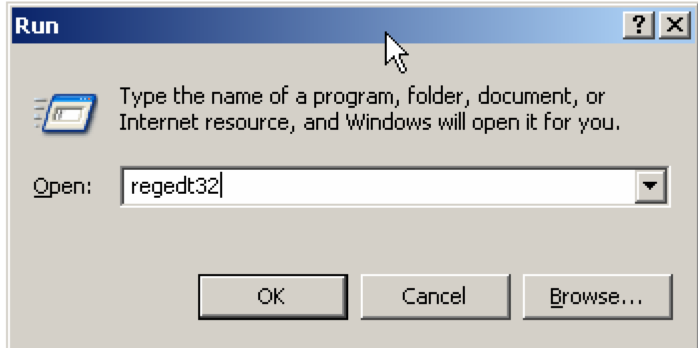
Registry Modifications

To operate ROMES with a limited account user as described above, the following registry keys need to be updated:

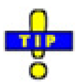
- ROMES Registry Key:
  HKEY_LOCAL_MACHINE\SOFTWARE\Rohde & Schwarz
- MapInfo Registry Key:
  HKEY_LOCAL_MACHINE\SOFTWARE\MapInfo

This involves the following steps:

4.) Open the "Start" menu and select "Run..." to obtain the following dialog.



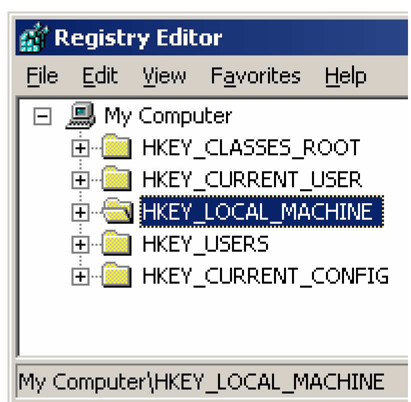
Type "regedt32", as shown above and click "OK" to start the MS Windows Registry editor.



Do not use “regedit” as this tool does not support security settings for registry entries.

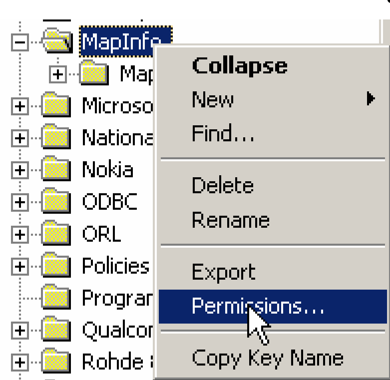
Alternatively, call C:\WINNT\SYSTEM32\regedt32.exe from the command prompt.

The Registry Editor starts with a window similar to the following:

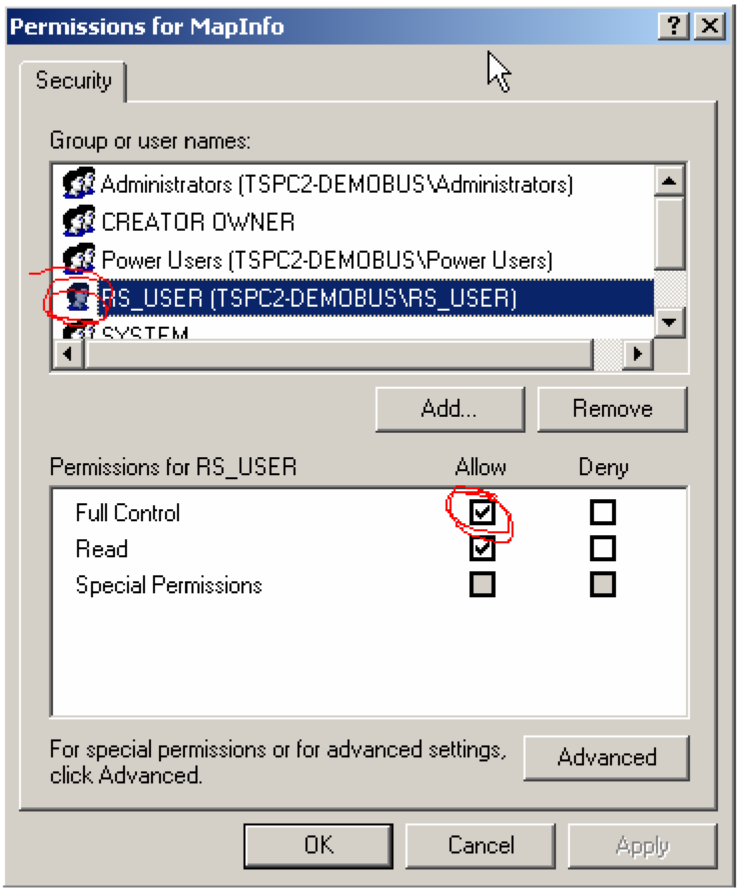


Click on "HKEY_LOCAL_MACHINE", then on "SOFTWARE".

5.) In the "SOFTWARE" list, locate the "Rohde & Schwarz" and "MapInfo" items. Right-click an item to obtain a context menu similar to the following:



6.) Select "Permissions..." to open the following dialog:



In the upper list, select the user with limited account privileges (RS_USER in this example). Then select "Allow" in the "Full control" list item of the lower list. "Apply" the change. and repeat this step for all SOFTWARE items listed at the beginning of this section.

These changes allow the full functionality of the ROMES software in the context of a limited user account.

ROMES Tools

Together with the main application, ROMES installs additional useful software tools. The tools are accessible in the *Tools* submenu of the ROMES program menu:

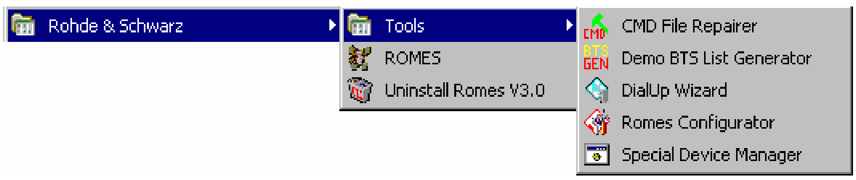


Fig. 8-1 ROMES Tools

CMD File Repairer

The *CMD File Repairer* can repair measurement (*.cmd) files that are corrupted, e.g. because of a system crash or a sudden voltage drop during the measurement. Successfully repaired measurement files can be used again for evaluation in a replay session. The success of the repair algorithm depends on the state of the measurement file.

Installation

The *CMD File Repairer* is automatically installed together with the test system. An executable file *CMDRepair.EXE* is stored in the ROMES program directory.

Repairing CDM file

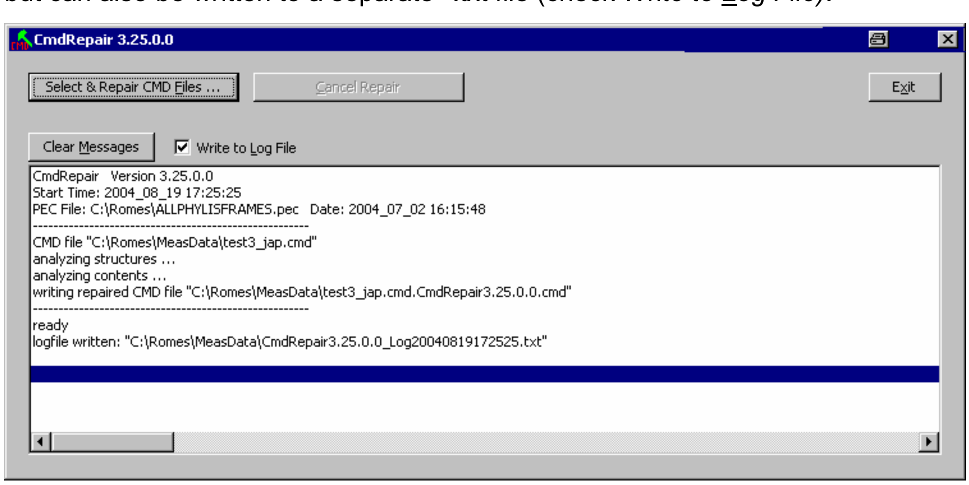
a To repair a CMD file...

Make sure that ROMES is closed.

Select *CMD File Repairer* in the *Tools* program subdirectory; see Fig. 8-1 on p. 8.12.

In the dialog opened, click *Select & Repair CMD Files* to call up an *Open File* dialog and choose the corrupted measurement file <file>.cmd.

If it is able to open the file, the file repair tool automatically assigns an output file name *<file>.cmd.CmdRepair3.25.0.0.cmd* and writes it to the CMD file directory. The progress of the file repair process is reported in the main application window but can also be written to a separate *.txt file (check *Write to Log File)*.



The tool indicates *ready* as soon as the file is successfully repaired. If a non-corrupted file is repaired, the repaired file is identical to the original file.

BTS List Generator

The *BTS List Generator* is a software utility which can be used to generate a sample BTS/Node B list from a GSM/CDMA/UMTS measurement (*.cmd) file. The sample BTS/Node B list is adjusted to the contents of the measurement file, it is a useful tool for demo purposes and for exploring the part of ROMES functionality that depends on a BTS/Node B list.

Installation

The *BTS List Generator* is automatically installed together with the test system. An executable file *BTSListGenerator.EXE* is stored in the ROMES program directory.

Generating a sample BTS list

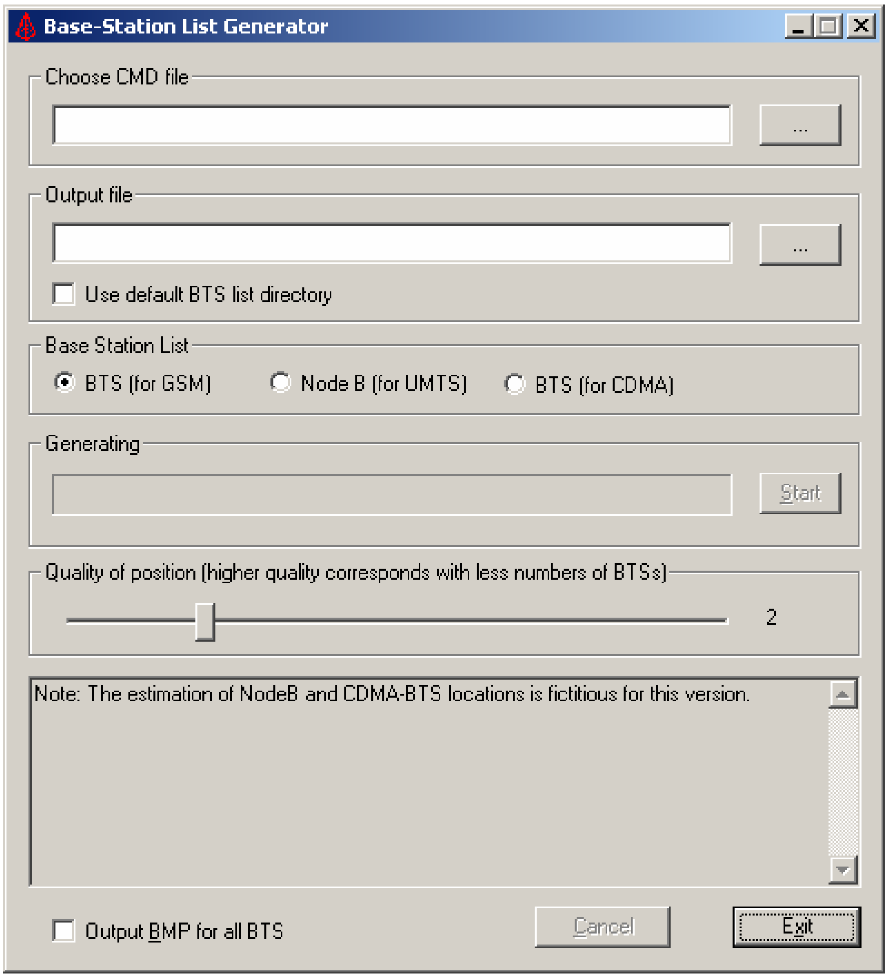
To generate a sample BTS or Node B list...

1. Make sure that ROMES is closed.

Double-click *BTSListGenerator.EXE* (or select *Demo BTS List Generator* in the *Tools* program subdirectory; see Fig. 8-1 on p. 8.12).

In the dialog opened, click the *Choose CMD file* "..." button to choose the GSM, CDMA or UMTS <file>.cmd file to be used for the BTS/Node B list generation.

The list generator automatically assigns an output file name <file>.txt and selects the folder of the measurement file as default BTS list file location. The *.txt BTS list file format is described in chapter 7.



If you wish to use another file name or file location, click the *Output file* "..." button or check *Use default BTS List directory*.

The default BTS list directory is the *BTSLists* subdirectory of the ROMES program directory.

Select either *BTS (for GSM)* or *Node B (for UMTS)* or *BTS (for CDMA),* depending on the technology of your CMD file.

Click *Start* and check the messages displayed in the *Generating* panel and in the lower section of the dialog.

BTSs detected in the measurement file are displayed as a scrollable list. The *Generating* panel displays a *Ready!* message when the BTS list is generated. The BTS list file can be imported into the GSM BTS data base as described in chapter 3.

Further program settings

The *BTS List Generator* provides additional parameters to control the generated output. The parameters are related to the calculation of the BTS position, which is based on the route of the test vehicle and the measured timing advance of the signals. The geometry and varying test conditions introduce a specific uncertainty to the position estimation of each BTS.

Quality of position

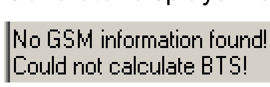
The BTSs are ordered according to the estimated accuracy of their position, BTSs with large inaccuracies are discarded. The condition for discarding BTSs can be varied on a scale between 1 and 6. Larger numbers cause more BTSs to be discarded so that the BTS list becomes shorter.

Output BMP for all BTS

If the box is checked, a bitmap file named *<PrositionEstimation_<n>.bmp* for each BTS in the BTS list is written to the output directory. The bitmap shows a graphical code for the estimated accuracy of the BTS position.

Error Messages

The measurement file must contain valid GSM or UMTS data. If an invalid measurement file is selected, file generation is stopped and the *BTS List Generator* displays the following message:



Example

An example BTS list file named *SAUERLACH_MUC.TXT* generated with the *BTS List Generator* is provided together with the application. The file has been generated from the sample measurement file *SAUERLACH_MUC.CMD* and is stored in the *BTSLists* subdirectory of the ROMES program directory.

DialUp Wizard

The *DialUp Wizard* offers a preconfigured list of connections to internet providers all over the world. To establish a dial-up connection from your local PC, it is sufficient to select a provider and a country. The wizard allows you to change the parameters of an existing connection or add new connections in an easy way.

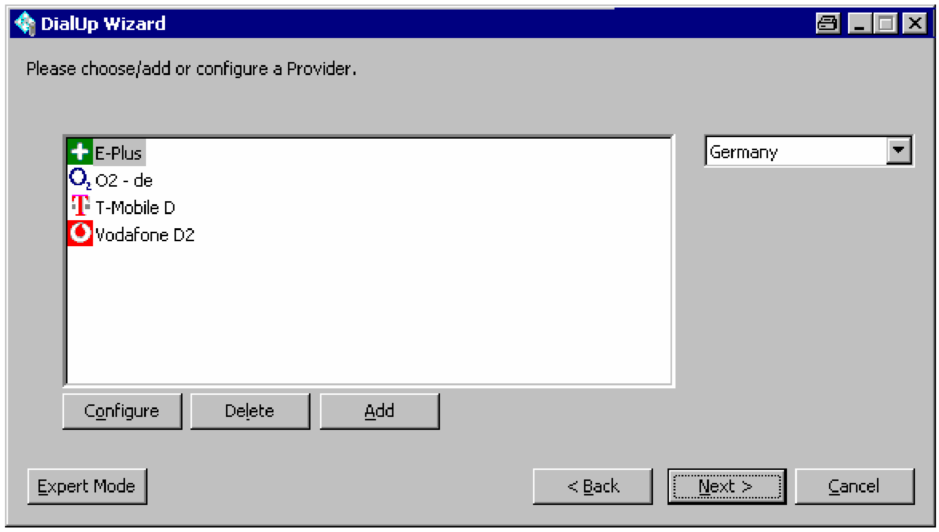
Installation

The *DialUp Wizard* is automatically installed together with the test system. An executable file *DialUp Wizard.exe* is stored in the ROMES program directory.

Setting up a connection

To disable unused views, technologies, or drivers...

2. Select *DialUp Wizard* in the *Tools* program subdirectory; see Fig. 8-1 on p. 8.12.
3. In the country list on the right side of the wizard, select your country.
4. In the provider list, select your provider.

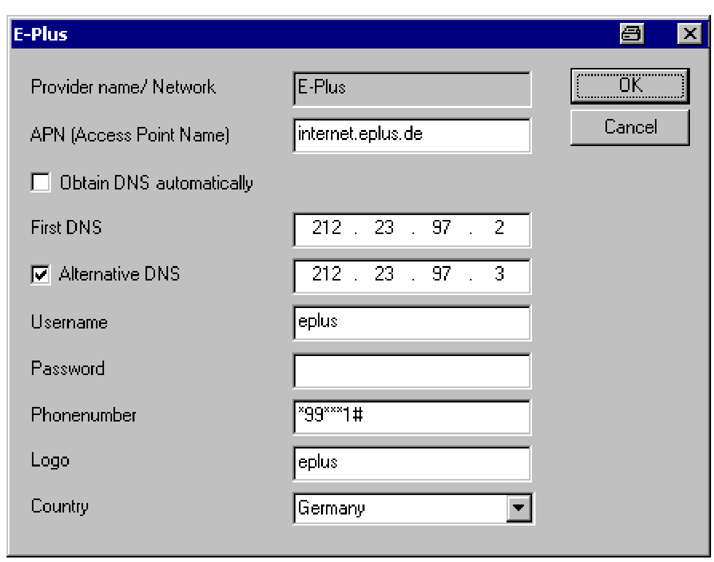


5. Click *Next* to proceed to the next dialog of the wizard and select a modem.
6. Click *Finish* to attempt the connection and close the wizard.

Customizing the DialUp Wizard

The buttons in the *DialUp Wizard* dialog allow you to perform the following configurations:

- Configure opens a dialog to modify or complement the connection parameters of the selected provider.



- *Delete* removes the selected connection from the list.
- *Add* opens the dialog shown above where you can add the name and the parameters for a new connection. The connection parameters are usually published in the internet.
- *Expert Mode* opens a dialog where you can again change your connection

configuration, look up or change your modem settings, or configure a Remote Access Service (RAS) connection. In expert mode, you can also set up a *GPRS Connection* to the internet using a GPRS mobile phone connected to your local PC.

ROMES Configurator

The *ROMES Configurator* temporarily disables ROMES program components and stores the restricted ROMES configuration as a user profile. In view of the large number of supported views, technologies, and drivers, a restricted configuration can significantly improve the system performance. ROMES does not have to load, reset or reconfigure unused views, technologies, and drivers whenever the application is started or an action affecting the workspace settings is performed.

Disabling components which are not needed for some time makes navigation within ROMES easier because the disabled components no longer appear in the ROMES menus. The ROMES Configurator allows you to re-enable any disabled component whenever you need it again.

Installation

The *ROMES Configurator* is automatically installed together with the test system. An executable file *RomesConfigurator.exe* is stored in the ROMES program directory.

Disabling components

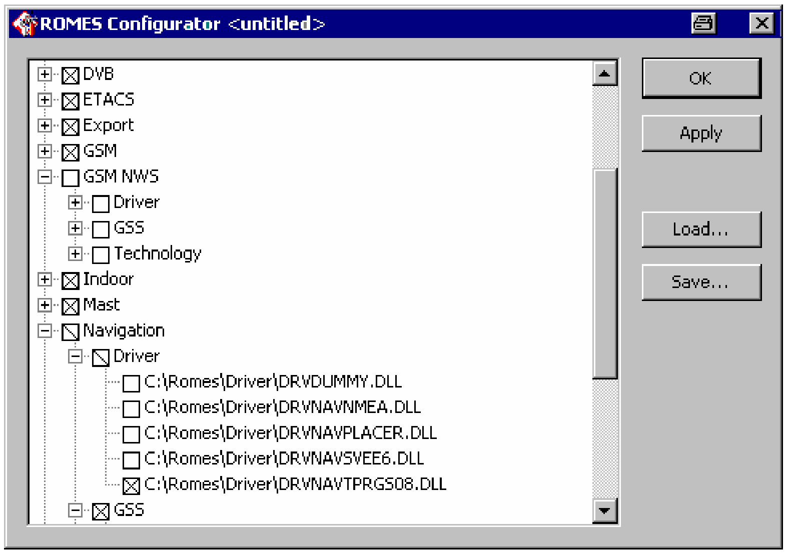
To disable unused views, technologies, or drivers...

1. Make sure that ROMES is closed.
2. Select *ROMES Configurator* in the *Tools* program subdirectory; see Fig. 8-1 on p. 8.12.

The application displays the consecutive messages *Scanning Driver*, *Scanning GSS* and *Scanning Technology* before it opens the main window.

3. Expand the nodes in the *ROMES Configurator* window, expand the parent nodes, and clear the components you want to disable.

In the following example, all GSM network scanner components (driver, views/GSS, and technology) and all but the Tprgs08 GPS driver are disabled.



4. Click *OK* to close the configurator.

Your settings will take effect when you start ROMES for the next time.

Enabling components

To re-enable a previously disabled components, simply select it again in the *ROMES Configurator* window. The re-enabled component will be part of your ROMES installation after you start ROMES again.

Using profile files

A profile file stores a ROMES configuration in ASCII format. The profile file (*.profile) contains a list of all installed ROMES components. A 1 behind an entry means that it is enabled, a zero that it is disabled.

```
[ModuleStates]
C:\Romes\Driver\DRVATTSDM.DLL=1
C:\Romes\Technology\CMSTECHATTENUATOR.DLL=1
C:\Romes\Driver\DRV_K6_DRIVERBASIC.DLL=1
C:\Romes\Driver\DRVK7.DLL=1
C:\Romes\GSS\GSS_K6_BASIC.DLL=1
C:\Romes\GSS\GSSNAVK6LAYER.RTM=1
C:\Romes\Technology\CMSTECH_K6.DLL=1
C:\Romes\Driver\DRVCDMA_QCP.DLL=1
```

➢ To store your current configuration to a file, click *Save…* and select a file name (*.profile).

➢ To re-use a stored configuration, click *Load…,* select the file, and click *OK* to close the configurator and put the configuration into effect.

Special Device Manager

The *Special Device Manager* helps to remove redundant USB drivers that ROMES used in previous measurement sessions. A USB driver must be loaded and assigned to several virtual COM ports whenever a USB device (in particular, a Nokia or Qualcomm UMTS test mobile) is connected; see section *Connection via USB Interface* in chapter 6.

The operating system does not delete unused virtual COM ports if USB devices are connected and disconnected repeatedly. As a result, the virtual COM port numbers for new devices *(Assign Serial Ports* dialog) tend to increase, which in the long run may cause connection problems. It is recommended to delete redundant USB ports using the *Special Device Manager* if the assigned port numbers exceed values of 30, or if holes in the sequence of the COM port numbers are noticed.

The *Special Device Manager* is the standard Device Manager from Microsoft with the environment variable SET DEVMGR_SHOW_NONPRESENT_DEVICES set to 1

Installation

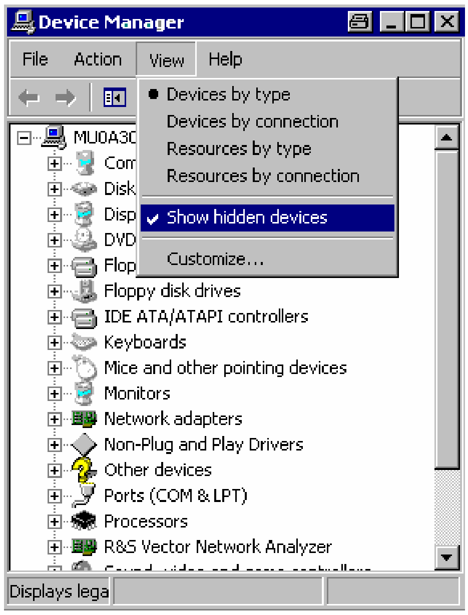
The *Special Device Manager* is automatically installed together with the test system. An executable file *DeviceManager.bat* is stored in the *Tools\DeviceManager* subdirectory of the ROMES program directory.

Removing unused drivers

To remove unused drivers...

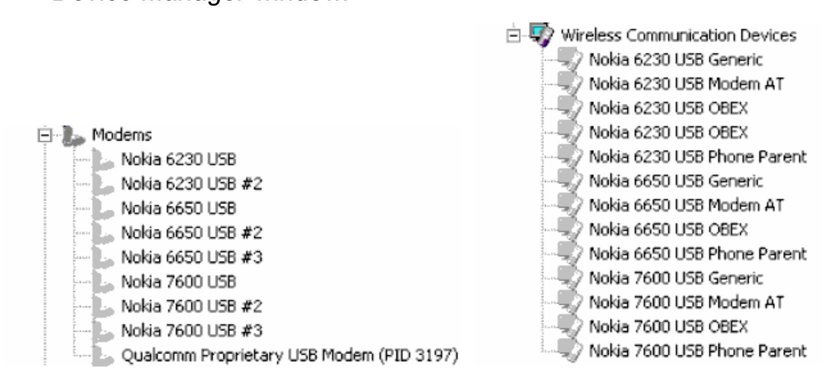
1. Select *Special Device Manager* in the *Tools* program subdirectory; see Fig. 8-1 on p. 8.12.

In the dialog opened, select *View – Show hidden devices.*



The entry must be ticked after each program start.

2. Expand the *Modems* and *Wireless Communication Devices* nodes in the *Device Manager* window.



Unused drivers and port assignments are displayed with gray icons.

3. Delete redundant entries, e.g. all *Nokia* and *Qualcomm* entries, all Qualcomm COM ports and “compound devices”, and all other drivers that are listed several times and no longer needed.

4. Close the *Special Device Manager.*

The lower virtual COM port numbers are available once again; you can use them for the connection of new USB devices.

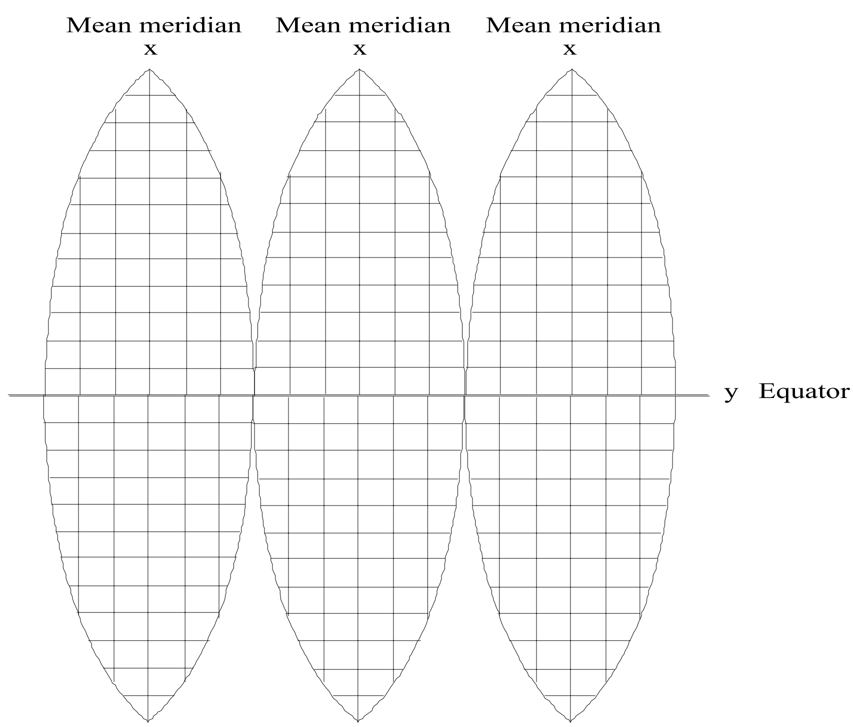
Coordinate Systems

The measured field strength values can be displayed in a variety of coordinate systems, depending on the needs of the user. Digitized data on the location coordinates can be obtained with a GPS system or with a digitizer, which is moved over an appropriate land map.

Gauß Coordinate Systems

The mathematical principles for this type of coordinate system were developed by Gauß, and its adaptation for practical application was completed by Krüger. This projection can be seen more or less as a cylindrical projection on a quadrature axis, where a cylinder is rotated over the earth ellipsoid at right angles to the rotational axis of the ellipsoid. The surface of the earth is then translated through a central projection to the inside of the cylinder. The position of the cylinder is chosen in such a manner that a tangential meridian forms a distortion-free straight line. The equator, perpendicular to the meridian, also forms a straight line. As distance from the tangential meridian increases, there is some distortion. This is also noticeable in the representation of the earth's surface to the east and to the west of the tangential meridian.

To keep the distortion as low as possible, the projection is limited to a strip 1.5° to the side of the tangential meridian (for this reason also referred to as the mean or main meridian). A ellipse is thus created on the surface of the cylinder, the extremities of which are the poles. The entire surface of the earth is divided into 60 meridian strips, which, by "opening up" the cylinder, can be represented as follows:



The Gauß-Krüger System

With the Gauß quadrature axis projection the surface of the earth can be represented on one level in meridian strips. The mean meridian is represented by the y-axis (abscissa) and the equator by the x-axis (ordinate). Both axes are perpendicular to each other. The result is a rectangular coordinate system in each meridian strip (cf. diagram above). The abscissa to the north of the equator are vertical values, the ordinates to the east of the mean meridian are horizontal values.

To avoid negative values for the ordinates, every main meridian is given the value of 500000 meters. As a means of identification, this is prefaced by its degree of longitude divided by three.

To reduce to acceptable values the distortions occurring as distance from the tangential meridian increases, strip systems were introduced in Germany which assume the degrees of longitude (meridians) at 6°, 9°, 12°, etc. to be main meridians true to longitude and represent them as abscissa axes. Every partial system has an extension of 1.5 degrees of longitude in both directions (approx. 100 km).

A point which is 30500 m to the west of the mean meridian at 6° is assigned the horizontal value

500000 m - 30500 m = 469500 m.

The UTM System

The Universal Transversal Mercator projection (UTM) is a transversal cylindrical projection used mainly for NATO and USA military maps. The UTM system covers the earth between 80° north and south with 60 meridian systems (zones). The main meridians of each zone lying at 3°, 9°, 15°, etc. are numbered from west to east, beginning with the mean meridian at 177° west. In each zone intervals of approx. 8° are selected and marked with capital letters, beginning at 80° south. All of the fields produced in this way are then divided by grids with round 100 km values in the x and y directions from the mean meridian to form squares with a width of 100 km. These squares are marked with two letters according to their row and column position. Coordinates are then used to determine an exact position within one of the squares. The coordinates are marked E (east, corresponding to y or the horizontal value) and N (north, corresponding to x or the vertical value). The resulting structure is a universal grid.

The Coordinate System of the East European States

For average-scale maps the East European states use Gauß-Krüger meridian systems with a longitudinal extension of 6° and a mean meridian true to longitude on the basis of Krassovskij earth ellipsoid. For maps with scales of 1:5000 and more, strips of 3° are used.

The Geographical Grid

In the geographical grid positional information is given by measuring the degrees of longitude and latitude in degrees, minutes and seconds.

The Decimal Grid

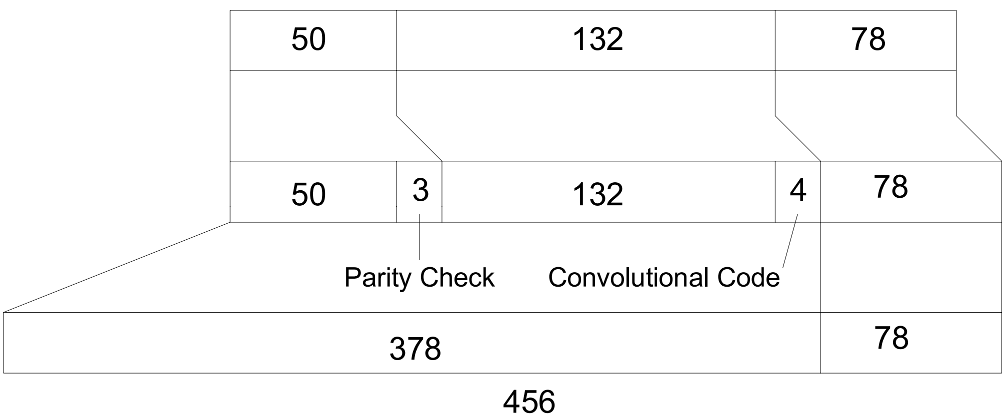
In the decimal grid positional information is given by measuring the degrees of longitude and latitude in decimal figures.

GSM: The Coded Channel

There are various types of channels. The traffic channel (TCH) serves to carry data, the control channel (CCH) to carry signaling and synchronization data. Furthermore there are three types of control channel: broadcast channels are used to carry mobile station frequency corrections (FCCH = frequency correction channel), for frame synchronization (SCH = synchronization channel) and to carry information about the mode in operation at the base station (BCCH = broadcast control channel). General control channels (CCCH = common control channel) carry information about the communication network set-up. Purpose-related control channels (DCCH = dedicated control channels) encode the exchanges between the base station (BS) and the mobile station (MS).

Channel coding with error recognition and correction causes redundancies in the utilizable data. Channel coding may raise the bandwidth requirements, but it also raises the signal interference resistance and therefore lowers the power requirement.

The language coder on the TCH delivers 260 bit per 20 ms (13 kbit/s) to channel coding. The first 182 bits (class 1 bits) are far more important than the rest of the data (78 bit, class 2 bits) as far as their content is concerned. The first 50 bits in class 1 are further protected with 3 parity bits (class 1a bits). The remaining bits in class 1 are called class 1b bits. Three sensibility classes stem from this.



All class 1 bits are coded with a convolutional code (Viterbi-Code, R = 1/2, v = 4). 4 additional bits are allocated to each bit in class 1 whereby the additional bits form the memory of the Viterbi coder. So, a coded bit sequence of bit length 378 results from the 189 bits of class1. The bit sequence together with the 78 non-coded, class 2 bits form a block of 456 bits which are transmitted in 20 ms (22.8 kBit/s).

On the SCH (Synchronization Channel) 25-bit blocks are sequentially coded to a block length of 78 bits with a BCH code shortened to 35 bits and then analogue to the TCH.

To save the signaling data, 184 bit frames are sequentially coded to a block length of 456 bits with the fire code on a 224 bit frame length and then analogue to the TCH.

The data are then interleaved and encoded.

GSM Channels and Power Classes

Table 8-2 Frequency ranges

Band	Subband	Uplink [MHz]	Downlink [MHz]
GSM400	**GSM450**	450.4 to 457.4	460.4 to 467.4
	GSM480	478.8 to 486.0	488.8 to 496.0
GSM700	**GSM 750**	747 to 762	777 to 792
GSM900	**P-GSM900 (primary GSM)**	890 to 915	935 to 960
	E-GSM (extended GSM)	880 to 890	925 to 935
	R-GSM (Railways GSM)	876 to 880	921 to 925
GSM1800	**GSM1800**	1710 to 1785	1805 to 1880
GSM850	**GSM850**	824 to 849	869 to 894
GSM1900	**GSM1900**	1850 to 1910	1930 to 1990

Table 8-3 Channel numbers (ARFCN)

(Sub)band	Uplink [MHz]	Downlink [MHz]	n Range
GSM450	450.6 + 0.2 * (n – 259)	460.6 + 0.2 * (n – 259)	259 ≤ n ≤ 293
GSM480	479.0 + 0.2 * (n – 306)	489.0 + 0.2 * (n – 306)	306 ≤ n ≤ 340
GSM 750	747.2 + 0.2 * (n – 438)	777.2 + 0.2 * (n – 438)	438 ≤ n ≤ 511
P-GSM900	890 + 0.2 * n	935 + 0.2 * n	1 ≤ n ≤ 124
E-GSM900	880.2 + 0.2 * (n – 975)	925.2 + 0.2 * (n – 975)	975 ≤ n ≤ 1023
R-GSM900	876.2 + 0.2 * (n – 955)	921.2 + 0.2 * (n – 955)	955 ≤ n ≤ 974
GSM1800	1710.2 + 0.2 * (n – 512)	1805.2 + 0.2 * (n – 512)	512 ≤ n ≤ 885
GSM850	824.2 + 0.2 * (n – 128)	869.2 + 0.2 * (n – 128)	128 ≤ n ≤ 251
GSM1900	1850.2 + 0.2 * (n - 512)	1930.2 + 0.2 * (n - 512)	512 ≤ n ≤ 810

n: Channel number (ARFCN)

Table 8-4 Downlink channels in P-GSM900 (primary GSM)

Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]
1	935.2	41	943.2	81	951.2	121	959.2
2	935.4	42	943.4	82	951.4	122	959.4
3	935.6	43	943.6	83	951.6	123	959.6
4	935.8	44	943.8	84	951.8	124	959.8
5	936	45	944	85	952		
6	936.2	46	944.2	86	952.2		
7	936.4	47	944.4	87	952.4		
8	936.6	48	944.6	88	952.6		
9	936.8	49	944.8	89	952.8		
10	937	50	945	90	953		
11	937.2	51	945.2	91	953.2		
12	937.4	52	945.4	92	953.4		
13	937.6	53	945.6	93	953.6		
14	937.8	54	945.8	94	953.8		
15	938	55	946	95	954		
16	938.2	56	946.2	96	954.2		
17	938.4	57	946.4	97	954.4		
18	938.6	58	946.6	98	954.6		
19	938.8	59	946.8	99	954.8		
20	939	60	947	100	955		
21	939.2	61	947.2	101	955.2		
22	939.4	62	947.4	102	955.4		
23	939.6	63	947.6	103	955.6		
24	939.8	64	947.8	104	955.8		
25	940	65	948	105	956		
26	940.2	66	948.2	106	956.2		
27	940.4	67	948.4	107	956.4		
28	940.6	68	948.6	108	956.6		
29	940.8	69	948.8	109	956.8		
30	941	70	949	110	957		
31	941.2	71	949.2	111	957.2		
32	941.4	72	949.4	112	957.4		
33	941.6	73	949.6	113	957.6		
34	941.8	74	949.8	114	957.8		
35	942	75	950	115	958		
36	942.2	76	950.2	116	958.2		
37	942.4	77	950.4	117	958.4		
38	942.6	78	950.6	118	958.6		
39	942.8	79	950.8	119	958.8		
40	943	80	951	120	959		

Table 8-5 Downlink channels in GSM900: E-GSM and R-GSM

R-GSM Channel	f [MHz]
955	921.2
956	921.4
957	921.6
958	921.8
959	922
960	922.2
961	922.4
962	922.6
963	922.8
964	923
965	923.2
966	923.4
967	923.6
968	923.8
969	924
970	924.2
971	924.4
972	924.6
973	924.8
974	925

E-GSM Channel	f [MHz]	E-GSM Channel	f [MHz]
975	925.2	1000	930.2
976	925.4	1001	930.4
977	925.6	1002	930.6
978	925.8	1003	930.8
979	926	1004	931
980	926.2	1005	931.2
981	926.4	1006	931.4
982	926.6	1007	931.6
983	926.8	1008	931.8
984	927	1009	932
985	927.2	1010	932.2
986	927.4	1011	932.4
987	927.6	1012	932.6
988	927.8	1013	932.8
989	928	1014	933
990	928.2	1015	933.2
991	928.4	1016	933.4
992	928.6	1017	933.6
993	928.8	1018	933.8
994	929	1019	934
995	929.2	1020	934.2
996	929.4	1021	934.4
997	929.6	1022	934.6
998	929.8	1023	934.8
999	930		

Table 8-6 Downlink channels in GSM1800

Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]
		551	1813	591	1821	631	1829
512	1805.2	552	1813.2	592	1821.2	632	1829.2
513	1805.4	553	1813.4	593	1821.4	633	1829.4
514	1805.6	554	1813.6	594	1821.6	634	1829.6
515	1805.8	555	1813.8	595	1821.8	635	1829.8
516	1806	556	1814	596	1822	636	1830
517	1806.2	557	1814.2	597	1822.2	637	1830.2
518	1806.4	558	1814.4	598	1822.4	638	1830.4
519	1806.6	559	1814.6	599	1822.6	639	1830.6
520	1806.8	560	1814.8	600	1822.8	640	1830.8
521	1807	561	1815	601	1823	641	1831
522	1807.2	562	1815.2	602	1823.2	642	1831.2
523	1807.4	563	1815.4	603	1823.4	643	1831.4
524	1807.6	564	1815.6	604	1823.6	644	1831.6
525	1807.8	565	1815.8	605	1823.8	645	1831.8
526	1808	566	1816	606	1824	646	1832
527	1808.2	567	1816.2	607	1824.2	647	1832.2
528	1808.4	568	1816.4	608	1824.4	648	1832.4
529	1808.6	569	1816.6	609	1824.6	649	1832.6
530	1808.8	570	1816.8	610	1824.8	650	1832.8
531	1809	571	1817	611	1825	651	1833
532	1809.2	572	1817.2	612	1825.2	652	1833.2
533	1809.4	573	1817.4	613	1825.4	653	1833.4
534	1809.6	574	1817.6	614	1825.6	654	1833.6
535	1809.8	575	1817.8	615	1825.8	655	1833.8
536	1810	576	1818	616	1826	656	1834
537	1810.2	577	1818.2	617	1826.2	657	1834.2
538	1810.4	578	1818.4	618	1826.4	658	1834.4
539	1810.6	579	1818.6	619	1826.6	659	1834.6
540	1810.8	580	1818.8	620	1826.8	660	1834.8
541	1811	581	1819	621	1827	661	1835
542	1811.2	582	1819.2	622	1827.2	662	1835.2
543	1811.4	583	1819.4	623	1827.4	663	1835.4
544	1811.6	584	1819.6	624	1827.6	664	1835.6
545	1811.8	585	1819.8	625	1827.8	665	1835.8
546	1812	586	1820	626	1828	666	1836
547	1812.2	587	1820.2	627	1828.2	667	1836.2
548	1812.4	588	1820.4	628	1828.4	668	1836.4
549	1812.6	589	1820.6	629	1828.6	669	1836.6
550	1812.8	590	1820.8	630	1828.8	670	1836.8

Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]
671	1837	711	1845	751	1853	791	1861	831	1869	871	1877
672	1837.2	712	1845.2	752	1853.2	792	1861.2	832	1869.2	872	1877.2
673	1837.4	713	1845.4	753	1853.4	793	1861.4	833	1869.4	873	1877.4
674	1837.6	714	1845.6	754	1853.6	794	1861.6	834	1869.6	874	1877.6
675	1837.8	715	1845.8	755	1853.8	795	1861.8	835	1869.8	875	1877.8
676	1838	716	1846	756	1854	796	1862	836	1870	876	1878
677	1838.2	717	1846.2	757	1854.2	797	1862.2	837	1870.2	877	1878.2
678	1838.4	718	1846.4	758	1854.4	798	1862.4	838	1870.4	878	1878.4
679	1838.6	719	1846.6	759	1854.6	799	1862.6	839	1870.6	879	1878.6
680	1838.8	720	1846.8	760	1854.8	800	1862.8	840	1870.8	880	1878.8
681	1839	721	1847	761	1855	801	1863	841	1871	881	1879
682	1839.2	722	1847.2	762	1855.2	802	1863.2	842	1871.2	882	1879.2
683	1839.4	723	1847.4	763	1855.4	803	1863.4	843	1871.4	883	1879.4
684	1839.6	724	1847.6	764	1855.6	804	1863.6	844	1871.6	884	1879.6
685	1839.8	725	1847.8	765	1855.8	805	1863.8	845	1871.8	885	1879.8
686	1840	726	1848	766	1856	806	1864	846	1872		
687	1840.2	727	1848.2	767	1856.2	807	1864.2	847	1872.2		
688	1840.4	728	1848.4	768	1856.4	808	1864.4	848	1872.4		
689	1840.6	729	1848.6	769	1856.6	809	1864.6	849	1872.6		
690	1840.8	730	1848.8	770	1856.8	810	1864.8	850	1872.8		
691	1841	731	1849	771	1857	811	1865	851	1873		
692	1841.2	732	1849.2	772	1857.2	812	1865.2	852	1873.2		
693	1841.4	733	1849.4	773	1857.4	813	1865.4	853	1873.4		
694	1841.6	734	1849.6	774	1857.6	814	1865.6	854	1873.6		
695	1841.8	735	1849.8	775	1857.8	815	1865.8	855	1873.8		
696	1842	736	1850	776	1858	816	1866	856	1874		
697	1842.2	737	1850.2	777	1858.2	817	1866.2	857	1874.2		
698	1842.4	738	1850.4	778	1858.4	818	1866.4	858	1874.4		
699	1842.6	739	1850.6	779	1858.6	819	1866.6	859	1874.6		
700	1842.8	740	1850.8	780	1858.8	820	1866.8	860	1874.8		
701	1843	741	1851	781	1859	821	1867	861	1875		
702	1843.2	742	1851.2	782	1859.2	822	1867.2	862	1875.2		
703	1843.4	743	1851.4	783	1859.4	823	1867.4	863	1875.4		
704	1843.6	744	1851.6	784	1859.6	824	1867.6	864	1875.6		
705	1843.8	745	1851.8	785	1859.8	825	1867.8	865	1875.8		
706	1844	746	1852	786	1860	826	1868	866	1876		
707	1844.2	747	1852.2	787	1860.2	827	1868.2	867	1876.2		
708	1844.4	748	1852.4	788	1860.4	828	1868.4	868	1876.4		
709	1844.6	749	1852.6	789	1860.6	829	1868.6	869	1876.6		
710	1844.8	750	1852.8	790	1860.8	830	1868.8	870	1876.8		

Table 8-7 Downlink channels in GSM850

Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]
		167	877	207	885	247	893
128	869.2	168	877.2	208	885.2	248	893.2
129	869.4	169	877.4	209	885.4	249	893.4
130	869.6	170	877.6	210	885.6	250	893.6
131	869.8	171	877.8	211	885.8	251	893.8
132	870	172	878	212	886		
133	870.2	173	878.2	213	886.2		
134	870.4	174	878.4	214	886.4		
135	870.6	175	878.6	215	886.6		
136	870.8	176	878.8	216	886.8		
137	871	177	879	217	887		
138	871.2	178	879.2	218	887.2		
139	871.4	179	879.4	219	887.4		
140	871.6	180	879.6	220	887.6		
141	871.8	181	879.8	221	887.8		
142	872	182	880	222	888		
143	872.2	183	880.2	223	888.2		
144	872.4	184	880.4	224	888.4		
145	872.6	185	880.6	225	888.6		
146	872.8	186	880.8	226	888.8		
147	873	187	881	227	889		
148	873.2	188	881.2	228	889.2		
149	873.4	189	881.4	229	889.4		
150	873.6	190	881.6	230	889.6		
151	873.8	191	881.8	231	889.8		
152	874	192	882	232	890		
153	874.2	193	882.2	233	890.2		
154	874.4	194	882.4	234	890.4		
155	874.6	195	882.6	235	890.6		
156	874.8	196	882.8	236	890.8		
157	875	197	883	237	891		
158	875.2	198	883.2	238	891.2		
159	875.4	199	883.4	239	891.4		
160	875.6	200	883.6	240	891.6		
161	875.8	201	883.8	241	891.8		
162	876	202	884	242	892		
163	876.2	203	884.2	243	892.2		
164	876.4	204	884.4	244	892.4		
165	876.6	205	884.6	245	892.6		
166	876.8	206	884.8	246	892.8		

Table 8-8 Downlink channels in GSM1900

Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]
		551	1938	591	1946	631	1954	671	1962
512	1930.2	552	1938.2	592	1946.2	632	1954.2	672	1962.2
513	1930.4	553	1938.4	593	1946.4	633	1954.4	673	1962.4
514	1930.6	554	1938.6	594	1946.6	634	1954.6	674	1962.6
515	1930.8	555	1938.8	595	1946.8	635	1954.8	675	1962.8
516	1931	556	1939	596	1947	636	1955	676	1963
517	1931.2	557	1939.2	597	1947.2	637	1955.2	677	1963.2
518	1931.4	558	1939.4	598	1947.4	638	1955.4	678	1963.4
519	1931.6	559	1939.6	599	1947.6	639	1955.6	679	1963.6
520	1931.8	560	1939.8	600	1947.8	640	1955.8	680	1963.8
521	1932	561	1940	601	1948	641	1956	681	1964
522	1932.2	562	1940.2	602	1948.2	642	1956.2	682	1964.2
523	1932.4	563	1940.4	603	1948.4	643	1956.4	683	1964.4
524	1932.6	564	1940.6	604	1948.6	644	1956.6	684	1964.6
525	1932.8	565	1940.8	605	1948.8	645	1956.8	685	1964.8
526	1933	566	1941	606	1949	646	1957	686	1965
527	1933.2	567	1941.2	607	1949.2	647	1957.2	687	1965.2
528	1933.4	568	1941.4	608	1949.4	648	1957.4	688	1965.4
529	1933.6	569	1941.6	609	1949.6	649	1957.6	689	1965.6
530	1933.8	570	1941.8	610	1949.8	650	1957.8	690	1965.8
531	1934	571	1942	611	1950	651	1958	691	1966
532	1934.2	572	1942.2	612	1950.2	652	1958.2	692	1966.2
533	1934.4	573	1942.4	613	1950.4	653	1958.4	693	1966.4
534	1934.6	574	1942.6	614	1950.6	654	1958.6	694	1966.6
535	1934.8	575	1942.8	615	1950.8	655	1958.8	695	1966.8
536	1935	576	1943	616	1951	656	1959	696	1967
537	1935.2	577	1943.2	617	1951.2	657	1959.2	697	1967.2
538	1935.4	578	1943.4	618	1951.4	658	1959.4	698	1967.4
539	1935.6	579	1943.6	619	1951.6	659	1959.6	699	1967.6
540	1935.8	580	1943.8	620	1951.8	660	1959.8	700	1967.8
541	1936	581	1944	621	1952	661	1960	701	1968
542	1936.2	582	1944.2	622	1952.2	662	1960.2	702	1968.2
543	1936.4	583	1944.4	623	1952.4	663	1960.4	703	1968.4
544	1936.6	584	1944.6	624	1952.6	664	1960.6	704	1968.6
545	1936.8	585	1944.8	625	1952.8	665	1960.8	705	1968.8
546	1937	586	1945	626	1953	666	1961	706	1969
547	1937.2	587	1945.2	627	1953.2	667	1961.2	707	1969.2
548	1937.4	588	1945.4	628	1953.4	668	1961.4	708	1969.4
549	1937.6	589	1945.6	629	1953.6	669	1961.6	709	1969.6
550	1937.8	590	1945.8	630	1953.8	670	1961.8	710	1969.8

Channel	f [MHz]	Kanal	f [MHz]	Kanal	f [MHz]
711	1970	751	1978	791	1986
712	1970.2	752	1978.2	792	1986.2
713	1970.4	753	1978.4	793	1986.4
714	1970.6	754	1978.6	794	1986.6
715	1970.8	755	1978.8	795	1986.8
716	1971	756	1979	796	1987
717	1971.2	757	1979.2	797	1987.2
718	1971.4	758	1979.4	798	1987.4
719	1971.6	759	1979.6	799	1987.6
720	1971.8	760	1979.8	800	1987.8
721	1972	761	1980	801	1988
722	1972.2	762	1980.2	802	1988.2
723	1972.4	763	1980.4	803	1988.4
724	1972.6	764	1980.6	804	1988.6
725	1972.8	765	1980.8	805	1988.8
726	1973	766	1981	806	1989
727	1973.2	767	1981.2	807	1989.2
728	1973.4	768	1981.4	808	1989.4
729	1973.6	769	1981.6	809	1989.6
730	1973.8	770	1981.8	810	1989.8
731	1974	771	1982		
732	1974.2	772	1982.2		
733	1974.4	773	1982.4		
734	1974.6	774	1982.6		
735	1974.8	775	1982.8		
736	1975	776	1983		
737	1975.2	777	1983.2		
738	1975.4	778	1983.4		
739	1975.6	779	1983.6		
740	1975.8	780	1983.8		
741	1976	781	1984		
742	1976.2	782	1984.2		
743	1976.4	783	1984.4		
744	1976.6	784	1984.6		
745	1976.8	785	1984.8		
746	1977	786	1985		
747	1977.2	787	1985.2		
748	1977.4	788	1985.4		
749	1977.6	789	1985.6		
750	1977.8	790	1985.8		

Table 8-9 GSM power classes and output powers

	GSM900		1800/1900	
TxPower Level (PCL)	**Nominal output power / dBm**	**Power Class/ Max. output power**	**Nominal output power / dBm**	**Power Class/ Max. output power**
0	43	1 / 20 W	30	1 / 1 W
1	41		28	
2	39	2 / 8 W	26	
3	37	3 / 5 W	24	2 / 0.25 W
4	35		22	
5	33	4 / 2 W	20	
6	31		18	
7	29	5 / 0.8 W	16	
8	27		14	
9	25		12	
10	23		10	
11	21		8	
12	19		6	
13	17		4	
14	15		-	
15	13		-	
16	11		-	
17	9		-	
18	7		-	
19	5		-	

GSM Phase 1: $0 \leq$ TxPower $\leq$ **15**

GSM Phase 2 (since 1996): $0 \leq$ TxPower $\leq$ **19**

Table 8-10 Definition of RX Level and RX Quality

Value of RX Level	Corresponding signal strength
63	> –48 dBm
62	–49 dBm to –48 dBm
62	–50 dBm to –49 dBm
...	...
...	...
2	–109 dBm to –108 dBm
1	–110 dBm to –109 dBm
0	< –110 dBm

Value of RX Quality	Corresponding bit error rate
0	0% to 0.2%
1	0.2% to 0.4%
2	0.4% to 0.8%
3	0.8% to 1.6%
4	1.6% to 3.2%
5	3.2% to 6.4%
6	6.4% to 12.8%
7	12.8% to 100%

UMTS Channels

The assignment between UMTS UARFCNs (UTRA Absolute Radio Frequency Channel Numbers) N , carrier frequency F, and frequency offset F_{offset} is defined in the 3GPP specification (TS 21.141). The following relation holds for both directions of transmission (uplink and downlink) and all operating bands (I to IX):

$$N = 5 \cdot (F / MHz - F_{offset}), \quad 0.0\ MHz \le F \le 3276.6\ MHz$$

The downlink and uplink channels assigned in the operating bands I to IX are listed in the tables below. Note that in operating bands II, IV and VI additional center frequencies are specified. These additional channels are outside of the normal 200 kHz raster and are calculated with different offsets according to the formula above, they must be specified with their channel frequency.

Table 8-11 UTRA operating bands and channel numbers: Downlink

Operating Band	DL Frequency Band (MHz)	DL Frequency Offset (MHz)	Assigned Channels (UARFCNs)	Assigned Center Frequencies (MHz)
I	2110 to 2170	0.0	10562 to 10838	2112.4 to 2167.6
II	1930 to 1990	0.0 1850.1	9662 to 9938, Additional channels: 412, 437, 462, 487, 512, 537, 562, 587, 612, 637, 662, 687	1932.4 to 1987.6, 1932.5, 1937.5, 1942.5, 1947.5, 1952.5, 1957.5, 1962.5, 1967.5, 1972.5, 1977.5, 1982.5, 1987.5
III	1805 to 1880	1575.0	1162 to 1513	1807.4 to 1877.6
IV	2110 to 2155	1805.0 1735.1	1537 to 1738, Additional channels: 1887, 1912, 1937, 1962, 1987, 2012, 2037, 2062, 2087	2112.4 to 2152.6, 2112.5, 2117.5, 2122.5, 2127.5, 2132.5, 2137.5, 2142.5, 2147.5, 2152.5
V	869 to 894	0.0 670.1	4357 to 4458, Additional channels: 1007, 1012, 1032, 1037, 1062, 1087	871.4 to 891.6, 871.5, 872.5, 876.5, 877.5, 882.5, 887.5
VI	875 to 885	0.0 670.1	4387 to 4413, Additional channels: 1037, 1062	877.4 to 882.6, 877.5, 882.5
VII	2620 to 2690	2175 2105.1	2237 to 2563 Additional channels: 2587, 2612, 2637, 2662, 2687, 2712, 2737, 2762, 2787, 2812, 2837, 2862, 2887, 2912	2622.4 to 2687.6, 2622.5, 2627.5, 2632.5, 2637.5, 2642.5, 2647.5, 2652.5, 2657.5, 2662.5, 2667.5, 2672.5, 2677.5, 2682.5, 2687.5
VIII	925 to 960	340	2937 to 3088	927.4 to 957.6
IX	1844.9 to 1879.9	0.0	9237 to 9387	1847.4 to 1877.4
Free (10 kHz resolution)[1]	80 to 3000	–	–	–

[1] freely configurable measurement with TSMU

Table 8-12 UTRA operating bands and channel numbers: Uplink

Operating Band	UL Frequency Band (MHz)	UL Frequency Offset (MHz)	Assigned Channels (UARFCNs)	Assigned Center Frequencies (MHz)
I	1920 to 1980	0.0	9612 to 9888	1922.4 MHz to 1977.6 MHz
II	1850 to 1910	0.0 1850.1	9262 to 9538, Additional channels: 12, 37, 62, 87, 112, 137, 162, 187, 212, 237, 262, 287	1852.4 MHz to 1907.6 MHz, 1852.5, 1857.5, 1862.5, 1867.5, 1872.5, 1877.5, 1882.5, 1887.5, 1892.5, 1897.5, 1902.5, 1907.5
III	1710 to 1785	1525.0	937 to 1287	1712.4 MHz to 1782.6 MHz
IV	1710 to 1755	1450.0 1380.1	1312 to 1513, Additional channels: 1662, 11687, 1712, 1737, 1762, 1787, 1812, 1837, 1862	1712.4 MHz to 1752.6 MHz, 1712.5, 1717.5, 1722.5, 1727.5, 1732.5, 1737.5, 1742.5, 1747.5, 1752.5
V	824 to 849	0.0 670.1	4132 to 4233, Additional channels: 782, 787, 807, 812, 837, 862	826.4 MHz to 846.6 MHz, 826.5, 827.5, 831.5, 832.5, 1 827.5, 842.5
VI	830 to 840	0.0 670.1	4162 to 4188, Additional channels: 812, 837	832.4 MHz to 837.6 MHz, 832.5, 837.5
VII	2500 to 2570	2100.0 2030.1	2012 to 2338 Additional channels: 2362, 2387, 2412, 2437, 2462, 2487, 2512, 2537, 2562, 2587, 2612, 2637, 2662, 2687	2502.4 MHz to 2567.6 MHz 2502.5, 2507.5, 2512.5, 2517.5, 2522.5, 2527.5, 2532.5, 2537.5, 2542.5, 2547.5, 2552.5, 2557.5, 2562.5, 2567.5
VIII	880 to 915	340	4412 to 4563	882.4 MHz to 912.6 MHz
IX	1749.9 to 1784.9	0.0	8762 to 8912	1752.4 MHz to 1782.4 MHz
Free (10 kHz resolution)[2]	80 to 3000	–	–	–

[2] freely configurable measurement with TSMU

Table 8-13 Downlink channels in UMTS operating band I

Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]	Channel	f [MHz]
10562	2112,4	10622	2124,4	10682	2136,4	10742	2148,4	10802	2160,4
10563	2112,6	10623	2124,6	10683	2136,6	10743	2148,6	10782	2156,4
10564	2112,8	10624	2124,8	10684	2136,8	10744	2148,8	10783	2156,6
10565	2113	10625	2125	10685	2137	10745	2149	10784	2156,8
10566	2113,2	10626	2125,2	10686	2137,2	10746	2149,2	10785	2157
10567	2113,4	10627	2125,4	10687	2137,4	10747	2149,4	10786	2157,2
10568	2113,6	10628	2125,6	10688	2137,6	10748	2149,6	10787	2157,4
10569	2113,8	10629	2125,8	10689	2137,8	10749	2149,8	10788	2157,6
10570	2114	10630	2126	10690	2138	10750	2150	10789	2157,8
10571	2114,2	10631	2126,2	10691	2138,2	10751	2150,2	10790	2158
10572	2114,4	10632	2126,4	10692	2138,4	10752	2150,4	10791	2158,2
10573	2114,6	10633	2126,6	10693	2138,6	10753	2150,6	10792	2158,4
10574	2114,8	10634	2126,8	10694	2138,8	10754	2150,8	10793	2158,6
10575	2115	10635	2127	10695	2139	10755	2151	10794	2158,8
10576	2115,2	10636	2127,2	10696	2139,2	10756	2151,2	10795	2159
10577	2115,4	10637	2127,4	10697	2139,4	10757	2151,4	10796	2159,2
10578	2115,6	10638	2127,6	10698	2139,6	10758	2151,6	10797	2159,4
10579	2115,8	10639	2127,8	10699	2139,8	10759	2151,8	10798	2159,6
10580	2116	10640	2128	10700	2140	10760	2152	10799	2159,8
10581	2116,2	10641	2128,2	10701	2140,2	10761	2152,2	10800	2160
10582	2116,4	10642	2128,4	10702	2140,4	10762	2152,4	10801	2160,2
10583	2116,6	10643	2128,6	10703	2140,6	10763	2152,6	10802	2160,4
10584	2116,8	10644	2128,8	10704	2140,8	10764	2152,8	10803	2160,6
10585	2117	10645	2129	10705	2141	10765	2153	10804	2160,8
10586	2117,2	10646	2129,2	10706	2141,2	10766	2153,2	10805	2161
10587	2117,4	10647	2129,4	10707	2141,4	10767	2153,4	10806	2161,2
10588	2117,6	10648	2129,6	10708	2141,6	10768	2153,6	10807	2161,4
10589	2117,8	10649	2129,8	10709	2141,8	10769	2153,8	10808	2161,6
10590	2118	10650	2130	10710	2142	10770	2154	10809	2161,8
10591	2118,2	10651	2130,2	10711	2142,2	10771	2154,2	10810	2162
10592	2118,4	10652	2130,4	10712	2142,4	10772	2154,4	10811	2162,2
10593	2118,6	10653	2130,6	10713	2142,6	10773	2154,6	10812	2162,4
10594	2118,8	10654	2130,8	10714	2142,8	10774	2154,8	10813	2162,6
10595	2119	10655	2131	10715	2143	10775	2155	10814	2162,8
10596	2119,2	10656	2131,2	10716	2143,2	10776	2155,2	10815	2163
10597	2119,4	10657	2131,4	10717	2143,4	10777	2155,4	10816	2163,2
10598	2119,6	10658	2131,6	10718	2143,6	10778	2155,6	10817	2163,4
10599	2119,8	10659	2131,8	10719	2143,8	10779	2155,8	10818	2163,6
10600	2120	10660	2132	10720	2144	10780	2156	10819	2163,8
10601	2120,2	10661	2132,2	10721	2144,2	10781	2156,2	10820	2164
10602	2120,4	10662	2132,4	10722	2144,4	10782	2156,4	10821	2164,2
10603	2120,6	10663	2132,6	10723	2144,6	10783	2156,6	10822	2164,4
10604	2120,8	10664	2132,8	10724	2144,8	10784	2156,8	10823	2164,6
10605	2121	10665	2133	10725	2145	10785	2157	10824	2164,8
10606	2121,2	10666	2133,2	10726	2145,2	10786	2157,2	10825	2165
10607	2121,4	10667	2133,4	10727	2145,4	10787	2157,4	10826	2165,2
10608	2121,6	10668	2133,6	10728	2145,6	10788	2157,6	10827	2165,4
10609	2121,8	10669	2133,8	10729	2145,8	10789	2157,8	10828	2165,6
10610	2122	10670	2134	10730	2146	10790	2158	10829	2165,8
10611	2122,2	10671	2134,2	10731	2146,2	10791	2158,2	10830	2166
10612	2122,4	10672	2134,4	10732	2146,4	10792	2158,4	10831	2166,2
10613	2122,6	10673	2134,6	10733	2146,6	10793	2158,6	10832	2166,4
10614	2122,8	10674	2134,8	10734	2146,8	10794	2158,8	10833	2166,6
10615	2123	10675	2135	10735	2147	10795	2159	10834	2166,8
10616	2123,2	10676	2135,2	10736	2147,2	10796	2159,2	10835	2167
10617	2123,4	10677	2135,4	10737	2147,4	10797	2159,4	10836	2167,2
10618	2123,6	10678	2135,6	10738	2147,6	10798	2159,6	10837	2167,4
10619	2123,8	10679	2135,8	10739	2147,8	10799	2159,8	10838	2167,6
10620	2124	10680	2136	10740	2148	10800	2160		
10621	2124,2	10681	2136,2	10741	2148,2	10801	2160,2		

Table 8-14 Downlink channels in UMTS operating band II

Channel	f [MHz]
9662	1932.4
9663	1932.6
9664	1932.8
9665	1933
9666	1933.2
9667	1933.4
9668	1933.6
9669	1933.8
9670	1934
9671	1934.2
9672	1934.4
9673	1934.6
9674	1934.8
9675	1935
9676	1935.2
9677	1935.4
9678	1935.6
9679	1935.8
9680	1936
9681	1936.2
9682	1936.4
9683	1936.6
9684	1936.8
9685	1937
9686	1937.2
9687	1937.4
9688	1937.6
9689	1937.8
9690	1938
9691	1938.2
9692	1938.4
9693	1938.6
9694	1938.8
9695	1939
9696	1939.2
9697	1939.4
9698	1939.6
9699	1939.8
9700	1940
9701	1940.2
9702	1940.4
9703	1940.6
9704	1940.8
9705	1941
9706	1941.2
9707	1941.4
9708	1941.6
9709	1941.8
9710	1942
9711	1942.2
9712	1942.4
9713	1942.6
9714	1942.8
9715	1943
9716	1943.2
9717	1943.4
9718	1943.6
9719	1943.8
9720	1944
9721	1944.2

Channel	f [MHz]
9722	1944.4
9723	1944.6
9724	1944.8
9725	1945
9726	1945.2
9727	1945.4
9728	1945.6
9729	1945.8
9730	1946
9731	1946.2
9732	1946.4
9733	1946.6
9734	1946.8
9735	1947
9736	1947.2
9737	1947.4
9738	1947.6
9739	1947.8
9740	1948
9741	1948.2
9742	1948.4
9743	1948.6
9744	1948.8
9745	1949
9746	1949.2
9747	1949.4
9748	1949.6
9749	1949.8
9750	1950
9751	1950.2
9752	1950.4
9753	1950.6
9754	1950.8
9755	1951
9756	1951.2
9757	1951.4
9758	1951.6
9759	1951.8
9760	1952
9761	1952.2
9762	1952.4
9763	1952.6
9764	1952.8
9765	1953
9766	1953.2
9767	1953.4
9768	1953.6
9769	1953.8
9770	1954
9771	1954.2
9772	1954.4
9773	1954.6
9774	1954.8
9775	1955
9776	1955.2
9777	1955.4
9778	1955.6
9779	1955.8
9780	1956
9781	1956.2

Channel	f [MHz]
9782	1956.4
9783	1956.6
9784	1956.8
9785	1957
9786	1957.2
9787	1957.4
9788	1957.6
9789	1957.8
9790	1958
9791	1958.2
9792	1958.4
9793	1958.6
9794	1958.8
9795	1959
9796	1959.2
9797	1959.4
9798	1959.6
9799	1959.8
9800	1960
9801	1960.2
9802	1960.4
9803	1960.6
9804	1960.8
9805	1961
9806	1961.2
9807	1961.4
9808	1961.6
9809	1961.8
9810	1962
9811	1962.2
9812	1962.4
9813	1962.6
9814	1962.8
9815	1963
9816	1963.2
9817	1963.4
9818	1963.6
9819	1963.8
9820	1964
9821	1964.2
9822	1964.4
9823	1964.6
9824	1964.8
9825	1965
9826	1965.2
9827	1965.4
9828	1965.6
9829	1965.8
9830	1966
9831	1966.2
9832	1966.4
9833	1966.6
9834	1966.8
9835	1967
9836	1967.2
9837	1967.4
9838	1967.6
9839	1967.8
9840	1968
9841	1968.2

Channel	f [MHz]
9842	1968.4
9843	1968.6
9844	1968.8
9845	1969
9846	1969.2
9847	1969.4
9848	1969.6
9849	1969.8
9850	1970
9851	1970.2
9852	1970.4
9853	1970.6
9854	1970.8
9855	1971
9856	1971.2
9857	1971.4
9858	1971.6
9859	1971.8
9860	1972
9861	1972.2
9862	1972.4
9863	1972.6
9864	1972.8
9865	1973
9866	1973.2
9867	1973.4
9868	1973.6
9869	1973.8
9870	1974
9871	1974.2
9872	1974.4
9873	1974.6
9874	1974.8
9875	1975
9876	1975.2
9877	1975.4
9878	1975.6
9879	1975.8
9880	1976
9881	1976.2
9882	1976.4
9883	1976.6
9884	1976.8
9885	1977
9886	1977.2
9887	1977.4
9888	1977.6
9889	1977.8
9890	1978
9891	1978.2
9892	1978.4
9893	1978.6
9894	1978.8
9895	1979
9896	1979.2
9897	1979.4
9898	1979.6
9899	1979.8
9900	1980
9901	1980.2

Channel	f [MHz]
9902	1980.4
9882	1976.4
9883	1976.6
9884	1976.8
9885	1977
9886	1977.2
9887	1977.4
9888	1977.6
9889	1977.8
9890	1978
9891	1978.2
9892	1978.4
9893	1978.6
9894	1978.8
9895	1979
9896	1979.2
9897	1979.4
9898	1979.6
9899	1979.8
9900	1980
9901	1980.2
9902	1980.4
9903	1980.6
9904	1980.8
9905	1981
9906	1981.2
9907	1981.4
9908	1981.6
9909	1981.8
9910	1982
9911	1982.2
9912	1982.4
9913	1982.6
9914	1982.8
9915	1983
9916	1983.2
9917	1983.4
9918	1983.6
9919	1983.8
9920	1984
9921	1984.2
9922	1984.4
9923	1984.6
9924	1984.8
9925	1985
9926	1985.2
9927	1985.4
9928	1985.6
9929	1985.8
9930	1986
9931	1986.2
9932	1986.4
9933	1986.6
9934	1986.8
9935	1987
9936	1987.2
9937	1987.4
9938	1987.6

The 12 additional downlink channels of the 200 MHz raster are listed in Table 8-11 on p. 8.31.

Table 8-15 Downlink channels in UMTS operating band III

Channel	f [MHz]
1162	1807,4
1163	1807,6
1164	1807,8
1165	1808
1166	1808,2
1167	1808,4
1168	1808,6
1169	1808,8
1170	1809
1171	1809,2
1172	1809,4
1173	1809,6
1174	1809,8
1175	1810
1176	1810,2
1177	1810,4
1178	1810,6
1179	1810,8
1180	1811
1181	1811,2
1182	1811,4
1183	1811,6
1184	1811,8
1185	1812
1186	1812,2
1187	1812,4
1188	1812,6
1189	1812,8
1190	1813
1191	1813,2
1192	1813,4
1193	1813,6
1194	1813,8
1195	1814
1196	1814,2
1197	1814,4
1198	1814,6
1199	1814,8
1200	1815
1201	1815,2
1202	1815,4
1203	1815,6
1204	1815,8
1205	1816
1206	1816,2
1207	1816,4
1208	1816,6
1209	1816,8
1210	1817
1211	1817,2
1212	1817,4
1213	1817,6
1214	1817,8
1215	1818
1216	1818,2
1217	1818,4
1218	1818,6
1219	1818,8
1220	1819
1221	1819,2
1222	1819,4
1223	1819,6
1224	1819,8
1225	1820
1226	1820,2
1227	1820,4
1228	1820,6
1229	1820,8
1230	1821

Channel	f [MHz]
1231	1821,2
1232	1821,4
1233	1821,6
1234	1821,8
1235	1822
1236	1822,2
1237	1822,4
1238	1822,6
1239	1822,8
1240	1823
1241	1823,2
1242	1823,4
1243	1823,6
1244	1823,8
1245	1824
1246	1824,2
1247	1824,4
1248	1824,6
1249	1824,8
1250	1825
1251	1825,2
1252	1825,4
1253	1825,6
1254	1825,8
1255	1826
1256	1826,2
1257	1826,4
1258	1826,6
1259	1826,8
1260	1827
1261	1827,2
1262	1827,4
1263	1827,6
1264	1827,8
1265	1828
1266	1828,2
1267	1828,4
1268	1828,6
1269	1828,8
1270	1829
1271	1829,2
1272	1829,4
1273	1829,6
1274	1829,8
1275	1830
1276	1830,2
1277	1830,4
1278	1830,6
1279	1830,8
1280	1831
1281	1831,2
1282	1831,4
1283	1831,6
1284	1831,8
1285	1832
1286	1832,2
1287	1832,4
1288	1832,6
1289	1832,8
1290	1833
1291	1833,2
1292	1833,4
1293	1833,6
1294	1833,8
1295	1834
1296	1834,2
1297	1834,4
1298	1834,6
1299	1834,8

Channel	f [MHz]
1300	1835
1301	1835,2
1302	1835,4
1303	1835,6
1304	1835,8
1305	1836
1306	1836,2
1307	1836,4
1308	1836,6
1309	1836,8
1310	1837
1311	1837,2
1312	1837,4
1313	1837,6
1314	1837,8
1315	1838
1316	1838,2
1317	1838,4
1318	1838,6
1319	1838,8
1320	1839
1321	1839,2
1322	1839,4
1323	1839,6
1324	1839,8
1325	1840
1326	1840,2
1327	1840,4
1328	1840,6
1329	1840,8
1330	1841
1331	1841,2
1332	1841,4
1333	1841,6
1334	1841,8
1335	1842
1336	1842,2
1337	1842,4
1338	1842,6
1339	1842,8
1340	1843
1341	1843,2
1342	1843,4
1343	1843,6
1344	1843,8
1345	1844
1346	1844,2
1347	1844,4
1348	1844,6
1349	1844,8
1350	1845
1351	1845,2
1352	1845,4
1353	1845,6
1354	1845,8
1355	1846
1356	1846,2
1357	1846,4
1358	1846,6
1359	1846,8
1360	1847
1361	1847,2
1362	1847,4
1363	1847,6
1364	1847,8
1365	1848
1366	1848,2
1367	1848,4

Channel	f [MHz]
1368	1848,6
1369	1848,8
1370	1849
1371	1849,2
1372	1849,4
1373	1849,6
1374	1849,8
1375	1850
1376	1850,2
1377	1850,4
1378	1850,6
1379	1850,8
1380	1851
1381	1851,2
1382	1851,4
1383	1851,6
1384	1851,8
1385	1852
1386	1852,2
1387	1852,4
1388	1852,6
1389	1852,8
1390	1853
1391	1853,2
1392	1853,4
1393	1853,6
1394	1853,8
1395	1854
1396	1854,2
1397	1854,4
1398	1854,6
1399	1854,8
1400	1855
1401	1855,2
1402	1855,4
1403	1855,6
1404	1855,8
1405	1856
1406	1856,2
1407	1856,4
1408	1856,6
1409	1856,8
1410	1857
1411	1857,2
1412	1857,4
1413	1857,6
1414	1857,8
1415	1858
1416	1858,2
1417	1858,4
1418	1858,6
1419	1858,8
1420	1859
1421	1859,2
1422	1859,4
1423	1859,6
1424	1859,8
1425	1860
1426	1860,2
1427	1860,4
1428	1860,6
1429	1860,8
1430	1861
1431	1861,2
1432	1861,4
1433	1861,6
1434	1861,8
1435	1862

Channel	f [MHz]
1436	1862,2
1408	1856,6
1409	1856,8
1410	1857
1411	1857,2
1412	1857,4
1413	1857,6
1414	1857,8
1415	1858
1416	1858,2
1417	1858,4
1418	1858,6
1419	1858,8
1420	1859
1421	1859,2
1422	1859,4
1423	1859,6
1424	1859,8
1425	1860
1426	1860,2
1427	1860,4
1428	1860,6
1429	1860,8
1430	1861
1431	1861,2
1432	1861,4
1433	1861,6
1434	1861,8
1435	1862
1436	1862,2
1437	1862,4
1438	1862,6
1439	1862,8
1440	1863
1441	1863,2
1442	1863,4
1443	1863,6
1444	1863,8
1445	1864
1446	1864,2
1447	1864,4
1448	1864,6
1449	1864,8
1450	1865
1451	1865,2
1452	1865,4
1453	1865,6
1454	1865,8
1455	1866
1456	1866,2
1457	1866,4
1458	1866,6
1459	1866,8
1460	1867
1461	1867,2
1462	1867,4
1463	1867,6
1464	1867,8
1465	1868
1466	1868,2
1467	1868,4
1468	1868,6
1469	1868,8
1470	1869
1471	1869,2
1472	1869,4
1473	1869,6
1474	1869,8

Channel	f [MHz]
1475	1870
1447	1864,4
1448	1864,6
1449	1864,8
1450	1865
1451	1865,2
1452	1865,4
1453	1865,6
1454	1865,8
1455	1866
1456	1866,2
1457	1866,4
1458	1866,6
1459	1866,8
1460	1867
1461	1867,2
1462	1867,4
1463	1867,6
1464	1867,8
1465	1868
1466	1868,2
1467	1868,4
1468	1868,6
1469	1868,8
1470	1869
1471	1869,2
1472	1869,4
1473	1869,6
1474	1869,8
1475	1870
1476	1870,2
1477	1870,4
1478	1870,6
1479	1870,8
1480	1871
1481	1871,2
1482	1871,4
1483	1871,6
1484	1871,8
1485	1872
1486	1872,2
1487	1872,4
1488	1872,6
1489	1872,8
1490	1873
1491	1873,2
1492	1873,4
1493	1873,6
1494	1873,8
1495	1874
1496	1874,2
1497	1874,4
1498	1874,6
1499	1874,8
1500	1875
1501	1875,2
1502	1875,4
1503	1875,6
1504	1875,8
1505	1876
1506	1876,2
1507	1876,4
1508	1876,6
1509	1876,8
1510	1877
1511	1877,2
1512	1877,4
1513	1877,6

The GPS Receiver

The Global Positioning System (GPS) is a satellite-supported navigation system which enables the current position of a user to be determined to within a few meters. In this system, a GPS receiver calculates the coordinates of the user from the satellite signals which contain the known positions of the satellites. To minimize disturbance the satellite signals are transmitted simultaneously on two frequencies.

The satellite signal consists of a message and codes. The message describes the position of the satellite and its path. The distances from the satellites can be calculated using the codes (spread spectrum technique). The correlation between the internal code copy and the code received enable a period of time corresponding to the distance being sought to be determined. The codes must also be decodable (correlated) for the message to be received. The GPS receiver evaluates the information and calculates its position on this basis.

GPS Data Transmission

The GPS receiver can be used to read the satellite signals into a processor via a serial interface. The signals can then be processed. The type of data format to be used for transferring the signals from the GPS receiver to the processor can be set at the receiver. Two frequently used formats are described below, the NMEA and the NAV string format:

(To get information in general and of the actual used GPS format please look up in the GPS manual)

<u>Sample NMEA format</u>

NMEA data has a format such as this: $GPGLL,1111.11,N,2222.222,W

$GPGLL	start mark and code for the longitude and latitude data
1111.11	geographical latitude
N	N = north, S = south
2222.222	geographical longitude
W	W = west, E = east

<u>Sample NAV string</u>

A navigation (NAV) string data block consists of 8 individual strings with at total of 110 ASCII characters.

String	Content	ASCII character
1	Reference time in UTC	13
2	Position (latitude, longitude, height [m])	27

3	3-D speed [m/s]	19
4	Current satellite	19
5	Test values	19
6	Status and BIT information	9
7	Check sum	2
8	End mark	2

GPS Glossary

2-D, 3-D	Refers to two-dimensional and three-dimensional positions. A 2-D position fix provides latitude and longitude. Altitude is assumed to be fixed. Only three satellites are required to provide a 2-D position with a user-supplied altitude. A 3-D position provides the altitude in addition to LAT/LON and requires four satellites.
Almanac	Data transmitted by a GPS satellite which includes orbit information on all the satellites, clock correction, and atmospheric delay parameters. This data is used to facilitate rapid SV acquisition. The orbit information is a subset of the ephemeris data with reduced accuracy.
Ambiguity	The unknown integer number of cycles of the reconstructed carrier phase contained in an unbroken set of measurements from a single satellite pass at a single receiver.
Argument of latitude	The sum of the true anomaly and the argument of perigee.
Argument of perigee	The angle or arc from the ascending node to the closest approach of the orbiting body to the focus or perigee point, as measured at the focus of an elliptical orbit, in the orbital plane in the direction of motion of the orbiting body.
Ascending node	The point at which an object's orbit crosses the reference plane (e.g. equatorial plane)from south to north.
Azimuth	A horizontal direction expressed as the angular distance between a fixed direction, say North, and the direction of the object.
Bandwidth	A measure of the information-carrying capacity of a signal, expressed as the width of the spectrum of that signal (frequency domain representation) in Hertz.
Baseline	The three-dimensional vector distance between a pair of stations for which simultaneous GPS data has been collected and processed with differential techniques. The most accurate GPS result.
Beat frequency	Either of the two additional frequencies obtained when signals of two frequencies are mixed. The beat frequencies are equal to the sum or difference of the original frequencies.
Bias	See Integer Bias Terms.
Binary biphase modulation	Phase changes of either 0 or 180 degrees on a constant frequency carrier (representing a binary 0 or 1 respectively). GPS signals are bi-phase modulated.
Binary pulse code modulation	Pulse modulation using a string of binary numbers (codes). This coding is usually represented by ones and zeros with definite meanings assigned to them, such as changes in phase or direction of a wave.
C/A code	The Coarse/Acquisition (or Clear/Acquisition) code modulated onto the GPS L1 signal. This code is a sequence of 1023 pseudo random binary bi-phase modulations on the GPS carrier at a chipping rate of 1.023 MHz, thus having a code repetition period of one millisecond. This code was selected to provide good acquisition properties.
Carrier	A radio wave having at least one characteristic (such as frequency, amplitude, phase)which may be varied from a known reference value by modulation.
Carrier beat	phase The phase of the signal which remains when the incoming Doppler-shifted satellite carrier signal is beat (the difference frequency signal is generated) with the nominally constant reference frequency generated in the receiver.
Carrier frequency	The frequency of the unmodulated fundamental output of a radio transmitter. The GPSL1 carrier frequency is 1575.42 MHz.
Celestial equator	The great circle that is the projection of the Earth's geographical equator of

	rotation onto the celestial sphere. Its poles are the North and South Celestial Poles.
Celestial meridian	That vertical circle through the elevated celestial pole. It also passes through the other celestial pole, the astronomical zenith, and the nadir.
Channel	The receiver hardware that is required to lock to a satellite, make the range measurements and collect data from the satellite.
Chip	The length of time to transmit either a zero or a one in a binary pulse code.
Chip rate	Number of chips per second (e.g., C/A code = 1.023 MHz).
Clock offset	Constant difference in the time reading between two clocks.
Code division multiple access (CDMA)	A method of frequency reuse whereby many radios use the same frequency but with each one having a separate and unique code. GPS uses CDMA techniques with Gold's codes for their unique cross-correlation properties.
Conventional international origin (CIO)	Average position of Earth's rotation axis during the years 1900- 1905.
Correlation-type channel	A GPS receiver channel which uses a delay lock loop to maintain an alignment(correlation peak) between the replica of the GPS code generated in the receiver and the received code.
Datum	A mathematical model of the earth. Many local data model the earth for a small region: e.g., Tokyo datum, OSGB-36 (Ordnance Survey of Great Britain 1936), NAD-27(North American). Others, WGS-84, for example, model the whole earth. See also Geodetic Datum
Deflection of the vertical	The angle between the normal to the ellipsoid and the vertical (true plumb line). Since this angle has both a magnitude and a direction, it is usually resolved into two components: one in the meridian and the other perpendicular to it in the prime vertical.
Delay lock	The technique whereby the received code (generated by the satellite clock) is compared with the internal code (generated by the receiver clock) and the latter is shifted in time until the two codes match. Delay lock loops can be implemented in several ways; tau dither and early-minus-late gating.
Delta pseudo-range	See reconstructed carrier phase.
DGPS	Differential GPS operation. The use of a reference station to provide corrections using the RTCM SC-104 protocol for one or more mobile receivers. This may be carried out in real time over a telemetry link or by storing the data and post processing (see below).The accuracy of position measurement may be improved from 100 meters 2dRMSunder Selective Availability conditions to 1 - 15 meters depending on the choice of sensors and telemetry.
Differential processing	GPS measurements can be differenced between receivers, satellites, and epochs. Although many combinations are possible, the present convention for differential processing of GPS phase measurements is to take differences between receivers(single difference), then between satellites (double difference), then between measurement epochs (triple difference). A single-difference measurement between receivers is the instantaneous difference in-phase of the signal from the same satellite, measured by two receivers simultaneously. A double-difference measurement is obtained by differencing the single difference for one satellite with respect to the corresponding single difference for a chosen reference satellite. A single-difference measurement is the difference between a double difference at one epoch of time and the same double difference at the previous epoch of

time.

Differential (relative) positioning — Determination of relative coordinates of two or more receivers which are simultaneously tracking the same satellites. Static differential GPS involves determining baseline vectors between pairs of receivers. See also DGPS.

Dilution of precision (DOP) — A description of the purely geometrical contribution to the uncertainty in a position fix, given by the expression DOP = SQRT TRACE (A A) where A A is the design matrix for the instantaneous position solution (dependent on satellite-receiver geometry). The DOP factor depends on the parameters of the position-fix solution. Standard terms for the GPS application are:

GDOP	Geometric (three position coordinates plus clock offset in the solution)
PDOP	Position (three coordinates)
HDOP	Horizontal (two horizontal coordinates)
TDOP	Time (clock offset only)
VDOP	Vertical (height only)
RDOP	Relative (normalized to 60 seconds)

Doppler aiding — The use of Doppler carrier-phase measurements to smooth code-phase position measurements.

Doppler shift — The apparent change in frequency of a received signal due to the rate of change of the range between the transmitter and receiver. See reconstructed carrier phase.

Double-difference method — A method to determine that set of ambiguity values which minimizes the variance of the solution for a receiver pair baseline vector.

Dynarnic positioning — Determination of a timed series of sets of coordinates for a moving receiver, each set of coordinates being determined from a single data sample, and usually computed in real time.

Earth-centered earth-fixed (ECEF) — Cartesian coordinate system where the X direction is the intersection of theprime meridian (Greenwich) with the equator. The vectors rotate with the earth. Z is the direction of the spin axis.

Eccentric anomaly E — The regularizing variable in the two-body problem. E is related to the mean anomaly M by Kepler's equation: M = E - e.sinE (e stands for eccentricity).

Eccentricity — The ratio of the distance from the center of an ellipse to its focus to the semimajor axis. e = (l - b^2/a^2)^-0.5 where a and b are the semimajor and semiminor axes of the ellipse.

Ecliptic — The earth-sun orbital plane. North is the direction of the system angular momentum. Also called the ecliptic pole.

Elevation — Height above mean sea level. Vertical distance above the geoid.

Elevation Mask Angle — That angle below which satellites should not be tracked. This varies according to the task and location, e.g. for land surveying it is normally set to 15 degrees to avoid interference problems caused by buildings, trees and multipath errors. For marine navigation on the other hand, the angle can be lowered to 5 degrees. Please note that,b ecause of the greater thickness of the ionosphere and troposphere traversed by the signal at low angles together with the increased distance of the satellite, the signal is weaker.

Ellipsoid — In geodesy, unless otherwise specified, a mathematical figure formed by revolving an ellipse about its minor axis. It is often used interchangeably with spheroid. Two quantities define an ellipsoid; these are usually given as the length of the semimajor axis, a, and the flattening, f = (a - b)/a, where b is the length of the semiminor axis. Prolate and triaxial ellipsoids are invariably

	described as such.
Ellipsoid height	The measure of vertical distance above the ellipsoid. Not the same as elevation above sea level. GPS receivers output position-fix height in the WGS-84 datum.
Ephemeris	A list of (accurate) positions or locations of a celestial object as a function of time. Available as "broadcast ephemeris" or as post processed "precise ephemeris." For GPS navigation purposes the broadcast ephemeris is always used and is updated every hour. It is sent as a set of 8 elements of the Keplerian orbital equation (qv) and used by the receiver to compute the instantaneous position of that satellite.
Epoch	Measurement interval or data frequency, as in making observations every 15 seconds. Loading data using 30-second epochs means loading every other measurement.
Fast switching channel	A switching channel with a sequence time short enough to recover (through software prediction) the integer part of the carrier beat phase.
Flattening	f = (a - b)/a = I -(I - e^2)^1/2 where: a = Semimajor axis b - Semiminor axis e = Eccentricity
Frequency band	A range of frequencies in a particular region of the electromagnetic spectrum.
Frequency spectrum	The distribution of amplitudes as a function of frequency of the constituent waves in a signal.
Fullwave	Term used to differentiate between measurements made with signal-squared (codeless)and code-tracking receivers. Specifically, a receiver tracking L2 P-code can make measurement using the whole L2 wavelength (23 cm): the full wave.
Fundamental frequency	The fundamental frequency used in GPS is 10.23 MHz. The carrier frequencies L1 and L2 are integer multiples of this fundamental frequency. L1 = 154F = 1575.42 MHz L2 =120F = 1227.60 MHz
GDOP	Geometric Dilution of Precision. The relationship between errors in user position and time and in satellite range. GDOP^2= PDOP^2 + TDOP^2
Geocenter	The center of the earth.
Geodetic datum	A mathematical model designed to best fit part or all of the geoid. It is defined by an ellipsoid and the relationship between the ellipsoid and a point on the topographic surface established as the origin of datum. This relationship can be defined by six quantities, generally (but not necessarily) the geodetic latitude, longitude, and the height of the origin, the two components of the deflection of the vertical at the origin, and the geodetic azimuth of a line from the origin to some other point. The GPS uses WGS-84.
Geoid	The actual physical shape of the earth which is hard to describe mathematically because of the local surface irregularities and sea-land variations. In geodetic terms it is the particular equipotential surface which coincides with mean sea level, and which maybe imagined to extend through the continents. This surface is everywhere perpendicular to the force of gravity.
Geoid height	The height above the geoid is often called elevation above mean sea level.
GPS	Global Positioning System, consisting of: 1) A Space Segment (up to 24 NAVSTAR satellites in 6 different orbits) 2) The Control Segment (5 monitor stations, 1 master control station and 3 upload stations) 3) The User Segment (GPS receivers) NAVSTAR satellites carry extremely accurate atomic clocks and broadcast coherent simultaneous signals.
GPS ICD-200	The GPS Interface Control Document is a government document that contains the full technical description of the interface between the satellites and the user.

	GPS receivers must comply with this specification if they are to receive and process GPS signals properly.
GPS Time	The length of the second is fixed and is determined by primary atomic frequency standards. Leap-seconds are not used, as they are in UTC. Therefore, GPS time and UTC differ by a variable whole number of seconds. See also Universal Time.
Gravitational constant	The proportionality constant in Newton's Law of Gravitation: G=6.672 x 1 1 1 Nm2/K92.
Greenwich mean time (GMT)	See Universal Time. They are often used interchangeably, although Universal Time is now defined as the accepted standard. Halfwave - Measurements made using L2-squared measurements. The squaring process results in only half of the original L2 wavelength being available.
HDOP	Horizontal Dilution of Precision. See DOP and PDOP.
HOW	Handover word. The word in the GPS message that contains time synchronization information for the transfer from the C/A code to the P-code.
Inclination	The angle between the orbital plane of a body and some reference plane (e.g., equatorial plane).
INS	Inertial Navigation System, which contains an inertial measurement unit (IMU).
Integer Bias Terms	The receiver counts the radio waves from the satellite, as they pass the antenna, to a high degree of accuracy. However, it has no information on the number of waves to the satellite at the time it started counting. This unknown number of wavelengths between the satellite and the antenna is the integer bias term.
Integrated Doppler	A measurement of Doppler shift frequency or phase over time.
IODE	Issue Of Data, Ephemeris. Part of the navigation data. It is the issue number of the ephemeris information. A new ephemeris is available usually on the hour. Especially important for Differential GPS operation that the IODE change is tracked at both the reference station and mobile stations.
Ionospheric delay	A wave propagating through the ionosphere [which is a non homogeneous (in space and time) and dispersive medium] experiences delay. Phase delay depends on electron content and affects carrier signals. Group delay depends on dispersion in the ionosphere as well, and affects signal modulation (codes). The phase and group delay are of the same magnitude but opposite sign.
ipar soln	Values giving the difference in each of delta X, delta Y, delta Z vector components.
JPO	Joint Program Office for GPS located at the USAF Space Division at El Segundo, California. The JPO consists of the USAF Program Manager and Deputy Program Managers representing the Army, Navy, Marine Corps, Coast Guard, Defense Mapping Agency and NATO.
Kalman Filter	A numerical method used to track a time-varying signal in the presence of noise. If the signal can be characterized by some number of parameters that vary slowly with time, then Kalman filtering can be used to tell how incoming raw measurements should be processed to best estimate those parameters as a function of time.
Kinematic surveying	A form of continuous differential carrier-phase surveying requiring only short periods of data observations. Operational constraints include starting from or determining a known baseline, and tracking a minimum of four satellites. One receiver is statically located at a control point, while others are moved between points to be measured.
Keplerian orbital	Allow description of any astronomical orbit:

elernents	a: semimajor axis l: right ascension of ascending node e: eccentricity i: inclination o: argument of perigee t: true anomaly
L1	The primary L-band signal radiated by each NAVSTAR satellite at 1575.42 MHz. The L1 beacon is modulated with the C/A and P-codes, and with the NAV message. L2 is centered at 1227.60 MHz and is modulated with the P-code and the NAV message.
Lane	The area (or volume) enclosed by adjacent lines (or surfaces) of zero phase of either the carrier beat phase signal, or of the difference between two carrier beat phase signals. On the earth's surface a line of zero phase is the locus of all points for which the observed value would be an exact integer for the complete instantaneous phase measurement. In three dimensions, this locus becomes a surface. Lane counts are used extensively also in terrestrial radio navigation systems such as Loran or Decca to define position.
L band	The radio-frequency band extending from 390 MHz to (nominally) 1550 MHz.
LLA	A topocentric spherical coordinate system, whose coordinates are Latitude, Longitude, and Altitude. Note that altitude can be expressed with respect to any particular ellipsoid or geoid model and generally depends on the model.
MCX	A small RF coaxial cable antenna connector system produced by several companies, e.g. Huber & Suhner.
Mean anomaly	M = n (t - T) where: n is the mean motion, t is the time and T is the instant of perigee passage.
Mean motion	n = 2 /P where P is the period of revolution.
Microstrip	Antenna. A two-dimensional, flat, precisely cut piece of metal foil glued to a substrate.
Monitor station	Worldwide group of stations used in the GPS control segment to monitor satellite clock and orbital parameters. Data collected here is linked to a Master Station where corrections are calculated and controlled. This data is uploaded to each satellite at least once per day from an Upload Station.
Multichannel receiver	A receiver containing many independent channels. Such a receiver offers highest SNR because each channel tracks one satellite continuously.
Multipath	Interference similar to "ghosts" on a television screen which occurs when GPS signals arrive at an antenna having traversed different paths. The signal traversing the longer path will yield a larger pseudo range estimate and increase the error. Multiple paths may arise from reflections from structures near the antenna.
Multipath error	A positioning error resulting from interference between radio waves which have traveled between the transmitter and the receiver by two paths of different electrical lengths.
Multiplexing channel	A receiver channel which is sequenced through several satellite signals (each from a specific satellite and at a specific frequency) at a rate which is synchronous with the satellite message bit-rate (50 bits per second, or 20 milliseconds per bit). Thus, one complete sequence is completed in a multiple of 20 milliseconds.
NAD-83	North American Datum, 1983.

NAVDATA	The 1500 bit Navigation Message broadcast by each satellite at 50 bps on both L1 or L2 beacons. This message contains system time, clock correction parameters, ionospheric delay model parameters, and the vehicle'ephemeris and health. This information is used to process GPS signals to obtain user position and velocity.
NAVSTAR	The name given to GPS satellites, built by Rockwell International (Block I) or GE (Block II), which is an acronym formed from NAVigation System with Time And Ranging.
N-type	A large diameter screwed coaxial antenna connector, normally used with RF cables such as RG213 or RG58 where the mechanical strain relief is taken through the connector.
Observing session	The period of time over which GPS data is collected simultaneously by two or more receivers.
Outage	The occurrence in time and space of a GPS dilution of precision value exceeding a specified maximum.
P-code	The protected or precise code used on both L1 and L2 GPS beacons. This code will be made available by the DOD only to authorized users. The P-code is a very long (about 1014 bits) sequence of pseudo random binary biphase modulations on the GPS carrier at a chipping rate of 10.23 MHz which does not repeat itself for about 38 weeks. Each satellite uses a one-week segment of this code which is unique to each GPS satellite, and is reset each week.
PDOP	Position Dilution of Precision, a unitless figure of merit expressing the relationship between the error in user position and the error in satellite position. Geometrically, PDOP is proportional to 1 divided by the volume of the pyramid formed by lines running from the receiver to four satellites observed. Values considered "good" for positioning are small, say 3. Values greater than 7 are considered poor. Thus, small PDOP is associated with widely separated satellites. Small PDOP is important in navigation and positioning, but much less so in surveying. PDOP is related to horizontal and vertical DOP by PDOP^2 = HDOP^2 + VDOP^2.
Parity error	A digital message is composed of 1s and 0s. Parity can be defined as the sum of these bits within a word unit. A parity error results when one of the bits is changed so that the parity calculated at reception is not the same as it was at transmission of the message.
PCB	Printed Circuit Board. Reference is also made to flexible PCBs, a method of providing flexible connector ribbons to normal PCBs.
Pengee	That point in a geocentric orbit when the geometric distance is a minimum. The closest approach of a body.
Phase lock	The technique whereby the phase of an oscillator signal is made to follow exactly the phase of a reference signal by first comparing the phases of the two signals, and then using the resulting phase difference signal to adjust the reference oscillator frequency to eliminate phase difference when the two signals are next compared.
Phase observable	See reconstructed carrier phase.
Point positioning	A geographic position produced from one receiver in a stand-alone mode. At best, position accuracy obtained from a stand-alone receiver is 15-25 meters, depending on the geometry of the satellites. With Selective Availability in operation the best that can be expected is 100 meters 2dRMS.
Polar motion	Motion of the instantaneous axis of the rotation of the Earth with respect to the solid body of the Earth. Irregular but more or less circular motion with an amplitude of about 15m and a main period of about 430 days (called Chandler

Wobble).

Precise positioning service (PPS)	The highest level of military dynamic positioning accuracy that will be provided by GPS, based on the dual-frequency P-code and having high anti-jam and anti-spoof qualities.
Prime vertical	The vertical circle perpendicular to the celestial meridian.
PRN	Pseudorandom noise, a sequence of digital Is and 0s which appears to be randomly distributed like noise, but which can be exactly reproduced. The important property of PRN codes is that they have a low autocorrelation value for all delays or lags except when they are exactly coincident. Each NAVSTAR satellite has its own unique C/A and P pseudorandom-noise codes.
Pseudolite	A ground-based GPS transmitter station which broadcasts a signal with a structure similar to that of an actual GPS satellite.
Pseudorange	A measure of the apparent propagation time from the satellite to the receiver antenna, expressed as a distance. Pseudorange is obtained by multiplying the apparent signal-propagation time by the speed of light. Pseudorange differs from the actual range by the amount that the satellite and user clocks are offset, by propagation delays, and other errors. The apparent propagation time is determined from the time shift required to align (correlate) a replica of the GPS code generated in the receiver with the received GPS code. The time shift is the difference between the time of signal reception (measured in the receiver time frame) and the time of emission (measured in the satellite time frame).
Pseudorange difference	See reconstructed carrier phase.
Range rate	The rate of change of range between the satellite and receiver. The range to a satellite changes due to satellite and observer motions. Range rate is determined by measuring the Doppler shift of the satellite beacon carrier.
RDOP	Relative Dilution Of Precision, defined as: $\frac{(\_DX^2 + \_DY^2 + DZ^2)^{1/2}}{\_DD}$ usually in units of m/cycle. Multiplying RDOP by the uncertainty of a double-difference measurement yields the spherical relative-position error.
Reconstructed carrier phase	The difference between the phase of the incoming Doppler-shifted GPS carrier and the phase of a nominally constant reference frequency generated in the receiver. For static positioning, the reconstructed carrier phase is sampled at epochs determined by a clock in the receiver. The reconstructed carrier phase changes according to the continuously integrated Doppler shift of the incoming signal, biased by the integral of the frequency offset between the satellite and receiver reference oscillators. The reconstructed carrier phase can be related to the satellite-to-receiver range, once the initial range (or phase ambiguity) has been determined. A change in the satellite-to-receiver range of one wavelength of the GPS carrier (19 cm for L1) will result in a one-cycle change in the phase of the reconstructed carrier.
Relative navigation	A technique similar to relative positioning except that one or both, of the points may be moving. The pilot of a ship or aircraft may need to know his position relative to a harbor or runway. A data link is used to relay the error terms to the moving vessel to allow real-time navigation.
Relative positioning	The process of determining the relative difference in position between two marks with greater precision than that to which the position of a single point can

	be determined. Here, a receiver (antenna) is placed over each spot and measurements are made by observing the same satellite at the same time. This technique allows cancellation (during computations) of all errors which are common to both observers, such as satellite clock errors, propagation delays, etc. See also Translocation and Differential Navigation.
Right ascension of ascending node	The angular distance measured from the vernal equinox, positive to the east, along the celestial equator to the ascending node. Typically denoted by a capital omega (Ω). Used to discriminate between orbital planes.
RTCM	Radio Technical Commission for Maritime Services. Commission set up to define a differential data link to relay GPS correction messages from a monitor station to a field user. RTCM SC-104 recommendations define the correction message format and 16 different correction message types.
SA	See Selective Availability SATNAV - A local term referring to use of the older TRANSIT system for satellite navigation. One major difference between TRANSIT and GPS is that the TRANSIT satellites are in low-altitude polar orbits with a 90-minute period.
Selective Availability(SA)	A DoD program to control the accuracy of pseudorange measurements, whereby the user receives a false pseudorange which is in error by a controlled amount. Differential GPS techniques can reduce these effects for local applications.
Semimajor axis	One half of the major axis of an ellipse.
SEP	Spherical Error Probable, a statistical measure of precision defined as the 50th percentile value of the three-dimensional position error statistics. Thus, half of the results are within a 3-D SEP value.
Sidereal day	Time between two successive upper transits of the vernal equinox.
Simultaneous measurements	Measurements referenced to time-frame epochs which are either exactly equal, or else so closely spaced in time that the time misalignment can be accommodated by correction terms in the observation equation, rather than by parameter estimation.
Slope distance	The three-dimensional vector distance from station one to station two. The shortest distance (a chord) between two points.
Slow switching channel	A switching channel with a sequencing period which is too long to allow recovery of the integer part of the carrier beat phase.
SMA, SMB, SMC	Small diameter RF coaxial cable connectors with various fastening mechanisms. See manufacturers' catalogues for details.
Solar day	Time between two successive upper transits of the sun.
Spheroid	See ellipsoid.
Spread spectrum	The received GPS signal is a wide bandwidth, low-power signal (-1 60dBW). This property results from modulating the L-band signal with a PRN code in order to spread the signal energy over a bandwidth which is much greater than the signal information bandwidth. This is done to provide the ability to receive all satellites unambiguously and to provide some resistance to noise and multipath.
Spread spectrum systems	A system in which the transmitted signal is spread over a frequency band much wider than the minimum bandwidth needed to transmit the information being sent.
Squaring-type channel	A GPS receiver channel which multiplies the received signal by itself to obtain a second harmonic of the carrier which does not contain the code modulation. Used in so-called codeless receiver channels.
Standard positioning service (SPS)	The level of dynamic- or static-positioning capability that will be provided by GPS, based on the single-frequency C/A-code. The accuracy of this service will

	be set at a level consistent with national security.
Static positioning	Positioning applications in which the positions of static or near static points are determined.
SV	Satellite Vehicle or Space Vehicle.
Switching channel	A receiver channel which is sequenced through a number of satellite signals (each from a specific satellite and at a specific frequency) at a rate which is slower than, and asynchronous with, the message data rate.
TAIP	Trimble ASCII Interface Protocol. A protocol used to interface with Trimble vehicle navigation sensors such as the Starfinder and SVeeSix. It is designed for bi-directional use with communication modems and radio data telemetry systems which have problems with binary or hexadecimal data packets. Each packet is preceded by two letters, followed by a sequence of alphanumeric information. A full specification of the protocol is contained Appended.
TANS	Trimble Advanced Navigation Sensor. A family of rugged 6 channel GPS sensors. Used also to refer to the protocol, also known as TSIP, Trimble Standard Interface Protocol (q.v.).
TDOP	Time Dilution of Precision. See DOP.
TOW	Time of week, in seconds, from midnight Sunday UTC.
Translocation	A version of relative positioning which makes use of a known position, such as a national survey authority mark, to aid in the accurate positioning of a desired point. Here, the position of the mark, determined using GPS, is compared with the accepted value. The three-dimensional differences are then used in the calculations for the second point.
Trop	Tropospheric correction. The correction applied to the measurement to account for tropospheric delay. This value is obtained from the modified Hopfield model.
True anomaly	The angular distance, measured in the orbital plane from the earth's center (occupied focus) from the perigee to the current location of the satellite (orbital body).
TSIP	Trimble Standard Interface Protocol. A binary/hex packet bi-directional protocol, also known as the TANS protocol. Used by a large number of Trimble sensors. TSIP is the subset of TANS which is recognized by all sensors except those of the 4000 series. The protocol is defined in full in the TSIP Appendix.
Universal time	Local solar mean time at Greenwich Meridian. Some commonly used versions of Universal Time are:

UTO	Universal Time as deduced directly from observations of stars and the fixed numerical relationship between Universal and Sidereal Time; 3 minutes 56.555 seconds.
UTI	UTO corrected for polar motion.
UT2	UTI corrected for seasonal variations in the earth's rotation rate.
UTC	Universal Time Coordinated; uniform atomic time system kept very close to UT2 by offsets. Maintained by the US. Naval Observatory. GPS time can be directly related to UTC.
UTC	GPS = seconds. (changing constant = 7 seconds in 1991).

User range accuracy (URA)	The contribution to the range-measurement error from an individual error source (apparent clock and ephemeris prediction accuracy's), converted into range units, assuming that the error source is uncorrelated with all other error sources. Values less than 10 are preferred. Block II satellites operating under Selective Availability are usually set to 32.

UTM	Universal Transverse Mercator Map Projection. A special case of the Transverse Mercator projection. Abbreviated as the UTM Grid, it consists of 60 north-south zones, each 6 degrees wide in longitude.
VDOP	Vertical Dilution of Precision. See DOP and PDOP.
Vernal equinox	The intersection of the celestial equator with the ecliptic, with the positive sense being from the earth to the sun, as the sun crosses the equator from south to north.
Vertical	The line perpendicular to the geoid at any point. The direction of the force of gravity at that point. Plumb line.
WGS-72	World Geodetic System (1972); the mathematical reference ellipsoid previously used by GPS, having a semimajor axis of 6378.135 km and a flattening of 1/298.26.
WGS-84	World Geodetic System (1984); the mathematical ellipsoid used by GPS since January 1987. The shift from WGS-72 to WGS-84 in Sunnyvale CA (370 N, 1220 W) is about 13.6 meters east, 45 meters north and 2.7 meters up.
Widelane	A linear combination of L1 and L2 observations (L1-L2) used to partially remove ionospheric errors. This combination yields a solution in about one-third the time of a complete ionosphere-free solution.
Z-count	The GPS satellite clock time at the leading edge of the next data subframe of the transmitted GPS message (usually expressed as an integer number of 6 seconds).

GSM Abbreviations

A

A3	Authentication Algorithm A3
A5/1	Encryption Algorithm A5
A5/2	Encryption Algorithm A5
A8	Algorithm A8
AB	Access Burst
AC	- Access Class (C0 to C15) - Application Context
ACC	Automatic Congestion Control
ACCH	Associated Control Channel
ACK	ACKnowledgement
ACM	Address Complete Message
ACU	Antenna Combining Unit
ADC	- ADministration Centre - Analogue to Digital Converter
ADN	Abbreviated Dialling Number
ADPCM	Adaptive Differential Pulse Code Modulation
AE	Application Entity
AEC	Acoustic Echo Control
AEF	Additional Elementary Functions
AGCH	Access Grant CHannel
Ai	Action indicator
AoCC	Advice of Charge (Charging) supplementary service
AoCI	Advice of Charge (Information) supplementary service
ASE	Application Service Element
ASN.1	Abstract Syntax Notation One
ARFCN	Absolute Radio Frequency Channel Number
ARQ	Automatic Request for Retransmission
ATT (flag)	Attach
AU	Access Unit
AuC	Authentication Centre
AUT(H)	Authentication

B

BA BCCH Allocation

BAIC Barring of All Incoming Calls supplementary service

BAOC Barring of All Outgoing Calls supplementary service

BCC Base Transceiver Station (BTS) Colour Code

BCCH Broadcast Control Channel

BCCH_FREQ_NCELL Frequency of the RF carrier on which the BCCH of a neighbouring cell is transmitted

BCD Binary Coded Decimal

BCF Base Station Control function

BCIE Bearer Capability Information Element

BCU (See GSM 08.56)

BER Bit Error Ratio

BFI Bad Frame Indication

BI all Barring of Incoming call services

BIC-Roam Barring of Incoming Calls when Roaming outside the HOME PLMN country supplementary service

Bm Full-rate traffic channel

BN Bit Number

BO all Barring of Outgoing call services

BOIC Barring of Outgoing International Calls supplementary service

BOIC-exHC Barring of Outgoing international Calls except those directed to the Home PLMN Country supplementary service

BS - Basic Service (group)

- Bearer Service

BS_AG_BLKS_RES Number of blocks on each common control channel reserved for access grant messages

BS_BCCH_SDCCH_C0MB Logical variable that indicates the combination of dedicated and associated control channels on the same physical channel

BS_CC_CHANS Number of basic physical channels supporting common control channels

BSG Basic Service Group

BS_G_BLKS_RES Number of blocks on each common control channel reserved for access grant messages

BS_PA_MFRMS Number of multiframes between two transmissions of the same paging message to MSs of the same paging group

BSC Base Station Controller

BSIC Base Transceiver Station Identity Code

BSIC-NCELL BSIC of an adjacent cell

BSS Base Station System

BSSAP Base Station System Application Part

BSSMAP Base Station System Management Application Part

BSSOMAP Base Station Operation and Maintenance Application Part

BTS Base Transceiver Station

C

C Conditional

CA Cell Allocation

CAI Charge Advice Information

CA_BAND_NUMB Number of the frequency band that contains the cell allocation

CBC Cell Broadcast Centre

CBCH Cell Broadcast CHannel

CC Country Code

CC Call Control

CCBS Completion of Calls to Busy Subscribers supplementary service

CCCH Common Control CHannel

CCCH_GROUP Group of MSs in idle mode

CCF Conditional Call Forwarding

CCH Control CHannel

CCITT Comité Consultatif International Télégraphique et Téléphonique

CCPE Control Channel Protocol Entity

Cct Circuit

CED called station identifier

CELL-BAR-ACCESS Cell Access Barred

CELL_RESELECT_HYSTERESIS RXLEV Hysteresis required for Cell Reselection

CEPT Conférence des administrations Européennes des Postes et Telecommunications

CFC Conditional Call Forward

CF - Conversion Facility
- All Call Forwarding services

CFB Call Forwarding on mobile subscriber Busy supplementary service

CFNRc Call Forwarding on MS Not Reachable supplementary service

CFNRy Call Forwarding on No Reply supplementary service

CFU Call Forwarding Unconditional supplementary service

CHV Card Holder Verification

CI - Cell Identity
- CUG Index

CIR Channel Interference Ratio

CKSN Ciphering Key Sequence Number

CLI Calling Line Identity

CLIP Calling Line Identification Presentation supplementary service

CLIR Calling Line Identification restriction supplementary service

CM Connection Management

CMD Command

CMM Channel Mode Modify

CNG calling tone

COLI Connect Line Identity

CoLP Connected Line Identification Presentation supplementary service

CoLR Connected Line identification Restriction supplementary service

COM Complete

CONNACK CONNect ACKnowledgement

C/R Command/Response field bit

CRC Cyclic Redundancy Check (3 bit)

CRE Call RE-establishment procedure

CS Coding Scheme

CSPDN Circuit Switched Public Data Network

CT Channel Tester

CUG Closed User Group supplementary service

CW Call Waiting supplementary service

D

DAC Digital to Analogue Converter

DB Dummy Burst

DCCH Dedicated Control Channel

DCE Data Circuit terminating Equipment

DCF Data Communication Function

DCN Data Communication Network

DET Detach

DISC DISConnect

DL - Data Link (layer),
- Downlink (base station to mobile)

DLCI Data Link Connection Identifier

DLD Data Link Discriminator

Dm Control Channel (ISDN terminology applied to mobile service)

DMR Digital Mobile Radio

DNIC Data Network Identifier

DP Dial/Dialled Pulse

DRX Discontinuous Reception (Mechanism)

DSE Data Switching Exchange

DSI Digital Speech Interpolation

DSS1 Digital Subscriber Signalling No1

DTAP Direct Transfer Application Part

DTE Data Terminal Equipment

DTMF Dual Tone Multi-Frequency (signalling)

DTX Discontinuous Transmission (Mechanism)

E

EA External Alarms

EBSG Elementary Basic Service Group

ECM Error Correction Mode (facsimile)

Ec/No Ratio of energy per modulating bit to the noise spectral density

ECT Explicit Call Transfer supplementary service

EEL Electric Echo Loss

EIR Equipment Identity Register

EL Echo Loss

EMMI Electrical Man Machine Interface

ERP Ear Reference Point

ERR ERRor

ETR ETSI Technical Report

ETS European Telecommunication Standard

ETSI European Telecommunications Standards Institute

F

FA - Full Allocation
- Fax Adapter

FAC Final Assembly Code

FACCH Fast ACCH

FACCH/F Full rate Fast Associated Control Channel

FACCH/H Half rate Fast Associated Control Channel

FB Frequency correction Burst

FCCH Frequency Correction CHannel

FCS Frame Check Sequence

FDM Frequency Division Multiplex

FEC Forward Error Correction

FER Frame Erasure Ratio

FH Frequency Hopping

FN Frame Number

FR Full Rate

ftn forwarded-to number

G

GMSC Gateway Mobile services Switching Centre

GMSK Gaussian Minimum Shift Keying (modulation)

GPA GSM PLMN Area

GPRS General Packet Radio Service

GSA GSM System Area

GSM Global System for Mobile communication

GSM MS GSM Mobile Station

GSM PLMN GSM Public Land Mobile Network

GT Global Title

H

HANDO Handover

HDLC High Level Data Link Control

HLC High Layer Compatibility

HLR Home Location Register

HO_MARGIN SDL Message name for Handover Margin

HOLD Call Hold supplementary service

HPLMN Home PLMN

HPU Hand Portable Unit

HR Half Rate

HSN Hopping Sequence Number

I

I Information (frames)

IA Incoming Access (closed user group SS)

IAM Initial Address Message

IC Interlock Code (CUG SS)

ICB Incoming Calls Barred

IC(pref) Interlock Code of the preferential CUG

ICM In-Call Modification

ID Identification / Identity

IDN Integrated Digital Network

IE Signalling Information Element

IEI Information Element Identifier

IMEI International Mobile station Equipment Identity

IMSI International Mobile Subscriber Identity

IN Interrogating Node

IPv4 Internet Protocol version 4

ISC International Switching Centre

ISDN Integrated Services Digital Network

ISUP ISDN User Part (of signalling system No.7)

ITC Information Transfer Capability

IWF InterWorking Function

IWMSC InterWorking MSC

IWU InterWorking Unit

K

K Constraint Length of the Convolutional Code

Kc Ciphering Key

Ki Individual subscriber authentication key

L

L1 Layer 1

L2ML Layer 2 Management Link

L2R Layer 2 Relay

L2R BOP L2R Bit Orientated Protocol

L2R COP L2R Character Orientated Protocol

L3 Layer 3

LA Location Area

LAC Location Area Code

LAI Location Area Identity

LAN Local Area Network

LAPB Link Access Protocol Balanced

LAPDm Link Access Protocol on the Dm channel
LCN Local Communication Network
LE Local Exchange
LI - Length Indicator
- Line Identity
LLc Low Layer Compatibility
Lm Traffic channel with capacity lower than Bm
LMSI Local Mobile Station Identity
LPLMN Local PLMN
LR Location Register
LSTR Listener Sidetone Rating
LTE Local Terminal Emulator
LV Length and Value

M

MA Mobile Allocation
MAC Medium Access Control (GPRS)
MACN Mobile Allocation Channel Number
MAF Mobile Additional Function
MAH Mobile Access Hunting supplementary service
MAI Mobile Allocation Index
MAIO Mobile Allocation Index Offset
MAP Mobile Application Part
MCC Mobile Country Code
MCI Malicious Call Identification supplementary service
MCS Modulation and Coding Scheme
MD Mediation Device
MDL (mobile) Management (entity) - Data Link (layer)
ME - Maintenance Entity
- Mobile Equipment
MEF Maintenance Entity Function
MF MultiFrame
MHS Message Handling System
MIC Mobile Interface Controller
MM - Man Machine
- Mobility Management
MME Mobile Management Entity

MMI Man Machine Interface

MNC Mobile Network Code

MO Mobile Originated

MoU Memorandum of Understanding

MPH (mobile) Management (entity) - PHysical (layer) [primitive]

MPTY MultiParTY supplementary service

MRP Mouth Reference Point

MS Mobile Station

MS_PWR_CLASS MS PoWeR Class. Parameter defining the power class of an MS expressed in the same way as the R parameters

MS_RANGE_MAX Mobile Station Range Maximum. Handover criterion to determine serving cell

MS_RXLEV_L Lower Receive Level. Threshold of RXLEV received from the serving BS below which either power control or handover must take place to improve the cell quality

MS_TXPWR_CONF MS Transmitted RF Power Confirmation. Parameter sent by the MS to indicate its current transmitted RF power level

MS_TXPWR_MAX_CCH Maximum Allowed Transmitted RF Power for MSs to Access the System until commanded otherwise

MS_TXPWR_REQUEST MS Transmitted RF Power Request. Parameter sent by the BSS that commands the required MS RF Power Level

MSC Mobile-services Switching Centre, Mobile Switching Centre

MSCM Mobile Station Class Mark

MSCU Mobile Station Control Unit

MSISDN Mobile Station ISDN Number

MSRN Mobile Station Roaming Number

MT - Mobile Terminated

MT (0,1,2) - Mobile Termination

MTM Mobile-To-Mobile (call)

MTP Message Transfer Part

MUMS Multi User Mobile Station

N

N/W Network

NB Normal Burst

NBIN A parameter in the hopping sequence

NC0, NC1, NC2 NETWORK_CONTROL_ORDER options defining the measurement reports provided by the mobile and its cell re-selection

NCC Network (PLMN) Colour Code

NCELL Neighbouring (or current serving) Cell

NDC National Destination Code

NDUB Network Determined User Busy

NE Network Element

NEF Network Element Function

NET Norme Européenne des Télécommunications

NF Network Function

NIC Network Independent Clocking

NM Network Management

NMC Network Management Centre

NMSI National Mobile Station Identification number

NPI Number Plan Indentifier

NSAP Network Service Access Point

NSAPI Network layer Service Access Point Identifier

NT - Network Termination

- Non Transparent

NUA Network User Access

NUI Network User Identification

NUP National User Part (of signalling system No7)

O

O Optional

OA Outgoing Access (CUG SS)

O&M Operations & Maintenance

OACSU Off-Air-Call-Set-Up

OCB Outgoing Calls Barred within the CUG

OD Optional for operators to implement for their aim

OLR Overall Loudness Rating

OMC Operations & Maintenance Centre

OML Operations and Maintenance Link

OS Operating System

OSI Open System Interconnection

OSI RM OSI Reference Model

P

PABX Private Automatic Branch eXchange

PAD Packet Assembly/Disassembly facility

PAGING_GROUP The set of MSs monitoring a particular paging block

PCH Paging CHannel

PCM Pulse Code Modulation

PD - Protocol Discriminator
- Public Data

PDN Public Data Networks

PH - Packet Handler
- PHysical (layer)

PHI Packet Handler Interface

PI Presentation Indicator

PIN Personal Identification Number

PLMN_PERMITTED PLMN Permitted for handover purposes

PLMN Public Land Mobile Network

PNE Présentation des Normes Européennes

POI Point Of Interconnection (with PSTN)

PP Point-to-Point

PPE Primative Procedure Entity

Pref CUG Preferential CUG

Ps Location Probability

PSPDN Packet Switched Public Data Network

PSTN Public Switched Telephone Network

PW Pass Word

Q

QA Q (Interface) - Adapter

QAF Q - Adapter Function

QoS Quality Of Service

R

[R] Value of Reduction of the MS Transmitted RF Power relative to the maximum allowed output power of the highest power class of MS (A)

RA RAndom mode request information field

RAB Random Access Burst

RACH Random Access CHannel

RADIO_LINK_TIMEOUT The timeout period for radio link failure. Maximum value of the radio link timer

RADIO_LINK_TIMER Parameter which is incremented or decremented according to the success with which SACCH messages are decoded

RAND RANDom Number (used for authentication)

RBER Residual Bit Error Ratio

REC RECommendation

REJ Reject(ion)

REL RELease

REQ REQuest

RESELECT_INTERVAL_MIN Minimum time between cell reselections

RFC Radio Frequency Channel

RFCH Radio Frequency CHannel

RFN Reduced TDMA Frame Number

RLC Radio Link Control (GPRS)

RLP Radio Link Protocol

RLR Receiver Loudness Rating

RMS Root Mean Square (value)

RNTABLE Table of 128 integers in the hopping sequence

RPOA Recognised Private Operating Agency

RR Radio Resource

RSE Radio System Entity

RSL Radio Signalling Link

RTE Remote Terminal Emulator

RXLEV Received Signal Level

RXLEV_ACCESS_MIN The minimum received signal level at a MS for access to a cell

RXLEV_MIN The minimum received signal level at a MS from a neighbouring cell for handover to be permitted

RXLEV_NCELL Received signal level of neighbouring or current serving cell measured on the BCCH carrier

RXLEV_SERVING_CELL Received signal level in the serving cell measured on the BCCH carrier

RXQUAL Received Signal Quality

RXQUAL_FULL Received signal quality assessed over the full set of TDMA frames within a SACCH block

RXQUAL_SERVING_CELL Received signal quality of serving cell

RXQUAL_SUB Received signal quality assessed over a subset of 12 TDMA frames

S

S/W SoftWare

SABM Set Asynchronous Balanced Mode

SACCH Slow Associated Control CHannel

SACCH/C4 Slow, SDCCH/4 Associated, Control CHannel

SACCH/C8 Slow, SDCCH/8 Associated, Control CHannel
SACCH/T Slow, TCH-Associated, Control CHannel
SACCH/TF Slow, TCH/F-Associated, Control CHannel
SACCH/TH Slow, TCH/H-associated, Control CHannel
SAP Service Access Point
SAPI Service Access Point Indicator/Identifier
SB Synchronization Burst
SC - Service Centre (used for SMS)
- Service Code
SCCP Signalling Connection Control Part
SCH Synchronization CHannel
SCN Sub-Channel Number
SDCCH Stand-alone Dedicated Control CHannel
SDCCH/4 Stand-alone Dedicated Control CHannel/4
SDCCH/8 Stand-alone Dedicated Control CHannel/8
SDL Specification Description Language
SDU Service Data Unit
SE Support Entity
SEF Support Entity Function
SFH Slow Frequency Hopping
SI - Screening Indicator
- Service Interworking
- Supplementary Information (SIA Supplementary Information A)
SID Silence Descriptor
SIM Subscriber Identity Module
SLR Send Loudness Rating
SLTM Signalling Link Test Message
SME Short Message Entity
SMS Short Message Service
SMSCB Short Message Service Cell Broadcast
SMS-SC Short Message Service - Service Centre
SMS/PP Short Message Service / Point-to-Point
Smt Short message terminal
SN Subscriber Number
SNDCPSubnetwork Dependent Convergence Protocol
SNR Serial NumbeR
SOA Suppress Outgoing Access
SP - Service Provider
- Signalling Point

- Spare

SPC Signalling Point Code

SPC Suppress Preferential (CUG)

SRES Signed RESponse (authentication)

SS - Supplementary Service

- System Simulator

SSC Supplementary Service Control string

SSN Sub-System Number

SS7/SS#7 Signalling System No 7

STMR Sidetone Masking Rating

STP Signalling Transfer Point

T

T - Timer

- Transparent

- Type only

TA Terminal Adapter

TAC Type Approval Code

TAF Terminal Adaptation Function

TBF Temporary Block Flow

TC Transaction Capabilities

TCH Traffic CHannel

TCH/F A Full-rate TCH

TCH/F2.4 A Full-rate data TCH (< 2.4kbit/s)

TCH/F4.8 A Full-rate date TCH (4.8kbit/s)

TCH/F9.6 A Full-rate data TCH (9.6kbit/s)

TCH/FS A Full-rate Speech TCH

TCH/H A Half-rate TCH

TCH/H2.4 A Half-rate data TCH (2.4kbit/s)

TCH/H4.8 A Half-rate data TCH (4.8kbit/s)

TCH/HS A Half-rate Speech TCH

TCI Transceiver Control Interface

TDMA Time Division Multiple Access

TE Terminal Equipment

Tei Terminal endpoint identifier

TFA Transfer Allowed

TFI Temporary Flow Identity

TFP Transfer Prohibited

TI Transaction Identifier

TLV Type, Length and Value

TMN Telecommunications Management Network

TMSI Temporary Mobile Subscriber Identity

TN Timeslot Number

TON Type Of Number

TRX Transceiver

TS - Time Slot

- Technical Specification (see ETS)

- Teleservice

TSC Training Sequence Code

TSDI Transceiver Speech & Data Interface

TUP Telephone User Part (of signalling system No7)

TV Type and Value

TXPWR Transmit power; Tx power level in the MS_TXPWR_REQUEST and MS_TXPWR_CONF parameters

U

UDI Unrestricted Digital Information

UDUB User Determined User Busy

UI Unnumbered Information (Frame)

UL Uplink (mobile to base station)

UPCMI Uniform PCM Interface (13-bit)

UPD Up to Date

USSD Unstructured SS Data

UUS User-to-User Signalling supplementary service

V

V Value only

VAD Voice Activity Detection

VAP Videotex Access Point

VLR Visitor Location Register

VMSC Visited MSC, (recommendation not to be used)

VPLMN Visited PLMN

VSC Videotex Service Centre

V(SD) SenD state Variable

VTX host The components dedicated to Videotex service

W

WS Work Station

WPA Wrong Password Attempts (counter)

X

XID eXchange IDentifier

Contents

9 Messages 9.1

Message Dialogs 9.1

Choice List Dialogs 9.1

9 Messages

This chapter describes the messages shown during database maintenance procedures. Some of the choice list dialogs do not appear during measurement, they are only shown during manual database manipulations. Those messages are written to the file *CtoI_Reports.txt* in the *TestFile* subdirectory of the main directory.

Message Dialogs

- *DB Init: Database Init OK:* A database has been successfully loaded.
- *DB Init: Init Failed:* The database could not be loaded. See the accompanying choice list dialog for details.
- *DB Init: Transmitter Scan is nonlinear:* There are several Transmitter Scan values out of the allowed deviation. See the accompanying choice list dialog for details.

The other Message Dialogs are self explanatory.

Choice List Dialogs

****

Message #1 **Info**

Unexpected network type
Database: DCS1800
BTS_INFO frame: GSM

Abort

Reason: A database was loaded which contains a network type different from the one chosen in the *network* field in the *DB Settings/Query* dialog.

Effect: The new database was not loaded.

****

Message #2 **Info**

Missing DLL
No DLL GSS_K6_Import_... is available in the path

Abort

Reason: If the user takes the opportunity to write a dynamical linked library (DLL) to define the loading of a network operator file of its own format (see chapter 5) this DLL must be in the main directory or in a directory being in the path so that automatic loading is possible.

Effect: The database is not created or updated.

****

Message #3 **Info**

Skip sector <*nr*> (name)

Abort
Suppress this message for the next sectors
OK

Reason: If the user takes the opportunity to write a dynamical linked library (DLL) to define the loading of a network operator file of its own format (see chapter 5) and has defined a situation where loading yields the return value SKIP_SECTOR this message appears, showing the sector number <*nr*> and, if defined, the sector name.

Effect: Abort selected: The database remains unchanged
Suppress this message for the next sectors: During loading of the ASCII file, this message is not shown anymore on screen. Instead, all subsequent messages are written into the file *Dummy.chl* in the subdirectory *TestFiles.*

OK selected: This sector is not loaded, but the program continues loading the next sector.

****

Message #4

Format error

Wrong BCC
At value: 8
In line 33
BTS1 | 22.33454 | 44.5666 | 8 | 120 | 34 | 77

Abort

Reason: Format error was found in ASCII text.

Effect: The database remains unchanged.

Remarks: The error is specified in more detail by the name (here BCC), the value (here 8), the line number in the text file (here 33, where caption line is line number 0) and the contents of the complete line.

****

Message #5

Info

Line buffer too small while reading antenna type list

Abort

Reason: The length of one line in the antenna type list text file exceeds 256 bytes.

Effect: The database remains unchanged.

Remarks: The end-of-line character is Line Feed (= 0x0A)

****

Message #6

Info

More than 3 sectors at one position with the same clock code.

Ok

Reason: The database can handle up to 3 synchronized sectors at one position. If more than 3 sectors at one position share the same clock code, the PCSD will try to separate the sectors by their name. If that is not possible a message occurs.

Effect: The database remains unchanged.

****

Message #7

Info

Skip invalid position value:

34.5566 -> 34.5578
11.2345 -> 11.4345
22.2 km (distance) > 0.6 km (max. range)

Ok
All

Reason: Before processing any Transmitter Scan data the system checks whether a valid position value was obtained during the last 3 evaluated seconds. A position value is valid if it lies inside a circle of radius $r = 100\text{ m} + 120\text{ km/h} * (t - t_1)$ around the position measured at time t_1. Message no. 10 indicates that an invalid position value was detected.

Effect: OK selected: The indicated position value will be skipped.
All selected: The indicated position value and all subsequent invalid position values will be skipped.

Remarks: Parameters displayed: position measured at time t_1 (here: 34.5566, 11.2345)
invalid position at time t (here: 34.5578, 11.4345)
distance between the position values (here: 22.2 km)
allowed distance (here: 0.6 km)

****

Message #8

Info

Measurement not related to database.

Ok

Reason: No Transmitter Scan was assigned to a BTS in the database.

Effect: The database remains unchanged.

Remarks: Possible reasons

1) The GPS was not working properly during the Transmitter Scan. In this case no position data for the Transmitter Scan are found and an assignment to a BTS is not possible
2) The Transmitter Scan was performed in an area for which no BTSs are available in the database
3) The network has been provided with a new channel configuration, but the database has not been updated with this new configuration.
4) If there is a finite reset probability per month for a BTS, the total reset probability might be above a threshold where an assignment is still reasonable. In this case, a new database should be created.

****

Message #9

Info

Drift time evaluation failed.

Abort

Reason: There is not enough input data to calculate the time drift of the ESVD. This might e.g. occur, if the number of Transmitter Scan data with strong drift is larger than 5%.

Effect: The database remains unchanged.

****

Message #10

Info

1.10% measurements out of time range

Abort
Discard wrong values and continue

Reason: There are two reasons for obtaining values out of time range

1) The ESVD time drift is not constant. This may occur if the ESVD was cold in the beginning of the measurement or strong temperature changes occurred.

2) One or more base stations transmit signals with a time stability out of specification (0.05 ppm)

Effect: Discard the wrong values or interrupt the update process without changing the database

Remarks:

To evaluate the time drift of the ESVD against the network a group of Transmitter Scan values is used and the time drift is evaluated by means of linear approximation. It is assumed that the time drift of the ESVD is constant and the time drift of the used BTS signals is smaller than 0.05 ppm. If the time drift has been evaluated, all completed measurements will be checked to test the validity of the assumption.

****

Message #11

Info

Start time evaluation failed.

Ok

Reason: Synchronization between previous Transmitter Scans and the new one failed.

Effect: The database remains unchanged.

Remarks: No common BTSs were found or the reset probability for the BTSs found was too high.

****

Message #12

Example 1 **Different timing for one base station:**

BTS_A1 [25: 7]

[C0:BCC]	**Probability**	**T51(TS)/us**	**Distance/km**	**Power/dBm**
[25: 7]	**99.7%**	**011234**	**3.5**	**-77**
[25: 7]	**98.4%**	**123567**	**4.7**	**-88**

Do not use 1st measurement.
Do not use 2nd measurement.
Do not use either measurement.

BTS_A1 [25: 7]	BTS name [C0: BCC]
[C0:BCC]	Channel and BCC of measurement value
Probability	Probability that the measurement belongs to the given BTS
T_{51}(TS)/us	Synchronization time of the T_{51} frame within the Transmitter Scan. ***Note:*** *This time **(TS)** is **not** the time in the database because the start time of the Transmitter Scan file was not evaluated while this message was produced.*
Distance/km	Distance of measurement to the BTS
Power/dBm	Received power in Transmitter Scan

Example 2 **Different timing for one base station:**

BTS_B1 [27: 7]
BTS_B2 [33: 7]
BTS_B3 [49: 3]

[C0:BCC]	**Probability**	**T51(dB)/us**	**Distance/km**	**Power/dBm**
[33: 7]	**99.3%**	**055534**	**3.5**	**-61**
[49: 3]	**97.4%**	**177777**	**4.7**	**-85**

Do not use 1st measurement.
Do not use 2nd measurement.
Do not use either measurement.

BTS_B1 [27: 7] BTS_B2 [33: 7] BTS_B3 [49: 3]	Names of synchronized sectors and [C0: BCC] information.
[C0:BCC]	Channel and BCC of measurement value
Probability	Probability that the measurement belongs to the given BTS (one of the sectors)
T_{51}(dB)/us	Synchronization time of the T_{51} frame within the Transmitter Scan. ***Note:*** *This time **(dB)** is the time in the database because the start time of the Transmitter Scan file was evaluated before this message was produced.*
Distance/km	Distance of measurement to the BTS
Power/dBm	Received power in Transmitter Scan

Reason:
1) The BTS list is not complete or the C0 channel number or BCC value has been changed.
2) During the Transmitter Scan a signal from BTS A [C0, BCC] was received next to BTS B. The power of the signal was high with respect to the distance to BTS A and C0, BCC is reused for BTS B. In this case the evaluated probability value that the received signal belongs to BTS B was higher than 95%. At another location next to BTS B the signal of BTS B was received. So there are two measurements for BTS B.
3) If 2 or 3 sectors are given and the measurements have been performed on different channels (as in example 2) the clock code setting for this BTS may be wrong. In this case the given sectors have the same clock code and the PCSD is forced to assign the same synchronization time to each sector. If the sectors are not synchronized, then this message is displayed.

Effect: Either the first, the second or both measurements can be discarded.

Remarks: To assign a Transmitter Scan value to a BTS the probability that the measurement belongs to the BTS is calculated and assessed. The assignment is made if this probability exceeds 95%. In the case that two measurements with different synchronization times for the T_{51} frames belong to the same BTS with a probability greater than 95%, message no. 13 will appear.

****

Message #13

Example 1 **Difficult assignment:**

TS from: 06.22.97 15.30.07 P =-88 dBm T51 = 098840

Sector name	**p(P)**	**p(P, T51)**	**d/km**	**T51/us**
BTS_A1	**98.0%**	**1.5%**	**3.7**	**123456**
BTS_B2	**2.0%**	**98.5%**	**17.8**	**098883**

Use first assignment
Do not use first assignment

Example 2 **Difficult assignment:**

TS from: 06.22.97 15.30.07 P =-69 dBm T51 = 05789

Sector name	**p(P)**	**p(P, T51)**	**d/km**	**T51/us**
BTS_A1	**98.0%**	**3.5%**	**3.7**	**123456**
BTS_B2	**2.0%**	**96.5%**	**19.5**	**------**

Use first assignment
Do not use first assignment

TS from: 06.22.97 15.30.07	Date and time of the measurement
P = -88 dBm	Measured power
T_{51} = 098840	Measured synchronization time for T_{51} frame
Sector name	Name of the sector of both BTSs the measurement may belong to
p(P)	Probability of received power
p(P, T_{51})	Probability of received power and T_{51} synchronization time
d/km	Distance from the measurement position to the location of BTS
T_{51}/us	Last synchronization time value assigned to the BTS

Reason: In both examples, the first given BTS has the higher power probability, whereas the second has the higher probability with respect to power **and** time.

In example 1 it is highly probable that the measurement belongs to the BTS_B2 due to the matching of the old and new measured T_{51} time.

In example 2 the new measured T_{51} value does not match the value in the database for BTS_A1. For the BTS_B2 no previous synchronization time measurement exists. This is why the probability p(P, T51) for BTS_B2 is higher than for BTS_A1.

Effect: Example 1: <Do not use first assignment> may be a good choice

Example 2: If it is positively known that BTS_A1 was hit by a reset between the last and the new Transmitter Scan, or if it is not probable that the signal from BTS_B2 was received with a power of –67 dBm at a distance of 19.5 km, then it may be the right choice to assign the measurement value to BTS_A1 by selecting <Use first assignment>.

Remarks: To assign a Transmitter Scan to a BTS, two probabilities p(P) and p(P, T51) will be evaluated if some BTSs already have synchronization time values obtained from other measurements in the same Transmitter Scan file or other measurements in the database.
The probability p(P) takes into account the received power and position of the measurement and location, transmitted power, antenna type and direction for all the BTSs listed in the database which match the C0 and BCC of the Transmitter Scan.

For the probability p(P, T51) will be used in addition to the measured synchronization time of the T_{51} frame and the probability function for this synchronization time for each BTS which depend on the existence of a previous T_{51} measurement, the age of this measurement, the drift of the BTS and the reset probability. In case that p(P) and p(P, T_{51}) contradict each other, message no. 13 will be produced.

****

Message #14

Info

... sectors were discarded in the validation of its values

Ok

Reason: After reading a base station list, the program checks, whether the entries are consistent (e.g. channel 150 does not denote a valid channel). If the data are not consistent, a message appears in the *K6 Message View* window for each sector containing such inconsistent data.

Effect: These sectors are not included in the database.

****

Index

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.fr (fast replay configuration file) 3.100

1

1xEV-DO..4.141, 4.155
1xEV-DO Forward PN Grid View...............................4.165
1xEV-DO Forward Statistic Summary 4.163
1xEV-DO mobile driver..6.96
1xEV-DO Overview View 4.146
1xEV-DO Pilot Set View..4.141
1xEV-DO Views 3.36, 4.141

2

2D Chart View...4.11
2G/3G (UMTS/GSM) Views 4.75
2G/3G ETSI QoS View..4.273
2G/3G Layer 3 View..4.259
2G/3G Views...3.31

A

Abbreviations (GSM)...8.49
About ROMES...3.110
ACK/NACK..4.78
Action (menu)..6.22
  DAB...6.118
  DQA 6.241
  DVB...6.146
  ETACS...6.113
  GSM...6.66
  Handset (ETACS)..6.114
  Handset (GSM) 6.67
  Handset (UMTS) 6.88
  Receiver Control (DAB) 6.118
  Test receiver drivers...6.172
  UMTS..6.87
Activate Network Analyzer...4.247
Active Set
  neighborhood analyzer 4.139
Active Set Spider.......................................4.58, 4.64, 4.70
Add BTS List Files...3.84
Add Frequency (CDMA PNS)....................................6.208
Add Frequency / BCH Demodulation..........................6.183
Add to stack 5.40
Add to Stack File...5.16
Add Transmitter Scan Files 3.85
Add window..4.139
Address
  Ethernet IP (ESPI/FSP (pectrum) 6.217
  Ethernet IP (UMTS PN Scanner).............................6.182
  IEC/IEEE bus 6.153
  IEC/IEEE bus (ESPI/FSP Spectrum)........................6.217
  IEC/IEEE bus (UMTS PN Scanner)..........................6.182
  TCP/IP 6.153
Adj. Channel Interferer.. 4.381
Adjacent channel interference 5.27
Advanced Options (Qualcomm).......................... 6.72, 6.98
Advanced Settings... 3.71, 4.43
Airlink Summary (1xEV-DO 4.159
Alarm
  GSM NWS Frequency Reuse 4.381
Alphanumeric View.. 4.7
Amplitude Distribution (DVB) 4.302
Analog interferers 5.27
Analog TV Configuration... 6.133
Anchor
  route track... 4.48
Antenna
  Atlas 6.117, *6.123*
  CDMA... *6.108*
  CDMA PNS... 6.213
  EFA-T 6.139
  ETACS *6.112*
  GSM 6.50
  Spectrum 6.219
  test receiver.. *6.164*
  TSM-DVB 6.144
  UMTS 6.85, *6.94, 6.102*
  UMTS PNS 6.197
Antenna file (csy).. 6.144
Antenna type 5.8
  BTS file... 7.30
Append file 1.12
Apply for all devices.. 3.65
Archive (route track) 4.44
ARQ (1xEV-DO Performance) 4.157
Arrange Icons 3.107
ASCII export configuration file 1.8
ASCII Export file 7.13
ASCII export formats 7.7
ASCII file 7.39
ASCII table description 7.33
Ask for Comment… 3.58
Assign Block Names.. 3.58
Assign TCP/IP Address 6.8
AT-command 6.30
ATD files.. 7.33
Atlas (DVB view)... 4.298
Atlas Measurements... 6.120
Atlas Settings 6.121
ATSC... 4.300
ATSC Configuration....................................... 6.136, 6.137
ATSC display modes 6.135
ATSC Ext. Configuration... 6.137
ATSC Measurement Configuration 6.134
Attach configuration settings.............4.54, 4.59, 4.67, 4.72
Autoanswer incoming calls 6.44
Autodialing
  CDMA... 6.107
  CDMA2000/1xEV-DO 6.100
  ETACS 6.111
  GSM 6.43
  UMTS 6.82, 6.91

Automatic Serving Cell Channel Selection 6.271
Autorange
Test receiver 6.153
Autoscrolling
2G/3G Layer 3 View 4.262
GSM Layer 2 View 4.211
Available Events..3.63
Available Signals..3.60
data tree 1.6
Average divider 6.161

B

Background Color..4.322
Background Information 8.1
Background map
indoor 4.284
world 4.37
Backup CMD File...3.58
Band definition
database 6.158
test receiver..6.157
test receiver TSMx..6.154
Band Forcing (GSM) 6.39, 6.80
Bandwidth (receiver) 6.153
Base station
reset 2.18
Basic Concepts 1.3
Basic Views.. 4.7
BCC (BTS file)..7.30
BCCH...6.38
measurement report 4.213
BCCH (2G/3G Layer 3 View).....................................4.262
BCCH Scan..6.38
BCH Demodulation (UMTS PNS) 6.183
Beep/Sound 3.64
Bitmap
indoor 6.254
route track 4.38
Bitmap archive 1.7
Bitmap handling (route track) 4.46
BLER Exceed Percentage..................................6.82, 6.91
BLER Threshold...6.82, 6.91
Blocked call..6.49, 7.46
Blocked Call Dela
UMTSy 6.81, 6.90
Blocked Call Delay 6.48
Blocks 3.104, 7.12
Bookmark (replay) 3.23
Browse for Folder... 7.5
BSIC 6.38
measurement report 4.213
scan view 4.222
BTS
data file 7.29
List 5.5
Show BTS List.. 5.5
Station.. 5.5
BTS database 3.76
BTS Information 5.6
Add to stack 5.6
TS Notification.. 5.6
BTS list 1.8, 3.76
format and example 7.26
BTS List Editor...3.87
BTS list file..1.12, 3.82
BTS List Generator 8.13
BTS Sector..4.54, 4.60
BTS Selection
1xEV-DO 4.72
C/I analysis...5.11
CDMA 4.67
GSM 4.54
UMTS 4.60
BTS symbols (limiting) 4.53, 4.66, 4.71
BTSListGenerator.exe 1.8
Buffer (CDMA PNS).. 6.211
Buffer Size
TSMx 6.187

C

C/I.. 4.9
C/I Analyser Views 3.27, 4.6
C/I analysis.. 5.1
C/I Analysis
sample session 2.12
C/I Driver 6.269
C/I Driver Measurement Selection 6.270
C/I Driver Measurement Specification....................... 6.272
C/I IF sampling 4.25
C/I Layer
command.. 4.74
C/I Layer configuration.. 5.4
C/I Layers Invisible 5.3
C/I Measurement Mode 6.271
C/I Messages 4.24
C0 channel 1.10
C0 Interferers.. 5.22
C0 scan
principle and driver.. 6.269
C0 Scan
Export Files.. 1.8, 7.41
C1/C2 parameters 4.213
Cable Loss 6.50, 6.85, 6.94, 6.102, 6.164
Cabling 2.1
Calc. Dist. 4.47
Calibrate (TS55-R2).. 6.162
Calibration
TSM-DVB 6.142
Calibration (GPS receiver).. 6.245
Calibration (PPS, CDMA PNS) 6.212
Calibration (route track) 4.46
Call class 6.49
Call details 4.275
Call duration
CDMA... 6.107
GSM 6.44
Call Resptime (TS9954 NQA) 7.58
Call Statistics (TS9954 NQA)...................................... 7.52
Call Window 6.45
Camp.. 6.36
Cancel Current Job (DQA).. 6.242
Carrier-to-interference... 4.9, 5.1
Carrier-to-Interference Analysis
Driver.. 6.269
CAS3173 CONFIG 6.124
Cascade 3.107
CBCH (cell broadcast channel)................................... 6.39
CBCH View 4.225
CCDF (DVB)... 4.303
CDMA 1xEV-DO BTS Layer
command.. 4.69
dialog.. 4.69
CDMA 1xEV-DO BTS Layers Invisible........................ 4.74
CDMA BTS Database... 3.106
CDMA BTS Layer
command.. 4.63
dialog.. 4.63
CDMA BTS Layers Invisible 4.68
CDMA BTS List Database 3.91
CDMA drivers 6.104
CDMA Finger View 4.179
CDMA Frame Error Rate View.................................. 4.182

CDMA Markov Statistic View....................................4.186
CDMA Messages 4.269, 4.270
CDMA mobiles (supported) 6.104
CDMA Pilot View...4.175
CDMA PN Grid View 4.187
CDMA Power View...4.180
CDMA Searcher View 4.181
CDMA Views..3.37, 4.170
CDMA Vocoder Rate View 4.184
CDMA_FREQ...4.409
CDMA2000 mobile driver 6.96
CDMA2000 PN scan 6.205
CDMA2000 PN Scanner Driver 6.205
CDMA2000 PNS Views...................................3.54, 4.401
CDMA2000/1xEV-DO drivers 6.96
CD-ROM for installation 8.1
Cell bar flag (GSM)..6.39, 6.80
Cell Broadcast Channel...6.39
Cell identity
BTS file 7.30
Cell Identity (CI) 1.14
Center 4.46
Change scale 4.42
Changed Mobile 6.29
Channel definition (DVB) 6.124
Channel list
GSM..8.23
UMTS 8.31
Channel List 5.8, 5.19
Channel Quality Indicator (CQI)...................................4.77
Channel selection (test receiver) 6.157
Channel selection map 6.158
Chess Filter 5.22
CIR (DVB view) 4.296
Class (call) 7.45
Class (DLL) 7.38
Clipboard...7.42
Clock code (BTS file) 7.30
Close All..3.107
Close All Windows 3.107
Close All Windows on…..3.107
Close CMD File 3.12
cmd file... 1.3
CMD File Info 3.12
CMD File Repairer...8.12
Co Channel Interferer 4.376
Color Graph...4.321
Color Scale 4.322
Colors menu (2D chart) 4.16
COM port 6.1
Command line (export) 7.24
Comment event 3.66
Communication mode..6.247
Compass...4.35
Compass driver 6.267
Compass Info 4.372
Compass Views 3.51, 4.371
Concepts of ROMES 1.3
Config (Fax) 6.51
Configuration
1xEV-DO mobile driver...6.97
CDMA Vocoder Rate View 4.144, 4.185
CDMA2000 mobile driver..6.97
DVB DVQ Meter View 4.293
DVB EFA-T CIR View...4.297
DVB EFA-T Status View...4.295
GPS drivers 6.244
GSM Handover View 4.218
GSM Layer 2 View 4.211
GSM mobile drivers..6.22, 6.27
measurement report 4.214, 4.272
QoS Report View...4.352
QoS Throughput View.. 4.356
UMTS mobile driver 6.71
Configuration (1xEV-DO mobile driver)........................ 6.98
Configuration (BTS layer) 4.51, 4.56
Configuration (CDMA2000 mobile driver).................... 6.98
Configuration (UMTS mobile driver)................... 6.72, 6.89
Configuration file... 1.13
Configuration menu 3.56
Configuration of Software Modules............................. 3.75
Configure Fast Replay 3.100
Configure SQA 6.59
Connect (Fax)... 6.51
Connect SQA.. 6.59
Connect to Network 6.227
Constant Call Pattern (ETSI) 6.44
Context menu 4.215
Continue Measurement... 3.96
Continuous
indoor measurement 6.265
Coordinate systems.. 8.19
Copy Job (DQA) 6.225
Copy to Clipboard 4.2
Coupled focus... 3.4
timestamp delta 3.60
Coupled Focus 4.5
CPICH CIR Chart.. 4.311, 4.325
CPICH List.. 4.312
CPICH Lists 4.312
CQI... 4.77
Create Database... 3.83
Create Test Files 6.224
Cross-connected cable 6.9
Cursor modes 4.46
CW Info View.. 4.279
CW Views.. 4.278
Cx channel 1.10
Cx Interference Analysis
sample session 2.19
Cycle Time 6.161
Cyclic handover 6.55

D

DAB 752 Frequency 6.116
DAB Mode 6.116
DAB752 Driver... 6.115
Data
export 7.3
processing 7.1
recording.. 7.2
saving 7.2
selection 1.6
Data (TS9954 NQA) 7.64
Data Call... 6.45
Data Quality Tester driver 6.223
Data Sources (neighborhood analyzer)..................... 4.138
Data tree... 1.6
Database 1.11
create 2.6
file... 1.12
Update 1.14
Database management... 3.83
Database menu 3.106
DAYLT... 4.409
DB Query... 5.11
dBm / 100 kHz 5.27
Dead Reckoning 6.245
Decimal grid.. 8.21
Decode BSIC (SeeGull) 6.160
Decode SCH (BSIC) 6.38
Dedicated 3G Cell List (GSM)................................... 4.229

Default (TS9954 NQA) 7.64
Default Directories....3.57
Default View Area 3.59
Definition color 4.322
Del. Spread 4.313
Delta T 4.314, 4.404
Demodulation 6.153
Destroy View....4.2
Detail filter....4.263
Detailed information 4.259
Details....4.266
Detector 6.153
Dev. Drift....4.313
Deviation min. 4.48
Device....1.6
Device Chooser....6.21
Device Into (NDIS) 6.222
Device Setup (NDIS)....6.221
Device tab....4.1
DGPS settings 6.244
Diagnostic Call 6.72, 6.98
DialUp Wizard 8.14
Direction
  BTS file 7.28, 7.29, 7.30
  of transmission....5.8
Directory for temporary MapX files 4.43
Directory Server Files....6.240
Disconnect (Fax) 6.51
Disconnect from Network 6.228
Disconnect SQA....6.59
Display (2G/3G Layer 3)....4.261
Display events
  route track 4.42
Display Update Rate 6.188
Distance Format....3.59
Distance tool 4.47
Distribution....5.28
Diversity 4.102, 4.109, 4.230, 4.233, 4.235, 4.238
Diversity (TSM-DVB)....6.140
DLL (dynamic link library) 3.76, 7.38
Doppler Freq. 4.314
DOS binary format....7.19
Downlink (UMTS) 4.322
DQA driver 6.223
DQA Settings 6.224
DRC (1xEV-DO Performance)....4.156
Drift 4.313
Driver
  CDMA IS-95....6.104
  CDMA2000 / 1xEV-DO....6.96
  CDMA2000 / 1xEV-DO mobile 6.96
  command line....6.22
  configuration....3.76
  DAB752....6.115
  DVB....6.119
  EB200 ....6.147
  ESVX 6.147
  ETACS....6.110
  GPS 6.243
  GSM mobile 6.25
  Indoor....6.253
  Installation....6.1
  SBR....6.148
  SeeGull 6.147
  test receiver....6.147
  UMTS mobile....6.69
Driver configuration 2.4
Driver Configuration
  CDMA2000/1xEV-DO mobiles....6.97
  GSM mobile 6.27
  INDOOR....6.254
  Trigger Box....6.168
  UMTS (Qualcomm) mobile....6.71
Driver settings....3.12
  GSM demodulator....6.276
Dropped call 6.49, 7.46
DS_INCL 4.409
DTX....4.213, 6.49
Dual input (TSM-DVB) 6.141
Dummy GPS....6.243
Dummy GPS configuration 6.251
DVB Atlas View 4.298
DVB Configuration....6.119
DVB Driver 6.119
DVB DVQ Meter View....4.292
DVB EFA-T Amplitude Distribution View....4.302
DVB EFA-T ATSC Histogram View....4.300
DVB EFA-T CCDF View 4.303
DVB EFA-T CIR View....4.296
DVB EFA-T Echo Pattern View....4.306
DVB EFA-T Status View....4.294
DVB Views 3.45, 4.291
DVB-T Configuration....6.136, 6.137
DVB-T display modes....6.134
DVB-T Ext. Configuration 6.137
DVB-T Measurement Configuration....6.134
DVMD Properties....6.128
DVMD Settings....6.127
DVMD StatusDlg 6.146
DVQ Meter (DVB view)....4.292
DVQ Settings....6.130
DVQ StatusDlg 6.146
Dynamic link library....3.76

E

EB200 driver....6.147
  LAN Address 6.8
Ec/Io....4.312
  CDMA2000 ....4.404
Ec/Io Exceed Percentage 6.82, 6.90
Ec/Io Threshold 6.82, 6.90
Echo Pattern (DVB) 4.306
Edit BTS Sector....3.87
Edit... (configuration dialog) 4.158, 4.162
EFA Options....6.132
EFA-T Amplitude Distribution (DVB view)....4.302
EFA-T ATSC (DVB view)....4.300
EFA-T CCDF (DVB view) 4.303
EFA-T Configuration....6.131
EFA-T Echo Pattern (DVB view)....4.306
EFR (enhanced full rate)....6.39
E-GSM....8.23
EIRP power 7.30
Ellipse (error)....5.7
EMail Download....6.236
EMail Upload 6.235
Enable CMD File Scanning....3.68
Enable DQA....6.242
Enable Neighborhood Analyzer....4.137
Enable Speech Quality 6.59
END_OF_FILE 7.39
Endless call 6.45
Enter Calibration Mode 4.43
Envelope (Spectrum) 4.366
Erase route… (route track) 4.42
ESPI (Spectrum)....6.216
ESPI driver
  IEC bus / LAN Address....6.7
ESVx driver 6.147
ESxx test receivers....6.147
ETACS Driver....6.110
ETACS Scan View....4.281

ETACS Signaling View ... 4.281
ETACS Views ... 3.43, 4.280
Ethernet IP address
ESPI (Spectrum) ... 6.217
UMTS PN Scanner ... 6.182
Evaluation (GSM BTS List) ... 3.85
Evaluation of results ... 4.1
Event Configuration ... 3.63
Event found ... 3.103
Event List ... 4.382
Event List Configuration ... 4.384
Event View ... 4.22
Events ... 3.105
Exit ... 3.17
Expert Mode ... 6.73, 6.99
Export ... 3.15, 7.3
Export All Data ... 7.9
Export CMD File ... 7.3
Export CMD File Info(s) ... 3.15
Export configuration ... 7.7
Export format ... 7.4
Export formats ... 1.7
Export measurement data ... 7.3
Export to ASCII File ... 3.85
Export/Trigger (2G/3G Layer 3) ... 4.264
EXT_CDMA_FREQ ... 4.409
Extended Features (DQA) ... 6.225

F

Fast Replay ... 3.99
configuration file ... 3.100
FCCH ... 1.10
File formats ... 1.7
File info ... 3.11
File menu ... 3.5
File Pre/Suffix ... 7.11
File replay ... 3.98
File scan ... 3.11
File to Patch ... 6.240
File types ... 1.12
Finger View
CDMA ... 4.179
Firewire ... 6.180, 6.182, 6.200, 6.206
Firewire interface (TSMx) ... 6.11
FIZZ Configuration ... 6.110
Force GPRS Attach ... 6.68
Force GPRS Detach ... 6.68
Forward Summary (1xEV-DO Performance) ... 4.156
F-PICH CIR Chart ... 4.403
F-PICH List ... 4.403
F-PICH Lists ... 4.403
Frame Error Rate
view (CDMA) ... 4.182
Frequency
CDMA2000 PN scan ... 4.402
UMTS PN scan ... 4.311
Frequency correction ... 4.25
Frequency Correction ... 6.274
Frequency Hopping View (GSM) ... 4.219
Frequency list
dialog ... 6.159
test receiver ... 6.157
Frequency Reuse View Configuration ... 4.379
F-SYNC Demodulation ... 6.210
FTP Download ... 6.230
FTP Up/Download ... 6.233
FTP Upload ... 6.232
Full Screen ... 3.18

G

Gauß coordinate systems ... 8.19
Gauß-Krüger system ... 8.20
GB127M configuration ... 6.267
GB127M driver ... 6.267
GC ... 6.154
General description of ROMES ... 1.1
General settings ... 3.57
General Status View ... 4.28
configuration ... 4.29
Generate filenames for recording ... 3.57
Generic Views ... 3.25
Geographic positioning ... 3.30
Geographical grid ... 8.20
Global position ... 4.49
GMM Info ... 4.196
Good call ... 6.49, 7.46
GPIB Drivers ... 8.4
GPIB7210 driver ... 6.148
GPRS PDP Info View ... 4.192
GPRS RLC/MAC Messages ... 4.267
GPRS RLC/MAC View ... 4.194
GPRS State View ... 4.191
GPRS System Information View ... 4.192
GPRS Views ... 3.39, 4.190
GPS
data transmission ... 8.36
driver (supported devices) ... 6.243
driver configuration ... 6.244
Glossary ... 8.38
receiver ... 8.36
GPS Health Monitoring ... 6.246
GPS Info ... 4.34
GPS time ... 6.245, 6.249
Graph (measurement report) ... 4.215
Graphic Display ... 5.21
Graphical C/I analysis ... 2.17
GSM
abbreviations ... 8.49
channels ... 8.22, 8.23
output power ... 8.30
supported devices ... 6.25
GSM BTS Database ... 3.106
GSM BTS Layer
command ... 4.51
dialog ... 4.51
GSM BTS List Database ... 3.81
GSM CBCH View ... 4.225
GSM Dedicated 3G Cell List View ... 4.229
GSM Demodulator ... 1.14, 6.275
GSM Frequency Hopping View ... 4.219
GSM GPRS PDP Info View ... 4.192
GSM GPRS RLC MAC Release Indicators View ... 4.206
GSM GPRS RLC/MAC Header View ... 4.201
GSM GPRS RLC/MAC View ... 4.194
GSM GPRS State View ... 4.191
GSM GPRS System Information View ... 4.192
GSM GPRS TS/CS View ... 4.199
GSM GPRS/EGPRS View ... 4.203
GSM Handover View ... 4.217
GSM Idle 3G Cell List View ... 4.232
GSM L1 Parameters ... 4.209
GSM L3 Messages ... 5.45
GSM Layer 1 View ... 4.208
GSM Layer 2 View ... 4.210
GSM Layers Invisible ... 4.55
GSM Measurement Report View ... 4.212
GSM Mobile Drivers ... 6.25
GSM Neighborhood Analyzer View ... 4.243
GSM network scan ... See C0 scan

GSM Network Scanner Driver 6.199
GSM NWS Frequency Reuse View............................4.375
GSM NWS info..3.81
GSM NWS scan signal settings 3.80
GSM NWS Top N View 4.385
GSM NWS Transmitter Scan View.............................4.374
GSM NWS Views...3.52, 4.373
GSM QoS View..4.226
GSM Rejected 3G CellsView......................................4.237
GSM RR 3G Reselection Measurements Parameters View
....4.240
GSM RR 3G Reselection Measurements View...........4.235
GSM Scan View...4.221
GSM SMS View 4.223
GSM Source (neighborhood analyzer)........................4.248
GSM System Information View...................................4.215
GSM Views 3.40, 4.207
GSM/GPRS Forcing...6.33
GSM/GPRS Forcing (GSM mobile drivers)..................6.33
GSM/NAS Messages 4.266
GSS (graphical subsystem)..4.25
GSS Configuration 3.72

H

Handover
GSM..6.66
Handover (Action menu)...6.66
Handover Maxcount 6.48
UMTS...6.81, 6.90
Handover View...4.217
Handset..6.67
ETACS 6.114
UMTS..6.88
Hard Pilot Pollution (HPP) 4.332, 6.193
Hardware 3.75
Hardware components 6.1
Hardware drivers..3.75
Hardware Drivers
load 2.1
Hardware Recognition.. 8.4
Hardware requirements... 1.1
HARQ (hs-MAC Layer)...4.95
HARQ process 4.81, 4.89
Header (TS9954 NQA)...7.51
Help menu...3.108
Hierarchical transmission (DVB).................................6.125
Hierarchy (data tree) 1.6
High Dynamic...6.186
High Speed 6.186
HO Info (TS9954 NQA) 7.56
HOA
UMTS...6.83, 6.92
HOA (driver)
GSM..6.58
Host ID..6.10
Hot spot...6.264
HSDPA Views 3.32
HS-DPCCH 4.77
HS-SCCH..4.78
HTTP Browser..6.242
HTTP Download...6.230
Hysteresis 6.192

I

Idle 3G Cell List (GSM) 4.232
Idle time
CDMA 6.107
GSM..6.45
IEC Bus Driver Info 6.166
IEC(IEEE)-bus 6.154
IEC/IEEE bus address 6.153
ESPI (Spectrum)... 6.217
UMTS PN Scanner 6.182
IEC/IEEE interface.. 6.7
IEEE 802.11 .... 6.220
Ignore BSIC.. 6.38
Image file.. 1.7
ImportConstruction 7.39
ImportDestruction 7.39
Inactive mode (GPS driver).. 6.248
Index 3.108
Indoor Driver.. 6.253
Indoor Views.. 3.44, 4.283
Info field for BTS 4.51
Info tab 4.4
Info Text…... 3.89
Infolevel 5.43, 5.44
Init Mobile 6.29
Initial automatic zoom 4.65, 4.71
Input Routing (DVQ) 6.130
Installation
ROMES 8.1
Interference
AdjC0.. 5.24
AdjCx.. 5.27
analysis 1.10
C0C0 .... 5.22
C0Cx 5.25
CxC0 .... 5.22
CxCx.. 5.25
detection 1.10
diagram... 5.22
measurement 1.12
point.. 5.14
signal assignment 1.10
Interference Analysis 5.16
sample session 2.15
Interferer
CI Measurement View.. 5.18
identification.. 5.24
selection 5.21
Interferer list (K6 CI Main View) 5.14
Interferer selection
CI Measurement View.. 5.21
Interferer window 4.139
Internal trigger (test receiver).................................... 6.152
Interpolate GPS Positions.. 7.10
Interval (Top N)... 6.191
Introduction... 1.1
Invisible layer... 4.43
IP address 6.9
ISCP.. 4.312

J

Jump to Block... 3.104

K

K6 CI Main View 5.13
K6 CI Measurement View 5.18
K6 CI Power Analysis View 5.29
K6 CI Remark Editor View 5.33
K6 Trigger View 5.34
K6 TS Notification.. 5.39
K6 TS View.. 5.38
K7 Transmitter Scan View 5.41

L

LAC ... 5.8
LAN interface ... 6.7
Language (TS9954 NQA) ... 7.64
Latitude
BTS file ... 7.30
Layer
invisible ... 4.43
Layer 1
view ... 4.208
Layer 2 (view) ... 4.210
Layer 2 Message ... 4.261
Layer 3
System information type 1 to 6 ... 4.216
view ... 4.259
Layer 3 Uplink Frames ... 6.68
Layer 3 Uplink frames tab ... 6.53
LC_STATE ... 4.409
Lee criteria ... 6.160
Legend
CDMA Finger View ... 4.179
CDMA Frame Error Rate View ... 4.183
CDMA Pilot View ... 4.176
CDMA Power View ... 4.181
CDMA Searcher View ... 4.182
CDMA Vocoder Rate View ... 4.185
indoor ... 4.287
measurement report ... 4.215
Polar View ... 4.31
route track ... 4.39
Statistic Histogram ... 4.19
Limit
BTS display ... 4.53, 4.66, 4.71
Line output format ... 7.10
Line thickness ... 4.42
List Format
user-defined ... 7.38
List of Visible Windows ... 3.107
Load (K6 CI Main View) ... 5.14
Load Driver Template ... 6.4
Load Hardware Drivers ... 3.8
Load Slave ... 6.51
Loaded Modules ... 3.108
Location Area Identifier (LAI) ... 1.14
Lock Channel (GSM) ... 6.40, 6.80
Log Mask ... 6.105
Logical Channel ... 4.261, 4.262
Logo (TS9954 NQA) ... 7.64
Longitude
BTS file ... 7.30
LP_SEC ... 4.409
LTM_OFF ... 4.409

M

Mac header ... 4.91
MAC-hs ... 4.87
Macro (MS Excel, TS9954 NQA) ... 7.65
Manual Start (K6 Trigger View) ... 5.35
Manual Stop (K6 Trigger View) ... 5.37
manual trigger ... 1.12
Map list (route track) ... 4.44
Map positioning ... 4.42
Map tool ... 4.46
Map units (route track) ... 4.42
MapInfo Symbol ... 7.17
Marker
2D chart ... 4.12
CDMA Finger View ... 4.179
CDMA Frame Error Rate View ... 4.183
CDMA Pilot View ... 4.176
CDMA Vocoder Rate View ... 4.184
CI Measurement View ... 5.21
CMDA Power View ... 4.181
CMDA Searcher View ... 4.182
Polar View ... 4.31
Mast driver ... 6.267
Mast Position ... 4.30
Master ... 6.111
Master.rms ... 4.3
Max. Access Time ... 6.44
Max. Display Lines (TSMU) ... 6.189
MCC ... 3.85, 5.8
MCI Analysis Files ... 7.15
Meas. Time ... 6.153
Measurement
example ... 2.7
file ... 1.13
Process ... 1.10
Measurement bar ... 3.20
Measurement control views ... 3.29
Measurement file ... 1.3, 3.95
Measurement menu ... 3.95
Measurement Mode
CDMA ... 6.105
GSM driver ... 6.34
indoor ... 4.284, 6.262
Measurement Period (DAB) ... 6.116
Measurement Principle ... 1.1
C/I Measurement ... 1.10
ROMES ... 1.3
Measurement Rate ... 6.188, 6.218
Measurement Report (GSM) ... 4.212
Measurement Settings (test receiver) ... 6.155
Measurements (CDMA PNS) ... 6.210
Measurements (UMTS PNS) ... 6.184
Merge CMD files ... 3.13
MES format ... 7.19
Message View ... 4.23
Mesurement Info ... 3.57
Metafile format ... 7.23
MIF (MapInfo Interchange Format) ... 7.16
MIN_P_REV ... 4.409
Missing neighbor ... 4.139
MNC ... 3.85, 5.8
Mobile display (Qualcomm) ... 6.73, 6.88, 6.98
Mobile Layers Invisible ... 4.62
Mobile MMI ... 6.29
Mobile Mode ... 6.111
Mobile phone ... 2.1
Mobiles (measurement report) ... 4.214
Monitoring (ETACS) ... 6.114
More Extended Features (DQA) ... 6.225
Move map ... 4.42, 4.46
Moving views ... 3.2
MS Excel ... 7.32
Multiple Views ... 3.27

N

Navigation ... 6.243
Navigation Mode
indoor ... 4.284, 6.263
Navigation Views ... 3.30, 4.33
NDIS driver ... 6.220
Negative slope ... 3.66
Net Statistic ... 6.238
Network ... 6.30
Network data base
create (GSM) ... 3.82
create (UMTS) ... 3.89

import BTS list file 3.82
import Node B list file 3.89
Network data base (*.ndb)....................3.81
Network ID 6.10
Network Quality Analysis....................7.43
Network Quality Analysis (NQA)....................6.47, 6.81, 6.90
view (2G/3G) 4.271
Network scan .... See C0 scan
New View 4.2
New Window 3.107
New Workspace 3.6
NID....................4.409
NMEA driver....................6.243
No Details 4.266
No service call....................6.49
No Service call 7.46
Node B data base (*.nbdb) 3.88
Node B list file 3.89
Noisy (TS9954 NQA)....................7.59
Nokia Settings (GSM mobile drivers)....................6.31
Nokia Settings (UMTS mobile drivers)....................6.78
Non-GSM-specific interferers 5.28
Non-hierarchical transmission (DVB)....................6.125
Normal (measurement mode)....................6.36
Notification 5.39, 5.40
NQ2 ASCII format 7.21
NQA (GSM drivers) 6.47
NQA (UMTS drivers) 6.81, 6.90
NQA ASCII format....................7.21
NQA Data Analysis 7.43
NQA devices 4.272
NQA monitoring....................6.48
NQA State
view (UMTS/GSM) 4.249
NQA-MAK.XLS....................7.49
NrOfTII (DAB)....................6.116
NT3 ASCII format....................7.20
NTSC 6.133
Null modem cable.................... 6.9
NYQI, NYQM, NYQN 6.133

O

OFDM parameters (Atlas) 4.298
Offset (autodialing)....................6.45
Offset (CDMA2000 PNS....................4.403
On All Changes 3.64
On-line help....................3.108
Open CMD File 3.10
Open Power Analyzer....................5.16
Open Workspace 3.7
Operator list 1.11, 3.76
Operators (MCC, MNC) with unique CI 3.86
Option
ROMES-Z7....................6.237
Options
Mobile 6.50, 6.85, 6.93, 6.101
Output Config. (DVB) 6.125
Overview of functionality 2.1
Overview View
CDMA....................4.171
OVSF 4.102

P

P total....................4.312
CDMA2000....................4.404
P total (SCH) 4.314
P_REV 4.409
Password (TS9954 NQA)....................7.63
Patch File....................6.239
Pause 3.99
PCL 8.30
PCS Driver Settings.................... 8.6
PCS Drivers.................... 8.4
PDP (Packet Data Protocol) 4.192
Peak List.................... 4.313, 4.404
PER (1xEV-DO Airlink Summary) 4.161
Performance counter 6.23
PESQ 6.62
PESQ scale 4.362
Philips752 Configuration 6.115
Phone State.................... 6.105
Pilot Energy (1xEV-DO Airlink Summary) 4.160
Pilot Pollution.................... 6.192
UMTS PNS 6.193
Pilot Set View
1xEV-DO 4.141
Pilot Sets 6.105
Pilot View
CDMA.................... 4.175
PILOT_PN.................... 4.409
PIN number (GSM) 6.29
PIN number (mobile).................... 6.98
PIN number (UMTS) 6.72, 6.89
Ping 6.229
Placer Navigation Driver 6.247
Play file (SQA) 6.60
PLMN 6.30
Plot (configuration dialog) 4.96
PN Layer 4.64, 4.70
PN Offsets (1xEV-DO Airlink Summary) 4.160
PNS BCH View.................... 4.341
PNS CPICH View 4.310
PNS F-PICH View 4.402
PNS F-SYNC View 4.408
PNS Layers Invisible 4.61
PNS PILOT View 4.328
PNS P-SCH View 4.308
PNS Rake Finger Chart View 4.337
PNS Rake Finger View 4.335
PNS SC Tracer View 4.323
PNS Spectrum History View 4.320
PNS Spectrum View 4.317
PNS Time Line Estimation View 4.411
PNS Top N Pool Member Selection.................... 4.61
PNS Top N View.................... 4.331
Point 4.46
Point to point 7.9
Polar View 4.30
Position
base station 5.7
interference point 5.15
Position Format 3.59
Position of Sectors.................... 4.55, 4.60, 5.12
CDMA 4.67, 4.73
Positioning system.................... 3.30
Positive slope 3.66
PostTrigger.................... 4.265
Potential interferer 4.139
Power analysis
View.................... 5.29, 5.33
Power Analysis 5.29
Power class (GSM).................... 6.29
Power density 5.27
Power View
CDMA 4.180
PRAT.................... 4.409
Preamplifier
ESVD, ESPI.................... 6.153
Preamplifier (TSMU) 6.189
Preparations 2.1
PreTrigger.................... 4.265

Preview
route track ... 4.43
Print ... 3.16
Print (TS9954 NQA) ... 7.65
Print File Header ... 7.10
Print Preview ... 3.16
Print Setup ... 3.16
Profile file ... 1.8, 8.17
Program Selection (DVB) ... 6.131
Protocol Discriminator ... 6.53
P-SCH CIR Chart ... 4.308
P-SCH List ... 4.309
PWR Time (TS9954 NQA) ... 7.55

Q

QCP Configuration ... 6.104
QoS DQA View ... 4.348
QoS Information ... 4.197
QoS Message View ... 4.344
QoS Object View ... 4.358
QoS Progress View ... 4.344
QoS RAS Statistics View ... 4.357
QoS Report View ... 4.349
QoS tab ... 6.56
QoS Tests
GSM ... 6.53
QoS Throughput View ... 4.354
QoS Views ... 3.49, 4.343
Quality Acceptance ... 4.276
Quality of position
BTS List ... 8.14
Quality of Service ... 4.273
Query DB ... 5.35

R

R&S GSM Demodulator ... 1.14, 6.275
Range of interference situation ... 5.16
Raster image map ... 4.47
RAT Settings
UMTS driver ... 6.80
Read NQA Data ... 7.49
Real Time Streaming Protocol ... 6.237
Real World Time ... 3.58
Received Power Density ... 5.30
Receiver ... 6.274
Receiver (CDMA PNS) ... 6.207
Receiver (UMTS PNS) ... 6.181
Receiver bandwidth ... 6.153
Receiver calibration ... 6.154
Receiver Control
DAB ... 6.118
Receiver Settings (ESVx, SBR) ... 6.151
Receiver Settings (TS55-R2) ... 6.157
Receiver type (ESPI/FSP Spectrum) ... 6.217
Receiver Type (PNS scanner) ... 6.181
Receiver type (UMTS PN Scanner) ... 6.182
Reference file (SQA) ... 6.61
Registry ... 3.73
Rejected 3G Cells (GSM) ... 4.237
Release Coupled Focus ... 3.105
Remarks ... 5.16
Remote display ... 4.29
Remote Receiver
GSM ... 6.40
UMTS ... 6.84, 6.92
Remove all BTS from map ... 4.55, 4.61, 4.68, 4.73
Remove All BTSs from Map ... 5.12
Remove anchors ... 4.48
Replay ... 3.98
sample session ... 2.14
Replay Control ... 3.22
Replay device filter ... 3.69
Replay Device Filter ... 3.101
Replay Jump ... 3.102
Replay Jump to Block ... 3.104
Replay Jump to Next Event ... 3.103
Replay jump to timestamp ... 3.102, 4.5
Replay Speed ... 3.98
Requested (HSDPA Performance) ... 4.94
Requested Throughput (1xEV-DO Airlink Summary) . 4.160
Reselection
UMTS ... 4.127
Reset BER ... 6.146
Reset Graphic ... 5.22
Reset Handover Counter ... 6.68
Reset of base station ... 1.11
Reset of BTS sector ... 5.24
Resolution Bandwidth ... 6.188, 6.218
Restart Measurement ... 3.97
Restart Replay ... 3.99
Results(display and evaluation) ... 4.1
Reverse Summary (1xEV-DO Performance) ... 4.157
RF Parameters
CDMA ... 6.108
RF Sensitivity (DAB) ... 6.116
R-GSM ... 8.23
RLC Layer ... 4.96
RLC/MAC ... 4.194
UMTS ... 4.123
rms file ... 1.3
ROMES Configurator ... 8.16
ROMES Installation ... 8.1
ROMES-Z7 ... 6.237
ROMES-Z8 ... 4.359, 6.58
Rotator mode (Mast) ... 6.268
Rotator speed (Mast) ... 6.268
Route Track ... 4.37
C/I Analysis ... 5.2
Route Tracking configuration ... 4.41
RR 3G Reselection Measurement Parameters (GSM)4.240
RR 3G Reselection Measurements (GSM) ... 4.235
RS TM user interface ... 6.29
RSCP ... 4.312
CDMA2000 ... 4.404
rtsp ... 6.237
Rx 1 ... 6.156
RX Level (table) ... 8.30
RX Quality (table) ... 8.30
RxLev ... 6.274
RxLev (full/sub) ... 4.213
RxLev (TS9954 NQA) ... 7.54
RXLev Calibration ... 6.31
RxLev Correction ... 6.38
RxLev Exceed Percent ... 6.48
RxLev Threshold ... 6.48
RxLev/RxQual Source ... 6.48
RxQual ... 6.274
RxQual (full/sub) ... 4.212
RxQual (Range) (TS9954 NQA) ... 7.53
RxQual (TS9954 NQA) ... 7.53
RxQual Exceed Percent ... 6.48
RxQual Threshold ... 6.48

S

SACCH block ... 4.212
Sample ... 6.38
Save ... 3.9, 5.17
Save as ... 3.9
Save as Default Configuration ... 4.3
Save Configuration ... 7.11, 7.18

Saving data 7.2
SBR driver 6.148
SC 4.312
SC color file 1.8
SC Layer 4.57, 4.58
SC sector 4.24
Scan File after Measurement 3.69
Scan Settings 6.38
Scan View
ETACS 4.281
GSM 4.221
Scan(ning) 6.37
Scanner 6.111
Scee6 Navigation Driver 6.244
Scheduled – Requested 4.95
Scheduled (HSDPA Performance) 4.95
Screenshot 7.42
Scroll
CI Measurement View 5.21
Searcher View
CDMA 4.181
Sector List 5.23
Sector Lock (UMTS) 6.81, 6.89
Sector number 7.39
SECTOR_INVALID 7.39
SECTOR_VALID 7.39
Sectors' Properties 4.54, 4.60, 5.11
SeeGull driver 6.147
Select BTSs 3.87
Select Mobile 4.62, 4.68, 4.73
Select Station for C/I 5.22
Selected Signals
data tree 1.6
Selftest 6.154
SER format 7.23
Serial Port Driver Info
CDMA 6.109
DAB 6.117
DVB 6.126
ETACS 6.113
GSM 6.63
Trigger Box (external) 6.170
Server Files 6.240
Set anchor 4.46, 4.48
Set Marker 3.105
Set Voice Marker 3.105
Settings 3.75
Settings (ESPI/FSP Spectrum) 6.217
Setup (GSM mobile drivers) 6.27
Setup GSM NWS Driver 6.201
Sheet 3.2
Short Message Options 6.52
Shortcut 3.70
Show Interferer 5.6
Show Replay Control Dialog… 3.58
Show Serving Cell 5.6
Show/Hide Mobile Display 6.88
Show/Hide Views 3.26
SIB Selection (BCH Demodulator) 6.183
SID 4.409
Signal 1.6
Signal Configuration 3.60
Signal Tree View 3.25
Signaling View (ETACS) 4.281
Simulation 6.182
SIR 4.312
Slave 6.111
Slaves tab 6.51
SMS Property 6.52
SMS Tester tab 6.52
SMS View 4.223
SNDCP Compression 4.197
Soft Pilot Pollution (SPP) 6.193
Software requirements 1.1
Sorted pool (Top N) 6.191
Speaker 6.29
Special Device Manager 8.17
Spectrum 4.322, 5.27
UMTS PN scan 6.188
Spectrum analysis 4.307, 6.178, 6.216
Measurement example 2.25
Spectrum History View 4.368
Spectrum View 4.365
Spectrum Views 3.50, 4.364
Speech Quality
driver configuration 6.58
UMTS 6.84, 6.93, 6.101
view 4.359
Speedometer 4.35
SQA Message View 4.359
Square triggered 7.9
SR1_BCCH_NON_TD_INCL 4.409
SR1_TD_INCL 4.409
SR3_INCL 4.409
SRS format 7.23
Stack files 1.13
Start BCCH 6.38
Start Measurement 3.95
Start of Call 7.45
Start of Dialing 7.45
Start Recording 3.96
Start Replay 3.98
Start up options (Preferences) 3.58
Station list 5.19
Statistic Histogram View 4.17
Statistical Calculation 4.21
Status
Atlas MK II 4.299
Status (call) 7.45
Status (DVB view) 4.294
Status bar 3.21
Step One Data Set Forward 3.99
Stop (measurement) 3.97
Stop BCCH 6.38
Stop Recording 3.97
Store Raw RRC Messages… 6.77, 6.100
Stream input 6.263
Stream Select (DVB) 6.125
Subnet mask 6.10
SucRate (switch.) (TS9954 NQA) 7.62
SucRate (TS9954 NQA) 7.59
SucRate 100% (TS9954 NQA) 7.60
Suppress Cell Reselection 6.68
Svee6 configuration 6.244
Symbol file 6.64
Sync. Mode (CDMA PNS) 6.210
Synchronisation Identification
BTS file 7.31
Synchronization
UMTS PN scan 6.188
Synchronization channel 6.38
Synchronization Rate 6.188
SYS_TIME 4.409
SysResptime (TS9954 NQA) 7.57
System Information (GPRS) 4.192
System Information Blocks 6.77, 6.100
System information type 1 .... 1.14
System Information Type 3 .... 7.41
System Lock (UMTS) 6.80, 6.89
System monitor 6.23
System requirements 1.1
System Response / Call Setup 4.277

T

T_{51} frame ... *5.22*
TAB file ... *4.47*
Target directory (export) ... *7.5*
TBF (Temporary Block Flow) ... *4.195*
T-connector ... *6.249*
TCP/IP Address ... *6.153*
TDMA frame ... *4.212, 5.22*
TEC for CDMA ... *3.91*
TEC for CW Devices ... *3.94*
TEC for GSM ... *3.81*
TEC for GSM NWS ... *3.76*
TEC for UMTS PNS ... *3.92*
TEC for UMTS Test Mobiles ... *3.88*
Technology ... *1.6*
Technology modules (route track) ... *4.45*
Tecs (configuration) ... *3.76*
Templates
  CDMA2000/1xEV-DO ... *6.102*
  UMTS ... *6.86, 6.94*
Templates (driver)
  DQA ... 6.241
  GSM ... 6.56
  Indoor ... 6.266
  TSM-DVB ... 6.145
  TSMU/TSML-W ... 6.196
  TSMx ... 6.164, 6.203, 6.215
Test Devices ... *6.25*
Test receiver ... *2.1, 6.274*
Test receiver drivers ... *6.7, 6.147*
Test Transmitter ... *6.37*
Text Markers ... *4.262*
TFI (Temporary Flow Identity) ... *4.195*
Third-party utilities ... *1.9*
Threshold Values
  GSM NWS Frequency Reuse ... 4.380
Thresholds
  Pilot Pollution ... 6.193
Thresholds for Interference Detection... ... *6.272*
Throughput (1xEV-DO ... *4.155*
Throughput (HSDPA ... *4.94*
Tile ... *3.107*
Time Base (TSMx) ... *6.186*
Time drift (BTS) ... *1.11*
Time limits (DMVD) ... *6.128*
Time offset ... *1.10, 5.23*
Time Stamp ... *4.261*
Time triggered ... *7.9*
Time Window (UMTS views) ... *4.116*
Timespan
  CDMA Vocoder Rate View ... *4.185*
Timestamp Format ... *3.58*
Tip of the Day ... *3.108*
Tool (map) ... *4.46*
Toolbar ... *3.19*
Top N ... *6.189*
Top N Chart ... *4.333, 4.387*
Top N List ... *4.332, 4.386*
Top N Pool ... *6.189*
  Measurement example ... *2.28*
Top N pool signal settings ... *3.77*
Top N Property ... *6.190*
Tracker ... *6.111*
Transmitter criteria (neighborhood analyzer) ... *4.139*
Transmitter Scan ... *1.10, 5.23*
  channel range ... *6.274*
  file ... *1.12*
Transmitter Scan Files ... *3.85*
Transmitter Scan Measurement Mode ... *6.270*
Transport Stream ... *4.298, 6.129*
Travel Pilot ... *6.243*
Trigger
  by distance ... 6.162
  by time ... *6.161*
  layer 3 message ... *4.265*
  neighborhood analyzer ... *4.138*
  Simulation ... 5.35
  View ... *5.34*
Trigger Box ... *6.11, 6.148, 6.149, 6.148*
Trigger Box (external)
  configuration ... 6.168
Trigger Box (internal)
  configuration ... 6.171
Trigger conditions (panel) ... *7.9*
Trimble Placer ... *6.243*
Trimble Svee6 ... *6.243*
True Heading ... *4.30*
TS Info ... *5.8*
TS Statistics ... *5.9*
TS95-RD (remote display) ... *4.29*
TS9953 ... *6.37*
TS9954 NQA ... *7.43*
  installation ... *7.46*
  operation ... *7.49*
  versions ... *7.46*
TSC ... *5.20*
TSM-DVB ... *6.139*
  Configuration ... 6.140
TSMx ... *6.180, 6.200, 6.206*
TSMx Installation ... *3.109*
TS-PNSYNC ... *6.179*
Tx Database Editor ... *3.90*
Type of Call ... *6.44*

U

UDP Download ... *6.233*
UDP Up/Download ... *6.234*
Ultra High Speed ... *6.186*
  configuration ... 6.195
UMTS
  channels ... *8.31*
UMTS CellSet View ... *4.108*
UMTS Finger Data View ... *4.101*
UMTS HSDPA Configuration View ... *4.83*
UMTS HSDPA Decode Statistic View ... *4.97*
UMTS HSDPA HARQ Statistic View ... *4.81*
UMTS HSDPA HS Decode Status View ... *4.78*
UMTS HSDPA MAC Configuration View ... *4.87*
UMTS HSDPA MAC Header View ... *4.91*
UMTS HSDPA MAC Status View ... *4.89*
UMTS HSDPA Performance View ... *4.94*
UMTS HSDPA UL HS-DPCCH View ... *4.77*
UMTS HSDPA Views ... *4.75*
UMTS Layer
  command ... *4.56*
  dialog ... *4.56*
UMTS Layer 1 Graph View ... *4.132*
UMTS Layer 1 View ... *4.104*
UMTS Measurement Report View ... *4.125*
UMTS mobile driver ... *6.69*
UMTS NAS Status View ... *4.111*
UMTS Neighborhood Analyzer View ... *4.132*
UMTS Node B Database ... *3.106*
UMTS Node B List Database ... *3.88*
UMTS Physical Channels View ... *4.117*
UMTS PN scan ... *4.307, 6.178*
UMTS PN Scan
  Measurement example ... *2.26*
UMTS PN Scanner Drivers ... *6.178*
UMTS PNS Views ... *3.47, 4.307*
UMTS Power Control View ... *4.130*
UMTS Reselection View ... *4.127*

UMTS RLC/MAC View 4.123
UMTS RRC Messages 4.268
UMTS SIB View 4.121
UMTS Technology Settings 3.91
UMTS TrCH View 4.114
UMTS Views 3.34, 4.100
UMTS/GSM Handover Analyzer View 4.252
UMTS/GSM NQA State View 4.249
UMTS/GSM NQA View 4.271
Undo change 4.48
Unload (K6 CI Main View) 5.14
Unsorted pool (Top N) 6.191
Update rate 6.161
Update Rate (Atlas) 6.120
Update Rate for P-SCH View 6.188
Update Rates (DVB) 6.131
Uplink (UMTS) 4.322
USB interface 6.5
Use Autodial 6.44
Use Fast Replay 3.99
Use ST1 .... 5.36
User event 3.66, 3.105
User interface 3.1
Using Help 3.108
UTM system 8.20
UTMS Reselection View 4.127
UTMS RLC/MAC View 4.123

V

Validity (GPS Info) 4.35
Value generation 7.9
Value visualizing
  route track 4.42
Values
  2D chart 4.14
  Polar View 4.32
  route track 4.41
  Statistic Histogram 4.20
Video Streaming 4.344, 6.237
View menu 3.18
View title 4.1
Views
  General Properties 4.1
  move 3.2
Views (configuration) 3.75
Vocoder Rate
  view (CDMA) 4.184
Voice Marker 3.67

W

Wait (DQA) 6.238
Wave file 1.8
Waypoint 6.263
Wheel trigger 6.160
Window menu 3.106
WLAN (NDIS) driver 6.220
WLAN C/I View 4.395
WLAN S/N View 4.396
WLAN Scan View 4.390
WLAN Signal View 4.394
WLAN Survey View 4.397
WLAN Views 3.53, 4.389
Worksheet 3.2
Worksheet (MS Excel, NQA) 7.51
Worksheets 3.24
Workspace 1.3, 3.60
  open 3.7
  save 3.9
Workspace file 1.13
World map 4.37

Z

Zoom in 4.46
Zoom In
  CI Measurement View 5.21
Zoom out 4.47
Zoom Out
  CI Measurement View 5.21