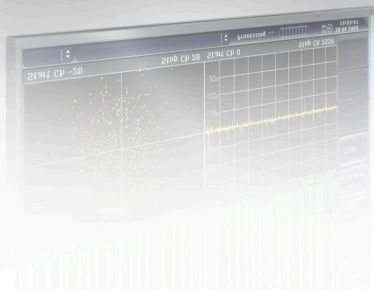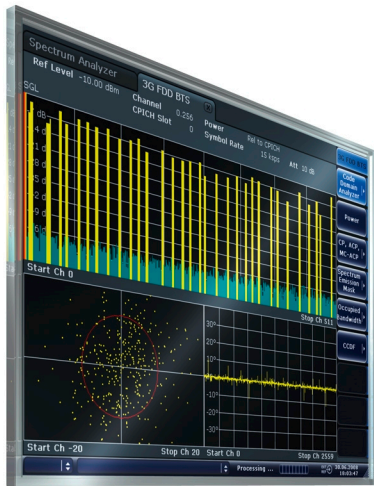# R&S® FSV-K72
3GPP FDD BTS Measurement
Operating Manual

ROHDE&SCHWARZ

This manual describes the following R&S®FSV options:

- R&S FSV-K72 (1310.8055.02)

This manual describes the following R&S®FSV models with firmware version 2.20 and higher:

- R&S®FSV 4 (1321.3008K04)
- R&S®FSV 7 (1321.3008K07)
- R&S®FSV 13 (1321.3008K13)
- R&S®FSV 30 (1321.3008K30)
- R&S®FSV 40 (1321.3008K39)
- R&S®FSV 40 (1321.3008K40)

It also applies to the following R&S®FSV models. However, note the differences described in chapter 1.4, "Notes for Users of R&S FSV 1307.9002Kxx Models", on page 9.

- R&S®FSV 3 (1307.9002K03)
- R&S®FSV 7 (1307.9002K07)
- R&S®FSV 13 (1307.9002K13)
- R&S®FSV 30 (1307.9002K30)
- R&S®FSV 40 (1307.9002K39)
- R&S®FSV 40 (1307.9002K40)

The firmware of the instrument makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgement" on the user documentation CD-ROM (included in delivery).

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

The following abbreviations are used throughout this manual: R&S®FSV is abbreviated as R&S FSV.

Contents

1 Preface

1.1 Documentation Overview

The user documentation for the R&S FSV is divided as follows:

- Quick Start Guide
- Operating Manuals for base unit and options
- Service Manual
- Online Help
- Release Notes

Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the CD. It provides the information needed to set up and start working with the instrument. Basic operations and basic measurements are described. Also a brief introduction to remote control is given. The manual includes general information (e.g. Safety Instructions) and the following chapters:

Chapter 1	Introduction, General information
Chapter 2	Front and Rear Panel
Chapter 3	Preparing for Use
Chapter 4	Firmware Update and Installation of Firmware Options
Chapter 5	Basic Operations
Chapter 6	Basic Measurement Examples
Chapter 7	Brief Introduction to Remote Control
Appendix	Printer Interface
Appendix	LAN Interface

Operating Manuals

The Operating Manuals are a supplement to the Quick Start Guide. Operating Manuals are provided for the base unit and each additional (software) option.

The Operating Manual for the base unit provides basic information on operating the R&S FSV in general, and the "Spectrum" mode in particular. Furthermore, the software options that enhance the basic functionality for various measurement modes are described here. The set of measurement examples in the Quick Start Guide is expanded by more advanced measurement examples. In addition to the brief introduction to remote control in the Quick Start Guide, a description of the basic analyzer commands and programming examples is given. Information on maintenance, instrument interfaces and error messages is also provided.

In the individual option manuals, the specific instrument functions of the option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S FSV is not included in the option manuals.

The following Operating Manuals are available for the R&S FSV:

- R&S FSV base unit; in addition:
    - R&S FSV-K9 Power Sensor Support
    - R&S FSV-K14 Spectrogram Measurement
- R&S FSV-K7 Analog Demodulation and R&S FSV-K7S FM Stereo Measurements
- R&S FSV-K10 GSM/EDGE Measurement
- R&S FSV-K30 Noise Figure Measurement
- R&S FSV-K40 Phase Noise Measurement
- R&S FSV-K70 Vector Signal Analysis Operating Manual
  R&S FSV-K70 Vector Signal Analysis Getting Started (First measurements)
- R&S FSV-K72 3GPP FDD BTS Analysis
- R&S FSV-K73 3GPP FDD UE Analysis
- R&S FSV-K76/77 3GPP TD-SCDMA BTS/UE Measurement
- R&S FSV-K82/83 CDMA2000 BTS/MS Analysis
- R&S FSV-K84/85 1xEV-DO BTS/MS Analysis
- R&S FSV-K91 WLAN IEEE 802.11
- R&S FSV-K93 WiMAX IEEE 802.16 OFDM/OFDMA Analysis
- R&S FSV-K100/K104 EUTRA / LTE Downlink Measurement Application
- R&S FSV-K101/K105 EUTRA / LTE Uplink Measurement Application

These manuals are available in PDF format on the CD delivered with the instrument.

Service Manual

This manual is available in PDF format on the CD delivered with the instrument. It describes how to check compliance with rated specifications, instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S FSV by replacing modules. The manual includes the following chapters:

Chapter 1	Performance Test
Chapter 2	Adjustment
Chapter 3	Repair
Chapter 4	Software Update / Installing Options
Chapter 5	Documents

Online Help

The online help contains context-specific help on operating the R&S FSV and all available options. It describes both manual and remote operation. The online help is instal-

led on the R&S FSV by default, and is also available as an executable .chm file on the CD delivered with the instrument.

Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The current release notes are provided in the Internet.

1.2 Conventions Used in the Documentation

1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

1.2.2 Conventions for Procedure Descriptions

When describing how to operate the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the instrument or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the instrument or on a keyboard.

1.3 How to Use the Help System

Calling context-sensitive and general help

► To display the general help dialog box, press the HELP key on the front panel.

The help dialog box "View" tab is displayed. A topic containing information about the current menu or the currently opened dialog box and its function is displayed.

> For standard Windows dialog boxes (e.g. File Properties, Print dialog etc.), no context-sensitive help is available.

► If the help is already displayed, press the softkey for which you want to display help.

A topic containing information about the softkey and its function is displayed.

> If a softkey opens a submenu and you press the softkey a second time, the submenu of the softkey is displayed.

Contents of the help dialog box

The help dialog box contains four tabs:

● "Contents" - contains a table of help contents
● "View" - contains a specific help topic
● "Index" - contains index entries to search for help topics
● "Zoom" - contains zoom functions for the help display

To change between these tabs, press the tab on the touchscreen.

Navigating in the table of contents

● To move through the displayed contents entries, use the UP ARROW and DOWN ARROW keys. Entries that contain further entries are marked with a plus sign.
● To display a help topic, press the ENTER key. The "View" tab with the corresponding help topic is displayed.
● To change to the next tab, press the tab on the touchscreen.

Navigating in the help topics

● To scroll through a page, use the rotary knob or the UP ARROW and DOWN ARROW keys.
● To jump to the linked topic, press the link text on the touchscreen.

Searching for a topic

1. Change to the "Index" tab.

2. Enter the first characters of the topic you are interested in. The entries starting with these characters are displayed.

3. Change the focus by pressing the ENTER key.

4. Select the suitable keyword by using the UP ARROW or DOWN ARROW keys or the rotary knob.

5. Press the ENTER key to display the help topic.

   The "View" tab with the corresponding help topic is displayed.

Changing the zoom

1. Change to the "Zoom" tab.

2. Set the zoom using the rotary knob. Four settings are available: 1-4. The smallest size is selected by number 1, the largest size is selected by number 4.

Closing the help window

► Press the ESC key or a function key on the front panel.

1.4 Notes for Users of R&S FSV 1307.9002Kxx Models

Users of R&S FSV 1307.9002Kxx models should consider the following differences to the description of the newer R&S FSV 1321.3008Kxx models:

- Functions that are based on the Windows7 operating system (e.g. printing or setting up networks) may have a slightly different appearance or require different settings on the Windows XP based models. For such functions, refer to the Windows documentation or the documentation originally provided with the R&S FSV instrument.

- The R&S FSV 1307.9002K03 model is restricted to a maximum frequency of 3 GHz, whereas the 1321.3008K04 model has a maximum frequency of 4 GHz.

- The bandwidth extension option R&S FSV-B160 (1311.2015.xx) is not available for the R&S FSV 1307.9002Kxx models. The maximum usable I/Q analysis bandwidth for these models is 28 MHz, or with option R&S FSV-B70, 40 MHz.

2 Introduction

This section contains all information required for operation of an R&S FSV equipped with application firmware R&S FSV-K72. It covers operation via menus and the remote control commands for the 3GPP FDD BTS base station test.

This part of the documentation consists of the following chapters:

- chapter 3, "Setup for Base Station Tests", on page 11
  Describes the measurement setup for base station tests.
- chapter 4, "3GPP FDD BTS Test Models", on page 13
  Gives an overview over the test models with different channel configurations.
- chapter 5, "Instrument Functions 3GPP Base Station Measurements", on page 15
  Describes the instrument functions of 3GPP Base Station Measurements
- chapter 6, "Configuration of 3GPP FDD BTS Measurements", on page 27
  Contains a detailed description of the possible base station test measurements as a reference for manual operation. This chapter also presents a list of remote control commands associated with each function.
- chapter 7, "Measurement Examples (R&S FSV-K72)", on page 114
  Explains some basic 3GPP°FDD base station tests.
- chapter 8, "Remote Control Commands", on page 125
  Describes all remote control commands defined for the code domain measurement. An alphabetic list of all remote control commands are provided at the end of this document.
- chapter 9, "Error Messages", on page 234
  Contains device-specific error messages for R&S FSV-K72.
- chapter 10, "Glossary", on page 235
  Contains an explanation of terms related to measured quantities of the code domain measurement.

This part of the documentation includes only functions of the application firmware R&S FSV-K72. For all other descriptions, please refer to the description of the base unit at the beginning of the documentation.

3 Setup for Base Station Tests

> **NOTICE**
>
> **Risk of instrument damage**
>
> Before switching on the instrument, make sure that the following conditions are met:
>
> - Instrument covers are in place and all fasteners are tightened.
> - All fan openings are unobstructed and the airflow perforations are unimpeded. The minimum distance from the wall is 10 cm.
> - The instrument is dry and shows no sign of condensation.
> - The instrument is operated in the horizontal position on an even surface.
> - The ambient temperature does not exceed the range specified in the data sheet.
> - Signal levels at the input connectors are all within the specified ranges.
> - Signal outputs are correctly connected and are not overloaded.
>
> Failure to meet these conditions may cause damage to the instrument or other devices in the test setup.

This section describes how to set up the analyzer for 3GPP FDD BTS base station tests. As a prerequisite for starting the test, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the analyzer. Furthermore, application firmware module R&S FSV-K72 must be properly installed following the instructions provided in the operating manual for the analyzer.

Standard Test Setup

- Connect antenna output (or TX output) of BTS to RF input of the analyzer via a power attenuator of suitable attenuation.
  The following values are recommended for the external attenuator to ensure that the RF input of the analyzer is protected and the sensitivity of the analyzer is not reduced too much.

Max. power	Recommended ext. attenuation
≥55 to 60 dBm	35 to 40 dB
≥50 to 55 dBm	30 to 35 dB
≥45 to 50 dBm	25 to 30 dB
≥40 to 45 dBm	20 to 25 dB
≥35 to 40 dBm	15 to 20 dB
≥30 to 35 dBm	10 to 15 dB
≥25 to 30 dBm	5 to 10 dB

Max. power	Recommended ext. attenuation
≥20 to 25 dBm	0 to 5 dB
<20 dBm	0 dB

- For signal measurements at the output of two-port networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (EXT REF IN/OUT).

- To ensure that the error limits specified by the 3GPP standard are met, the analyzer should use an external reference frequency for frequency measurements on base stations. For instance, a rubidium frequency standard may be used as a reference source.

- If the base station is provided with a trigger output, connect this output to the rear trigger input of the analyzer (EXT TRIG GATE).

Presetting

- Enter external attenuation (REF LVL OFFSET)
- Enter reference level
- Enter center frequency
- Set the trigger
- Select standard and measurement

4 3GPP FDD BTS Test Models

For measurements on base-station signals in line with 3GPP, test models with different channel configurations are specified in the document "Base station conformance testing (FDD)" (3GPP TS 25.141 V5.7.0). An overview of the test models is provided in this chapter.

Table 4-1: Test model 1

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (×256Tchip)
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
SCCPCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	16/32/64	76.8 total	see TS 25.141	see TS 25.141	see TS 25.141

Table 4-2: Test model 2

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (x256Tchip)
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
SCCPCH (SF=256)	1	5	-13	3	0
DPCH (SF=128)	3	2 × 10, 1 × 50	2 × -10, 1 × -3	24, 72, 120	1, 7, 2

Table 4-3: Test model 3

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (×256Tchip)
PCCPCH+SCH	1	12.6/7.9	-9/-11	1	0
Primary CPICH	1	12.6/7.9	-9/-11	0	0
PICH	1	5/1.6	-13/-18	16	120
SCCPCH (SF=256)	1	5/1.6	-13/-18	3	0
DPCH (SF=256)	16/32	63,7/80,4 total	see TS 25.141	see TS 25.141	see TS 25.141

Table 4-4: Test model 4

Channel type	Number of chan-nels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (×256Tchip)
PCCPCH+SCH	1	50 to 1.6	-3 to -18	1	0
Primary CPICH*	1	10	-10	0	0

Table 4-5: Test model 5

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (×256Tchip)
PCCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
SCCPCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=256)	30/14/6	14/14.2/14.4 total	see TS 25.141	see TS 25.141	see TS 25.141
HS_SCCH	2	4 total	see TS 25.141	see TS 25.141	see TS 25.141
HS_PDSCH (16QAM)	8/4/2	63.6/63.4/63.2 total	see TS 25.141	see TS 25.141	see TS 25.141

5 Instrument Functions 3GPP Base Station Measurements

The R&S FSV equipped with the 3GPP Base Station Measurement option R&S FSV-K72 performs code domain power measurements on downlink signals according to the 3GPP standard (Third Generation Partnership Project, FDD mode). Signals that meet the conditions for channel configuration of 3GPP standard test models 1 to 5 can be measured, including HSDPA and HSUPA signals (test model 5). In addition to the code domain power measurements specified by the 3GPP standard, the 3GPP Base Station Measurements option offers measurements with predefined settings in the frequency domain, e.g. power measurements.

To open the 3GPP BTS menu

- If the 3G FDD BTS mode is not the active measurement mode, press the MODE key and activate the 3G FDD BTS option.
- If the 3G FDD BTS mode is already active, press the HOME key.

The 3GPP BTS menu is displayed.

Menu and Softkey Description

- chapter 6.1.3, "Softkeys of the Code Domain Analyzer (R&S FSV-K72)", on page 49
- chapter 6.3.7, "Softkeys and Menus for RF Measurements (K72)", on page 91
- chapter 6.1.4, "Softkeys of the Frequency Menu for CDA measurements – FREQ key (R&S FSV-K72)", on page 66
- chapter 6.1.5, "Softkeys of the Amplitude Menu – AMPT key (R&S FSV-K72)", on page 67
- chapter 6.1.11, "Softkeys of the Auto Set Menu – AUTO SET Key (R&S FSV-K72)", on page 78
- chapter 6.1.6, "Softkeys of the Sweep Menu for CDA Measurements – SWEEP key (R&S FSV-K72)", on page 71
- chapter 6.1.7, "Softkeys of the Trigger Menu – TRIG key (R&S FSV-K72)", on page 72
- chapter 6.1.8, "Softkeys of the Trace Menu for CDA Measurements – TRACE key (R&S FSV-K72)", on page 73
- chapter 6.1.9, "Softkeys of the Marker Menu – MKR key (R&S FSV-K72)", on page 75
- chapter 6.1.10, "Softkeys of the Marker To Menu – MKR-> key (R&S FSV-K72)", on page 76
- chapter 6.1.12, "Softkeys of the Input/Output Menu for CDA Measurements", on page 80

The "Span", "Bandwidth", and "Marker Function" menus are disabled for measurements in the CDA mode. For all other measurements (see root menu), the settings are

described together with the measurement. The associated menu corresponds to that of the measurement in the base unit and is described in the manual for the base unit.

Importing and Exporting I/Q Data

As of firmware version 1.60, I/Q data can be imported from a file for processing in R&S FSV-K72, and captured I/Q data can be stored to a file ("IQ Import"/"IQ Export" softkeys in the "Save/Rcl" menu). For details see the base unit description.

To display help to a softkey, press the HELP key and then the softkey for which you want to display help. To close the help window, press the ESC key. For further information refer to chapter 1.3, "How to Use the Help System", on page 8.

5.1 Measurements and Result Diagrams

The 3GPP Base Station Measurement option provides Code Domain Measurements and RF measurements.

5.1.1 Code Domain Measurements

The Code Domain Measurement option provides various test measurement types and result diagrams which are available via the Display Config softkey or the Display Config button in the Settings Overview dialog box.

The code domain power measurements are performed as specified by the 3GPP standards. A signal section of approx. 20 ms is recorded for analysis and then searched through to find the start of a 3GPP FDD BTS frame. If a frame start is found in the signal, the code domain power analysis is performed for a complete frame starting from slot 0. The different result diagrams are calculated from the recorded IQ data set. Therefore it is not necessary to start a new measurement in order to change the result diagram. Common settings for these measurements are performed via the "Settings" dialog box (see "Settings Overview" on page 50).

For details on the measurement modes, see chapter 6.1.2, "Measurement Modes in Code Domain Analyzer", on page 32

5.1.2 Time Alignment Error Measurements

Time Alignment Error Measurements are a special type of Code Domain Analysis used to determine the time offset between the signals of both antennas of a base station. The measurement can be activated in the MEAS menu.

The settings for time alignment measurements are the same as for CDA measurements, although some settings may not be available. For a description see chapter 6.1.3, "Softkeys of the Code Domain Analyzer (R&S FSV-K72)", on page 49.

The result is displayed numerically on the screen, a graphical result is not available.

For details on Time Alignment Error Measurements see chapter 6.2, "Time Alignment Error Measurement", on page 84.

5.1.3 RF measurements

The RF Measurement option provides the following test measurement types and result displays:

- Output Power (see chapter 6.3.1, "Output Power Measurements", on page 86)
- Spectrum Emission Mask (see chapter 6.3.2, "Spectrum Emission Mask", on page 86)
- Adjacent Channel Power (see chapter 6.3.3, "Ch Power ACLR", on page 86)
- Occupied Bandwidth (see chapter 6.3.4, "Occupied Bandwidth", on page 87)
- CCDF (see chapter 6.3.5, "CCDF", on page 88)
- RF Combi (see chapter 6.3.6, "RF Combi", on page 89 ")

All these measurements are accessed via the MEAS key ("Measurement" menu). Some parameters are set automatically according to the 3GPP standard. A list of these parameters is given with each measurement type. A set of parameters is passed on from the 3GPP Base Station Measurements option to the base unit and vice versa, which allows you to switch between applications quickly and easily:

- center frequency
- reference level
- attenuation
- reference level offset
- center frequency step size
- trigger source
- trigger offset

5.2 Further Information

5.2.1 Short List of Abbreviations

Term or abbreviation	Description
BTS	base transmission station
CPICH	common pilot channel
DPCH	dedicated physical channel, data channel
FDD	frequency division duplexing
PCCPCH	primary common control physical channel
PICH	paging indication channel
SCH	synchronization channel, divided into P-SCH (primary synchronization channel) and S-SCH (secondary synchronization channel)

5.2.2 Channels of the Code Domain Channel Table and Their Usage

The channel assignment table contains the following (data) channels:

Channel	Description
CPICH	The common pilot channel is used to synchronize the signal in the case of CPICH synchronization. It is expected at code class 8 and code number 0.
PSCH	The primary synchronization channel is used to synchronize the signal in the case of SCH synchronization. It is a non-orthogonal channel. Only the power of this channel is determined.
SSCH	The secondary synchronization channel is a non-orthogonal channel. Only the power of this channel is determined.
PCCPCH	The primary common control physical channel is used to synchronize the signal in the case of SCH synchronization. It is expected at code class 8 and code number 1.

Channel	Description

SCCPCH	The secondary common control physical channel is a QPSK-modulated channel without any pilot symbols. In the 3GPP test models, this channel can be found in code class 8 and code number 3. However, the code class and code number need not to be fixed and can vary. For this reason, the following rules are used to indicate SCCPCH.
	• "HSDPA/HSUPA On/Off" softkey set to Off
	  – Only one QPSK-modulated channel without pilot symbols is detected and displayed as the SCCPCH. Any further QPSK-modulated channels without pilot symbols are not detected as active channels.
	  – If the signal contains more than one channel without pilot symbols, the channel that is received in the highest code class and with the lowest code number is displayed as the SCCPCH. It is expected that only one channel of this type is included in the received signal. According to this assumption, this channel is probably the SCCPCH.
	• "HSDPA/HSUPA On/Off" softkey set to On
	  – All QPSK-modulated channels without pilot symbols are detected. If one of these channels is received at code class 8 and code number 3, it is displayed as the SCCPCH. QPSK-modulated channels without pilot symbols and a code class higher than or equal to 7 are marked with the channel type CHAN. QPSK-modulated channels without pilot symbols and a code class lower than 7 are marked with channel type HSPDSCH.

PICH	The paging indication channel is expected at code class 8 and code number 16.
DPCH	The dedicated physical channel is a data channel that contains pilot symbols. The displayed channel type is DPCH. The status is inactive (channel is not active), active (channel is active and all pilot symbols are correct), or pilotf (channel is active but it contains incorrect pilot symbols).
HS-PDSCH (HSDPA)	The high speed physical downlink shared channel does not contain any pilot symbols. It is a channel type that is expected in code classes equal to or higher than 7: HSPDSCH(QPSK)_ (QPSK-modulated slot of an HS-PDSCH channel), HSPDSCH(16QAM)_ (16QAM-modulated slot of an HS-PDSCH channel), HSPDSCH(NONE)_ (slot without power of an HS-PDSCH channel). The modulation type of these channels can be varied depending on the selected slot. The status is inactive (channel is not active) or active (channel is active and all pilot symbols are correct).
HS-SCCH (HSDPA)	The high speed shared control channel does not contain any pilot symbols. It is a channel type that is expected in code classes equal to or higher than 7. The modulation type should always be QPSK. The channel does not contain any pilot symbols. The status is inactive (channel is not active) or active (channel is active and all pilot symbols are correct).

Channel	Description
CHAN	Any arbitrary channel that does not carry a valid pilot symbol sequence is displayed as an arbitrary channel. It is not possible to decide which channel type is transmitted. The only prerequisite is that the channel carries symbols of a sufficient signal to noise ratio. • Chan Type: CHAN (QPSK-modulated channel without any pilot symbols) • Status: inactive if the channel is not active; active if the channel is active
E-HICH	Enhanced HARQ hybrid acknowledgement indicator channel Carries hybrid ARQ ACK/NACK E-RGCH Enhanced relative grant channel Carries relative grant allocation for a UE E-AGCH Enhanced absolute grant channel Carries absolute grant allocation for a UE

5.2.3 Detector Overview

The measurement detector for the individual display modes can be selected directly by the user or set automatically by the R&S FSV. The detector activated for the specific trace is indicated in the corresponding trace display field by an abbreviation.

The detectors of the R&S FSV are implemented as pure digital devices. They collect signal power data within each measured point during a sweep. The default number of sweep points is 691. The following detectors are available:

Table 5-1: Detector types

Detector	Indicator	Function
Auto Peak	Ap	Determines the maximum and the minimum value within a measurement point (not available for SEM)
Positive Peak	Pk	Determines the maximum value within a measurement point
Negative Peak (min peak)	Mi	Determines the minimum value within a measurement point
RMS	Rm	Determines the root mean square power within a measurement point
Average	Av	Determines the linear average power within a measurement point
Sample	Sa	Selects the last value within a measurement point

The result obtained from the selected detector within a measurement point is displayed as the power value at this measurement point.

All detectors work in parallel in the background, which means that the measurement speed is independent of the detector combination used for different traces.

> **Number of measured values**
>
> During a frequency sweep, the R&S FSV increments the first local oscillator in steps that are smaller than approximately 1/10 of the bandwidth. This ensures that the oscillator step speed is conform to the hardware settling times and does not affect the precision of the measured power.
>
> The number of measured values taken during a sweep is independent of the number of oscillator steps. It is always selected as a multiple or a fraction of 691 (= default number of trace points displayed on the screen). Choosing less then 691 measured values (e.g. 125 or 251) will lead to an interpolated measurement curve, choosing more than 691 points (e.g. 1001, 2001 …) will result in several measured values being overlaid at the same frequency position.

> **RMS detector and VBW**
>
> If the RMS detector is selected, the video bandwidth in the hardware is bypassed. Thus, duplicate trace averaging with small VBWs and RMS detector no longer occurs. However, the VBW is still considered when calculating the sweep time. This leads to a longer sweep time for small VBW values. Thus, you can reduce the VBW value to achieve more stable trace curves even when using an RMS detector. Normally, if the RMS detector is used the sweep time should be increased to get more stable trace curves.

5.2.4 Trace Mode Overview

The traces can be activated individually for a measurement or frozen after completion of a measurement. Traces that are not activate are hidden. Each time the trace mode is changed, the selected trace memory is cleared.

The R&S FSV offers 6 different trace modes:

Clear Write
Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

All available detectors can be selected.

Remote command:
DISP:TRAC:MODE WRIT, see DISPlay[:WINDow<n>]:TRACe<t>:MODE
on page 177

Max Hold
The maximum value is determined over several sweeps and displayed. The R&S FSV saves the sweep result in the trace memory only if the new value is greater than the previous one.

The detector is automatically set to "Positive Peak".

This mode is especially useful with modulated or pulsed signals. The signal spectrum is filled up upon each sweep until all signal components are detected in a kind of envelope.

This mode is not available for statistics measurements.

Remote command:

DISP:TRAC:MODE MAXH, see DISPlay[:WINDow<n>]:TRACe<t>:MODE on page 177

Min Hold

The minimum value is determined from several measurements and displayed. The R&S FSV saves the smallest of the previously stored/currently measured values in the trace memory.

The detector is automatically set to "Negative Peak".

This mode is useful e.g. for making an unmodulated carrier in a composite signal visible. Noise, interference signals or modulated signals are suppressed whereas a CW signal is recognized by its constant level.

This mode is not available for statistics measurements.

Remote command:

DISP:TRAC:MODE MINH, see DISPlay[:WINDow<n>]:TRACe<t>:MODE on page 177

Average

The average is formed over several sweeps. The Sweep Count determines the number of averaging procedures.

All available detectors can be selected. If the detector is automatically selected, the sample detector is used (see chapter 5.2.3, "Detector Overview", on page 20).

This mode is not available for statistics measurements.

Remote command:

DISP:TRAC:MODE AVER, see DISPlay[:WINDow<n>]:TRACe<t>:MODE on page 177

View

The current contents of the trace memory are frozen and displayed.

Note: If a trace is frozen, the instrument settings, apart from level range and reference level (see below), can be changed without impact on the displayed trace. The fact that the displayed trace no longer matches the current instrument setting is indicated by the ⭐ icon on the tab label.

If the level range or reference level is changed, the R&S FSV automatically adapts the measured data to the changed display range. This allows an amplitude zoom to be made after the measurement in order to show details of the trace.

Remote command:

DISP:TRAC:MODE VIEW, see DISPlay[:WINDow<n>]:TRACe<t>:MODE on page 177

Blank

Hides the selected trace.

Remote command:

DISP:TRAC OFF, see DISPlay[:WINDow<n>]:TRACe<t>[:STATe] on page 178

5.2.5 Selecting the Appropriate Filter Type

All resolution bandwidths are realized with digital filters.

The video filters are responsible for smoothing the displayed trace. Using video bandwidths that are small compared to the resolution bandwidth, only the signal average is displayed and noise peaks and pulsed signals are repressed. If pulsed signals are to be measured, it is advisable to use a video bandwidth that is large compared to the resolution bandwidth (VBW * 10 x RBW) for the amplitudes of pulses to be measured correctly.

The following filter types are available:

- Normal (3dB) (Gaussian) filters
  The Gaussian filters are set by default. The available bandwidths are specified in the data sheet.

- CISPR (6 dB) filters

- MIL Std (6 dB) filters
  Note that the 6 dB bandwidths are available only with option R&S FSV-K54.

- Channel filters
  For details see chapter 5.2.6, "List of Available RRC and Channel Filters", on page 23 .
  Channel filters do not support FFT mode.

- RRC filters
  For details see chapter 5.2.6, "List of Available RRC and Channel Filters", on page 23 .
  RRC filters do not support FFT mode.

- 5-Pole filters
  The available bandwidths are specified in the data sheet.
  5-Pole filters do not support FFT mode.

5.2.6 List of Available RRC and Channel Filters

For power measurement a number of especially steep-edged channel filters are available (see the following table). The indicated filter bandwidth is the 3 dB bandwidth. For RRC filters, the fixed roll-off factor (a) is also indicated.

Table 5-2: Filter types

Filter Bandwidth	Filter Type	Application
100 Hz	CFILter	
200 Hz	CFILter	A0
300 Hz	CFILter	
500 Hz	CFILter	
1 kHz	CFILter	
1.5 kHz	CFILter	

Filter Bandwidth	Filter Type	Application
2 kHz	CFILter	
2.4 kHz	CFILter	SSB
2.7 kHz	CFILter	
3 kHz	CFILter	
3.4 kHz	CFILter	
4 kHz	CFILter	DAB, Satellite
4.5 kHz	CFILter	
5 kHz	CFILter	
6 kHz	CFILter	
6 kHz, a=0.2	RRC	APCO
8.5 kHz	CFILter	ETS300 113 (12.5 kHz channels)
9 kHz	CFILter	AM Radio
10 kHz	CFILter	
12.5 kHz	CFILter	CDMAone
14 kHz	CFILter	ETS300 113 (20 kHz channels)
15 kHz	CFILter	
16 kHz	CFILter	ETS300 113 (25 kHz channels)
18 kHz, a=0.35	RRC	TETRA
20 kHz	CFILter	
21 kHz	CFILter	PDC
24.3 kHz, a=0.35	RRC	IS 136
25 kHz	CFILter	
30 kHz	CFILter	CDPD, CDMAone
50 kHz	CFILter	
100 kHz	CFILter	
150 kHz	CFILter	FM Radio
192 kHz	CFILter	PHS
200 kHz	CFILter	
300 kHz	CFILter	
500 kHz	CFILter	J.83 (8-VSB DVB, USA)

Filter Bandwidth	Filter Type	Application
1 MHz	CFILter	CDMAone
1.228 MHz	CFILter	CDMAone
1.28 MHz, a=0.22	RRC	
1.5 MHz	CFILter	DAB
2 MHz	CFILter	
3 MHz	CFILter	
3.75 MHz	CFILter	
3.84 MHz, a=0.22	RRC	W-CDMA 3GPP
4.096 MHz, a=0.22	RRC	W-CDMA NTT DOCoMo
5 MHz	CFILter	
20 MHz	CFILter	
28 MHz	CFILter	
40 MHz	CFILter	

5.2.7   ASCII File Export Format

The data of the file header consist of three columns, each separated by a semicolon: parameter name; numeric value; basic unit. The data section starts with the keyword "Trace <n>" (<n> = number of stored trace), followed by the measured data in one or several columns (depending on measurement) which are also separated by a semico-lon.

File contents: header and data section	Description
Type;FSV;	Instrument model
Version;1.50;	Firmware version
Date;01.Apr 2010;	Date of data set storage
Screen;A;	Instrument mode
Points per Symbol;4;	Points per symbol
x Axis Start;-13;sym;	Start value of the x axis
x Axis Stop;135;sym;	Stop value of the x axis
Ref value y axis;-10.00;dBm;	Y axis reference value
Ref value position;100;%;	Y axis reference position
Trace;1;	Trace number
Meas;Result;	Result type
Meas Signal;Magnitude;	Result display
Demodulator;Offset QPSK;	Demodulation type

File contents: header and data section	Description
ResultMode;Trace;	Result mode
x unit;sym;	Unit of the x axis
y unit;dBm;	Unit of the y axis
Trace Mode;Clear Write;	Trace mode
Values;592;	Number of results
<values>	List of results

6 Configuration of 3GPP FDD BTS Measurements

The R&S FSV-K72 option appears in the "Select Mode" menu (MODE key) as "3GPP FDD BTS". This softkey can be used to start the R&S FSV-K72 options.

The most important parameters for the 3GPP FDD BTS base station tests are summarized in the root menu of the R&S FSV-K72 option and explained below using the softkey functions. The root menu is available by pressing the "3G FDD BTS" softkey in the "Select Mode" menu, the MEAS key or the HOME key.

The "Code Domain Analyzer" softkey activates the code domain analyzer measurement mode and opens the submenus for setting the measurement.

The "Power", "Ch Power ACLR", "Spectrum Emission Mask", "Occupied Bandwidth", "CCDF" and "RF Combi" softkeys activate base station tests in the analyzer mode. Pressing the associated softkey defines the settings required by 3GPP specifications. A subsequent modification of settings is possible.

The "Time Alignment" softkey activates the time alignment error measurement mode and opens the submenus for setting the measurement.

It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

chapter 6.1, "Code Domain Analyzer Measurements", on page 28	Activates the code domain measurement mode and opens another submenu for selecting and configuring the parameters. All other menus of the R&S FSV are adapted to the functions of the code domain measurement mode.
chapter 6.3.1, "Output Power Measurements", on page 86	Activates the channel power measurement with defined settings in the analyzer mode.
chapter 6.3.3, "Ch Power ACLR", on page 86	Activates the adjacent-channel power measurement with defined settings in the analyzer mode.
chapter 6.3.2, "Spectrum Emission Mask", on page 86	Compares the signal power in different carrier offset ranges with the maximum values specified by 3GPP.
chapter 6.3.4, "Occupied Bandwidth", on page 87	Activates the measurement of the occupied bandwidth (analyzer mode).
chapter 6.3.5, "CCDF", on page 88	Evaluates the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).
chapter 6.3.6, "RF Combi", on page 89	Activates the RF combination measurement of adjacent channel leakage error (ACP), spectrum emission mask (SEM) and occupied bandwidth (OBW).
chapter 6.2, "Time Alignment Error Measurement", on page 84	Activates the Time Alignment Error Measurement for the combined signals of both antennas of a base station.

6.1 Code Domain Analyzer Measurements

The "Code Domain Analyzer" softkey activates the code domain analyzer measurement mode and opens the submenu for setting the measurement.

For a brief introduction to the display concept of the code domain analyzer measurements refer to chapter 6.1.1, "Display Concept", on page 29.

In chapter 6.1.2, "Measurement Modes in Code Domain Analyzer", on page 32 the available measurement modes for code domain analysis and their results are described.

Refer to chapter 6.1.3, "Softkeys of the Code Domain Analyzer (R&S FSV-K72)", on page 49 for an introduction to the code domain analyzer settings, as well as the softkeys and menus for code domain analyzer measurements.

6.1.1   Display Concept

Measurement results

The code domain analyzer can show up to four result diagrams in four different screens (windows) at one time. For each screen, you can define which type of result diagram is to be displayed, or deactivate the screen temporarily. The current configuration of the display, i.e. which screens are displayed and which result diagram is displayed in which screen, can be stored and retrieved later. Thus, you can easily switch between predefined display configurations.

All results are calculated from the same dataset of the recorded signal. Thus, it is not necessary to restart the measurement in order to switch the display mode.

The available measurement types and result diagrams are described in chapter 6.1.2, "Measurement Modes in Code Domain Analyzer", on page 32 .

For more information on the display configuration, see the description of the "Display Config" on page 64 softkey.

Measurement settings

The most important measurement settings are displayed in the diagram header. For Code Domain Analyzer measurements, the following settings are shown:

Label	Description
Ref level	Reference level defined in "Ref Level" on page 52
Att	Attenuation
Freq	Center frequency defined in "Center" on page 52
Channel	Channel with spreading factor
CPICH Slot	CPICH slot
Power	"Demod Settings" on page 61: ""Code Power Display"" and ""Power Reference"" , e.g. ""Relative to Total"" (i.e. relative to *all* channels)
SymbRate	Symbol rate of the current channel

> **Overview of all measurement settings**
>
> You can easily display an overview of all measurement settings using the "Settings Overview" on page 50 softkey.

In addition to the information in the diagram header, each screen title contains diagram-specific trace information.

Screen focus

One of the screens has a blue frame indicating the focus. The screen focus can be changed just like in the base system. The settings for trace statistics and markers can only be changed for the focussed screen. Furthermore, the focussed screen can be set to full screen (for details see the R&S FSV Quick Start Guide).

6.1.1.1 Defining the display configuration

1. Select the "Display Config" softkey in the "Code Domain Analyzer" menu.

2. Select the tab for the screen you want to configure (A-D).

3. Select the "Screen X active" option to display the selected screen.

   Tip: SCPI command: `DISPlay[:WINDow<n>]:STATe` on page 177

4. Select the required result diagram to be displayed in the selected screen.

   Tip: SCPI command: `CALCulate<n>:FEED` on page 129

5. Press "Close".

To select a predefined display configuration

You can retrieve previously stored display configurations, and thus easily switch between different displays of measurement results.

1. Select the "Predefined" tab in the "Display Configuration" dialog box.

   The previously stored and default configurations are listed. The current configuration is displayed at the top of the dialog box.

2. Select the required set of screen configurations.

3. Press "Apply".

To store the current display configuration

You can store the current display configuration in the list of predefined settings in order to switch back to it later.

1. Select the current display configuration at the top of the "Display Configuration" dialog box.

2. Click "Add".

    The current display configuration is added to the list of predefined settings.

To remove a predefined display configuration

You can remove one of the stored display configurations.

1. Select the display configuration to be removed from the "Predefined" tab of the "Display Configuration" dialog box.

2. Click "Remove".

    The selected display configuration is removed from the list of predefined settings.

To restore the default display configurations

You can restore the default set of predefined display configurations.

► In the "Predefined" tab of the "Display Configuration" dialog box, click "Restore".

6.1.2 Measurement Modes in Code Domain Analyzer

The display modes in this chapter are all based on the recording of the IQ data. With the same dataset of the recorded signal, you can display the following evaluation types (see "Display Config" on page 64 softkey). Therefore it is not necessary to restart the measurement in order to switch the display mode.

The display mode is defined in the "Display Config" dialog box (see "Display Config" on page 64) or using the remote command CALCulate<n>:FEED on page 129. The selected display mode also affects the results of the trace data query (see TRACe<n>[:DATA]? on page 218).

The following display modes and measurements specified by the 3GPP standard are available:
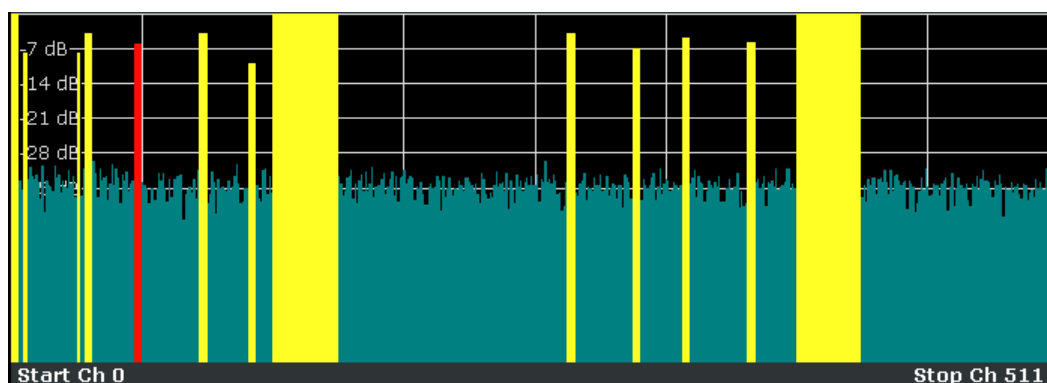
6.1.2.1   Code Domain Power

Fig. 6-1: Code Domain Power Display for R&S FSV-K72

The "Code Domain Power" display mode shows the power of the different code channels in the the adjusted slot. Due to the circumstance that the power is regulated from slot to slot, the result power may differ between different slots. Detected channels are displayed yellow. The code channel which is defined via "Select Channel" is marked red. The codes where no channel could be detected are displayed cyan.

If some of the DPCH-channels contain incorrect pilot symbols, these channels are marked with the color green, and a message "INCORRECT PILOT" is displayed in the status bar.

If HS-DPA/UPA is enabled in the "Channel Detection Settings" dialog box (see "Channel Detection Settings" on page 57), channels without pilot symbols, e.g. channels of type HS-PDSCH, are recognized as active.

Result data for remote query

SCPI command:

`CALC:FEED "XPOW:CDP"`, see chapter 8.2.1, "CALCulate:FEED subsystem", on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, 5 values are transmitted for each channel:

- the code class
- the channel number
- the absolute level
- the relative level
- the timing offset

The code class defines the spreading factor of the channel. Class 9 corresponds to the highest spreading factor (512, symbol rate 7.5 ksps), class 2 to the lowest admissible spreading factor (4, symbol rate 960 ksps).

The channels are output in ascending order sorted by code number, i.e. in the same sequence they are displayed on screen.

6.1.2.2 Channel Table

The "Code Domain Channel Table" display mode selects the display of the channel assignment table. The channel assignment table can contain a maximum of 512 entries, corresponding to the 512 codes that can be assigned within the class of spreading factor 512.

The upper part of the table indicates the channels that have to be available in the signal to be analyzed:

CPICH	The Common Pilot Channel is used to synchronize the signal in the case of CPICH synchronization. It is expected at code class 8 and code number 0.
PSCH	The Primary Synchronization Channel is used to synchronize the signal in the case of SCH synchroniza-tion. It is a nonorthogonal channel. Only the power of this channel is determined.
SSCH	The Secondary Synchronization Channel is a nonorthogonal channel. Only the power of this channel is determined.
PCCPCH	The Primary Common Control Physical Channel is also used to synchronize the signal in the case of SCH synchronization. It is expected at code class 8 and code number 1.
SCCPCH	The Secondary Common Control Physical Channel is a QPSK-modulated channel without any pilot symbols. In the 3GPP test models, this channel can be found in code class 8 and code number 3. However, the code class and code number need not to be fixed and can vary. For this reason, the following rules are used to inidicate the SCCPCH. ● Only one QPSK-modulated channel without pilot symbols is detected and displayed as the SCCPCH. Any fur-ther QPSK-modulated channels without pilot symbols are not detected as active channels. ● If the signal contains more than one channel without pilot symbols, the channel that is received in the highest code class and with the lowest code number is displayed as the SCCPCH. It is expected that only one channel of this type is included in the received signal. According to this assumption, this channel is probably the SCCPCH If HS-DPA/UPA is set "ON" in the "Channel Detection Settings"/"Common Settings" dialog box, all QPSK-modulated channels without pilot symbols are detected. If one of these channels is received at code class 8 and code number 3, it is displayed as the SCCPCH. Any other QPSK-modulated channels without pilot symbols and a code class higher than or equal to 7 are marked with the channel type CHAN. All fur-ther QPSK-modulated channels without pilot symbols and a code class lower than 7 are marked with channel type HSPDSCH.

PICH	The Paging Indication Channel is expected at code class 8 and code number 16. The lower part of the table indicates the data channels contained in the signal. A data channel is any channel that does not have a predefined channel number and symbol rate. There are different types of data channels, which can be indicated by the entry in the column "Chan Type".		
DPCH	The Dedicated Physical Channel is a data channel that contains pilot symbols. The displayed channel type is DPCH.		
	Chan Type:	DPCH	
	Status:	inactive	channel is not active
		active	channel is active and all pilot symbols are correct
		pilotf	channel is active but it contains incorrect pilot symbols
HS-PDSCH	The High Speed Physical Downlink Shared Channel (HSDPA) does not contain any pilot symbols. It is a channel type that is expected in code classes lower than 7. The modulation type of these channels can be varied depending on the selected slot.		
	Chan Type:	HSPDSCH-QPSK_	QPSK-modulated slot of an HS PDSCH channel
		HSPDSCH-16QAM_	16QAM-modulated slot of an HS PDSCH channel
		HSPDSCH-NONE_	slot without power of an HS PDSCH channel
	Status:	inactive	channel is not active
		active	channel is active
HS-SSCH	The High Speed Shared Control Channel (HSDPA) does not contain any pilot symbols. It is a channel type that is expected in code classes equal to or higher than 7. The modulation type should always be QPSK. The channel does not contain any pilot symbols.		
	Chan Type:	CHAN_	QPSK-modulated channel without any pilot symbols
	Status:	inactive	channel is not active
		active	channel is active
	If HS-DPA/UPA is set "ON" in the "Channel Detection Settings"/"Common Settings" dialog box,, the channels of HSDPA will be found among the data channels. If the type of a channel can be fully recognized, as for example with a DPCH (based on pilot sequences) or HS-PDSCH (based on modulation type), the type will be entered in the field TYPE. All other channels without pilot symbols are of type CHAN. The channels are in descending order according to symbol rates and, within a symbol rate, in ascending order according to the channel numbers. There-fore, the unassigned codes are always to be found at the end of the table.		
	If the modulation type for a channel can vary, the measured value of the modulation type will be appended to the type of the channel.		

The following parameters of these channels are determined by the CDP measurement:

Table 6-1: Parameters determined by the CDP measurement

Chan Type	Type of channel (active channels only). If the modulation type of a channel can vary (HS-PDSCH, if HS-DPA/UPA is set "ON" in the "Channel Detection Settings"/"Common Settings" dialog box), the value of the modulation type measured by the firmware application will be appended to the channel type. Data channels that do not have a type that can be fully recognized are of type CHAN.
Ch. SF	Number of channel spreading code (0 to [spreading factor-1])
Symbol Rate [ksps]	Symbol rate at which the channel is transmitted (7.5 ksps to 960 ksps).
Stat	Status display. Codes that are not assigned are marked as inactive channels.
TFCI	Indication whether the data channel uses TFCI symbols.
PilotL [Bits]	Number of pilot bits of the channel.
Pwr Abs [dBm]/Pwr Rel [dBm]	Indication of the absolute and relative channel power (referred to the CPICH or the total power of the signal).
T Offs [Chips]	Timing offset. Offset between the start of the first slot of the channel and the start of the analyzed 3GPP FDD BTS frame.

A data channel is considered to be active if the required pilot symbols (see 3GPP specification, exception: PICH) are to be found at the end of each slot. In addition, the channel should have minimum power (see "Inactive Channel Threshold" in "Channel Detection Settings" on page 57).

In the R&S FSV-K72, the display configuration can be set to show quarter screens. In such a case the channel table is reduced to: Channel, Code SF, State and Power Abs

Result data for remote query

SCPI command:

CALC:FEED "XTIM:CDP:ERR:CTAB", see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, 5 values are transmitted for each channel:

● the class
● the channel number
● the absolute level
● the relative level
● the timing offset

The channels are sorted by code class, i.e. the unassigned channels are transmitted last.

Units:	Absolute level: dBm
	Relative level: dB referenced to CPICH or total power
Timing offset:	chips

Example:

The following example shows the results of a query for three channels with the following configuration:

Channel	Spreading factor	Channel number	Timing offset
1st	512	7	0
2nd	4	1	256 chips
3rd	128	255	2560 chips

This yields the following result:

9, 7, -40, -20, 0, 2, 1, -40, -20, 256, 7, 255, -40, -20, 2560

The channel order is the same as in the CDP diagram, i.e. it depends on their position in the code domain of spreading factor 512.

6.1.2.3 Code Domain Error Power

"Code Domain Error Power" is the difference in power between the measured and his ideal signal. The unit is dB. There are no other units for the y axis.

Result data for remote query

SCPI command:

CALC:FEED "XTIM:CDP:ERR:PCD", see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, 4 values are transmitted for each channel with code class 9:

code class	Highest code class of a downlink signal, always set to 9 (CC9)
code number	Code number of the evaluated CC9 channel [0...511]
CDEP	Code domain error power value of the CC9 channel in [dB]
channel flag	Indicates whether the CC9 channel belongs to an assigned code channel: 0b00-0d0: CC9 is inactive. 0b01-0d1: CC9 channel belongs to an active code channel. 0b11-0d3: CC9 channel belongs to an active code channel; sent pilot symbols are incorrect

The channels are sorted by code number.

6.1.2.4 Power vs Slot

The "Power vs Slot" display mode displays the average power of a given channel over all slots. The power is measured relative to the power of the pilot channel inside the slot. Therefore the unit is dB. For Antenna OFF or Antenna No 1 the PICH channel is used as reference. For Antenna No 2 the TDPICH channel is used. The channel width

(width of the bars) depends on the IQ capture length. The bars have all the same width and use the complete range of the x axis.

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:PVSL"`, see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, 16 pairs of slots (slot number of CPICH) and level values are transferred:

<slot number>, <level value in dB> (for 16 slots)

6.1.2.5   Result Summary

The display mode Result Summary displays a list of measurement results on the screen. Three different tables are available, depending if the corresponding window is a full screen, a split screen or a quarter screen window. The full screen display mode shows the same results as the split screen window, but with a bigger font. In the quarter screen window, only the most important results are displayed on the screen.

Two different types of results are displayed: global results and channel results.

Table 6-2: Global results

Total Power:	Displays the total signal power (average power of total evaluated 3GPP FDD BTS slot).
Chip Rate Error:	Displays the chip rate error in the frame to analyze in ppm. As a result of a high chip rate error, symbol errors arise and the CDP measurement is possibly not synchronized to the 3GPP FDD BTS signal. The result is valid even if synchronization of the analyzer and signal failed.
IQ Offset:	DC offset of the signal in the selected slot in %
Composite EVM:	The composite EVM is the difference between the test signal and the ideal reference signal in the selected slot in % (see chapter 6.1.2.6, "Composite EVM (RMS)", on page 40).
CPICH Slot No:	Displays the number of the CPICH slot at which the measurement is performed.
No of Active Chan:	Indicates the number of active channels detected in the signal in the selected slot. Both the detected data channels and the control channels are considered active channels.
Carrier Freq Error:	Displays the frequency error relative to the center frequency of the analyzer. The absolute frequency error is the sum of the analyzer and DUT frequency error. The specified value is averaged via one slot; the frequency offset of the slot selected under SELECT CPICH SLOT applies.

The maximum frequency error that can be compensated is specified in the table below as a function of the sync mode. Transmitter and receiver should be synchronized as far as possible.		
SYNC mode	ANTENNA DIV	Max. Freq. Offset

	CPICH	X	5.0 kHz
	SCH	OFF	1.6 kHz
	SCH	ANT 1	330 Hz
	SCH	ANT 2	330 Hz
Trigger to Frame:	This result displays the time difference between the beginning of the recorded signal section to the start of the analyzed 3GPP FDD BTS frame. In the case of triggered data collection, this difference is identical with the time difference of frame trigger (+ trigger offset) – frame start. If synchronization of the analyzer and W-CDMA signal fails, the value of Trigger to Frame is not significant.		
IQ Imbalance:	I/Q imbalance of signals in the selected slot in %		
Pk CDE (30 ksps):	The Peak Code Domain Error measurement specifies a projection of the difference between the test signal and the ideal reference signal onto the selected spreading factor in the selected slot (see chapter 6.1.2.7, "Peak Code Domain Error", on page 41). The spreading factor onto which projection is made is shown beneath the measurement result.		
CPICH Power	The power of the CPICH channel in the selected slot		
Avg. RCDE (64 QAM)	Average Relative Code Domain Error over all channels detected with 64 QAM in the selected frame.		
RHO	Quality parameter RHO for each slot.		

Table 6-3: Channel Results

Symbol Rate:	Symbol rate at which the channel is transmitted.
Channel Code:	Number of the spreading code of the selected channel.
No of Pilot Bits:	Number of pilot bits of the selected channel.
Chan Power Rel:	Channel power, relative (referenced to CPICH or total signal power)
Chan Power Abs:	Channel power, absolute
Modulation Type:	Modulation type of an HSDPA channel. High speed physical data channels can be modulated with QPSK, 16 QAM or 64 QAM modulation.
Timing Offset:	Offset between the start of the first slot in the channel and the start of the analyzed 3GPP FDD BTS frame.
Channel Slot No:	The channel slot number is obtained by combining the value of the selected CPICH and the channel's timing offset.
Symbol EVM:	Peak or average of the results of the error vector magnitude measurement. The measurement provides information on the EVM of the channel (marked red) in the CDP diagram in the slot (marked red) of the power-versus slot diagram at the symbol level.
RCDE	Relative Code Domain Error for the complete frame of the selected channel.

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:ERR:SUMM"`, see `CALCulate<n>:FEED` on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, the results of the RESULT SUMMARY are output in the following order:

<composite EVM [%]>,

<peak CDE [dB]>,

<carr freq error [Hz]>,

<chip rate error [ppm]>,

<total power [dB]>,

<trg to frame [µs]>,

<EVM peak channel [%]>,

<EVM mean channel [%]>,

<code class>,

<channel number>,

<power abs. channel [dB]>,

<power rel. channel [dB], referenced to CPICH or total power>,

<timing offset [chips]>,

<I/Q offset [%]>,

<I/Q imbalance [%]>

6.1.2.6 Composite EVM (RMS)

The "Composite EVM" measurement displays the error between the entire measurement signal and the ideal reference signal in present. The error is averaged over all channels for different slots. A bar diagram with EVM values versus slots is used. The Composite EVM measurement covers the entire signal during the entire observation time.

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:ERR:MACC"`, see `CALCulate<n>:FEED` on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, 15 pairs of slots (slot number of CPICH) and level values are transferred:

<slot number>, <level value in %> (for 15 slots)

6.1.2.7   Peak Code Domain Error

With "Peak Code Domain Error" display mode for a given slot and for all codes the maximum of the code domain error values are determined. This display is a bar diagram over slots. The unit is dB. The Peak Code Domain Error measurement covers the entire signal and the entire observation time.

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:ERR:PCD"`, see `CALCulate<n>:FEED` on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, 15 pairs of slots (slot number of CPICH) and level values are transferred:

<slot number>, <level value in dB> (for 15 slots)

6.1.2.8   Composite Constellation

The "Composite Const" measurement analyzes the entire signal given one single slot. For large numbers of channels to analyze the results will superimpose. In that case the benefit of this measurement is limited (senseless).

In "Composite Const" measurement the constellation points of the 1536 Chips are displayed for the specified slot. This data is determined inside the DSP even before the channel search. I.e. it is not possible to assign constellation points to channels. The constellation points are displayed normalized with respect to the total power.

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:COMP:CONS"`, see `CALCulate<n>:FEED` on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, the real and the imaginary components of the chip constellation at the selected slot are transferred:

<Re1>, <Im1>, <Re2>, <Im2>, ..., <Re2560>, <Im2560>

The values are normalized to the square root of the average power at the selected slot.

6.1.2.9   Power vs Symbol

The "Power vs. Symbol" measurement shows the power over the symbol number for the selected channel and the selected slot. The power are not averaged here. The trace is drawn using a histogram line algorithm, i.e. only vertical and horizontal lines, no diagonal, linear Interpolation (polygon interpolation). Surfaces are NOT filled. This measurement displays Power versus Symbol for one single channel and for one single slot.

Result data for remote query

SCPI command:

CALC:FEED "XTIM:CDP:PVSY", see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, the power of each symbol at the selected slot is transferred. The values indicate the difference to the reference power in dB. The number of the symbols depends on the spreading factor of the selected channel:

$NOFSymbols = 10 * 2^{(8-CodeClass)}$

6.1.2.10 Symbol Constellation

The "Symbol Constellation" measurement shows QPSK or BPSK modulated signals of the selected channel and the selected slot. QPSK constellation points are located on the diagonals (not x and y axis) of the constellation diagram. BPSK constellation points are always on the x axis. If possible the display should use more than just 1 pixel per value, as in the minimum case only 12 symbols are available. This would improve the visibility.

Result data for remote query

SCPI command:

CALC:FEED "XTIM:CDP:SYMB:CONS", see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, the real and the imaginary components are transferred:

$<Re_0>, <Im_0>, <Re_1>, <Im_1>, ..., <Re_n>, <Im_n>$

The number of level values depends on the spreading factor:

Spreading factor	Number of level values
512	5
256	10
128	20
64	40
32	80
16	160
8	320
4	640

6.1.2.11 Symbol EVM

The "Symbol EVM" display mode shows the error between the measured signal and the ideal reference signal in percent for the selected channel and the selected slot. A trace over all symbols of a slot is drawn. The number of symbols is in the range from 12 (min) to 384 (max). It depends on the symbol rate of the channel.

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:SYMB:EVM"`, see `CALCulate<n>:FEED` on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, the real and the imaginary components are transferred:

$\langle Re_0 \rangle$, $\langle Im_0 \rangle$, $\langle Re_1 \rangle$, $\langle Im_1 \rangle$, ..., $\langle Re_n \rangle$, $\langle Im_n \rangle$

The number of level values depends on the spreading factor:

Spreading factor	Number of level values
512	5
256	10
128	20
64	40
32	80
16	160
8	320
4	640

6.1.2.12 Bitstream

The "Bitstream" measurement displays the demodulated bits of a selected channel for a given slot. Depending on the symbol rate the number of symbols within a slot can vary from 12 (min) to 384 (max). For QPSK modulation a symbol consists of 2 Bits (I and Q). For BPSK modulation a symbol consists of 1 Bit (only I used).

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:BSTR"`, see `CALCulate<n>:FEED` on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, the bit stream of one slot is transferred. Each symbol contains two consecutive bits in the case of a QPSK modulated slot and 4 consecutive bits in the case of a 16QAM modulated slot. One value is transferred per

bit (range 0, 1). The number of symbols is not constant and may vary for each sweep. Individual symbols in the bit stream may be invalid depending on the channel type and the bit rate (symbols without power). The assigned invalid bits are marked by on of the digits "6", "7" or "9".

If "HS-DPA/UPA" is disabled (see "Channel Detection Settings" on page 57 or `[SENSe:]CDPower:HSDPamode` on page 185), the values and number of the bits are as follows:

Unit	[]
Value range	{0, 1, 6, 9} 0 - Low state of a transmitted bit 1 - High state of a transmitted bit 6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD) 9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)
Bits per slot	$N_{BitPerSymb} = 2$
Number of symbols	$N_{Symb} = 10*2^{(8-Code\ Class)}$
Number of bits	$N_{Bit} = N_{Symb} * N_{BitPerSymb}$
Format	Bit_{00}, Bit_{01}, Bit_{10}, Bit_{11}, Bit_{20}, Bit_{21},.... , $Bit_{NSymb\ 0}$, $Bit_{NSymb\ 1}$

If "HS-DPA/UPA" is enabled (see "Channel Detection Settings" on page 57 or `[SENSe:]CDPower:HSDPamode` on page 185), the values and number of the bits are as follows:

Unit	[]
Value range	{0, 1, 6, 7, 8, 9} 0 - Low state of a transmitted bit 1 - High state of a transmitted bit 6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD) 7 - Bit of a switched-off symbol of an HS-PDSCH channel 8 - Fill value for unused bits of a lower order modulation symbol in a frame containing higher order modulation 9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)
Bits per symbol	$N_{BitPerSymb} = \{2, 4, 6\}$
Symbols per slot	$N_{Symb\_Slot} = 10*2^{(8-Code\ Class)}$
Symbols per frame	$N_{Symb\_Frame} = 15*N_{Symb\_Slot} = 150*2^{(8-Code\ Class)}$
Number of bits	$N_{Bit} = N_{Symb\_Frame} * N_{BitPerSymb\_MAX}$

Format (16QAM)	$Bit_{00}, Bit_{01}, Bit_{02}, Bit_{03}, Bit_{10}, Bit_{11}, Bit_{12}, Bit_{13}, \ldots \ldots$, $Bit_{NSymb\_Frame\ 0}, Bit_{NSymb\_Frame\ 1}, Bit_{NSymb\_Frame\ 2}$, $Bit_{NSymb\_Frame\ 3}$
Format (64QAM)	$Bit_{00}, Bit_{01}, Bit_{02}, Bit_{03}, Bit_{04}, Bit_{05}, Bit_{10}, Bit_{11}, Bit_{12}, Bit_{13}, Bit_{14}, Bit_{15}, \ldots$, $Bit_{NSymb\_Frame\ 0}, Bit_{NSymb\_Frame\ 1}, Bit_{NSymb\_Frame\ 2}, Bit_{NSymb\_Frame\ 3}, Bit_{NSymb\_Frame\ 4}, Bit_{NSymb\_Frame\ 5}$

6.1.2.13   Frequency Error vs Slot

To reduce the overall span of "Frequency Err vs Slot", for each value to be displayed the difference between the frequency error of the corresponding slot to the frequency error of the first (zero) slot is calculated. This will help to eliminate a static frequency offset of the whole signal to achieve a better display of a real time-depending frequency curve.

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:FVSL"`, see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, 15 pairs of slot (slot number of CPICH) and values are transferred:

<slot number>, <value in Hz>

6.1.2.14   Phase Discontinuity vs Slot

The "Phase Discontinuity vs Slot" is calculated according to 3GPP specifications. The phase calculated for each slot is interpolated to both ends of the slot using the frequency shift of that slot. The difference between the phase interpolated for the beginning of one slot and the end of the preceding slot is displayed as the phase discontinuity of that slot.

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:PSVSL"`, see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, 15 pairs of slot (slot number of CPICH) and values are transferred:

<slot number>, <value in deg>

6.1.2.15 EVM vs Chip

EVM vs Chip activates the Error Vector Magnitude (EVM) versus chip display. The EVM is displayed for all chips of the slected slot. The EVM is calculated by the root of the square difference of received signal and reference signal. The reference signal is estimated from the channel configuration of all active channels. The EVM is related to the square root of the mean power of reference signal and given in percent.

$$EVM_k = \sqrt{\frac{\left| s_k - x_k \right|^2}{\frac{1}{N}\sum_{n=0}^{N-1}\left| x_n \right|^2}} \bullet 100\% \quad | \; N = 2560 \quad | \; k \in \left[0 \ldots (N-1) \right]$$

where:

EVM_k	vector error of the chip EVM of chip number k
s_k	complex chip value of received signal
x_k	complex chip value of reference signal
k	index number of the evaluated chip
N	number of chips at each CPICH slot
n	index number for mean power calculation of reference signal

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:CHIP:EVM"`, see `CALCulate<n>:FEED` on page 129

`TRACe<1…4>[:DATA]? TRACE<1...4>`

When the trace data for this mode is queried, a list of vector error values of all chips at the selected slot is returned. The values are calculated as the square root of the square difference between the received signal and the reference signal for each chip, normalized to the square root of the average power at the selected slot.

6.1.2.16 Mag Error vs Chip

Mag Error vs Chip activates the Magnitude Error versus chip display. The magnitude error is displayed for all chips of the slected slot. The magnitude error is calculated by the difference of the magnitude of received signal and magnitude of reference signal. The reference signal is estimated from the channel configuration of all active channels. The magnitude error is related to the square root of the mean power of reference signal and given in percent.

$$MAG_k = \sqrt{\frac{\left| s_k \right| - \left| x_k \right|}{\frac{1}{N}\sum_{n=0}^{N-1}\left| x_n \right|^2}} \bullet 100\% \quad | \; N = 2560 \quad | \; k \in \left[0 \ldots (N-1) \right]$$

where:

MAG_k	magnitude error of chip number k
s_k	complex chip value of received signal
x_k	complex chip value of reference signal
k	index number of the evaluated chip
N	number of chips at each CPICH slot
n	index number for mean power calculation of reference signal

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:CHIP:MAGN"`, see `CALCulate<n>:FEED` on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, a list of magnitude error values of all chips at the selected slot is returned. The values are calculated as the magnitude difference between the received signal and the reference signal for each chip in %, and are normalized to the square root of the average power at the selected slot.

6.1.2.17 Phase Error vs Chip

"Phase Error vs Chip" activates the phase error versus chip display. The phase error is displayed for all chips of the slected slot. The phase error is calculated by the difference of the phase of received signal and phase of reference signal. The reference signal is estimated from the channel configuration of .all active channels. The phase error is given in degrees in a range of +180° to -180°.

$$PHI_k = \varphi(s_k) - \varphi(x_k) \quad | \quad N = 2560 \quad | \quad k \in \left[0 \ldots (N-1)\right]$$

where:

PHI_k	phase error of chip number k
s_k	complex chip value of received signal
x_k	complex chip value of reference signal
k	index number of the evaluated chip
N	number of chips at each CPICH slot
$\varphi(x)$	phase calculation of a complex value

Result data for remote query

SCPI command:

`CALC:FEED "XTIM:CDP:CHIP:PHAS"`, see `CALCulate<n>:FEED` on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, a list of phase error values of all chips at the selected slot is returned. The values are calculated as the phase difference between the received signal and the reference signal for each chip in degrees, and are normalized to the square root of the average power at the selected slot.

6.1.2.18 Symbol Magnitude Error

The "Symbol Magnitude Error" is calculated analogous to symbol EVM. The result of calculation is one symbol magnitude error value for each symbol of the slot of a special channel. Positive values of symbol magnitude error indicate a symbol magnitude that is larger than the expected ideal value; negative symbol magnitude errors indicate a symbol magnitude that is less than the ideal one.The symbol magnitude error is the difference of the magnitude of the received symbol and that of the reference symbol, related to the magnitude of the reference symbol.

Result data for remote query

SCPI command:

CALC:FEED "XTIM:CDP:SYMB:EVM:MAGN", see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, the magnitude error in % of each symbol at the selected slot is transferred. The number of the symbols depends on the spreading factor of the selected channel:

$NOFSymbols=10*2^{(8-CodeClass)}$

6.1.2.19 Symbol Phase Error

The "Symbol Phase Error" is calculated analogous to symbol EVM. The result of calculation is one symbol phase error value for each symbol of the slot of a special channel. Positive values of symbol phase error indicate a symbol phase that is larger than the expected ideal value; negative symbol phase errors indicate a symbol phase that is less than the ideal one.

Result data for remote query

SCPI command:

CALC:FEED "XTIM:CDP:SYMB:EVM:PHAS", see CALCulate<n>:FEED on page 129

TRACe<1…4>[:DATA]? TRACE<1...4>

When the trace data for this mode is queried, the phase error in degrees of each symbol at the selected slot is transferred. The number of the symbols depends on the spreading factor of the selected channel:

$$NOFSymbols = 10*2^{(8-CodeClass)}$$

6.1.3 Softkeys of the Code Domain Analyzer (R&S FSV-K72)

The "Code Domain Analyzer" softkey opens the "Code Domain Analyzer" submenu.

Settings Overview

The "Settings Overview" softkey opens the "Settings Overview" dialog box that visualizes the data flow of the Code Domain Analyzer and summarizes the current settings. In addition, the current settings can be changed via the Settings Overview dialog box.

To change the settings, either use the rotary knob or the curser keys to change the focus to another button and press the ENTER key to open the corresponding dialog box. To open the dialog boxes displayed in the "Settings Overview" dialog box, you can also press the particular softkey in the "Code Domain Analyzer" submenu.
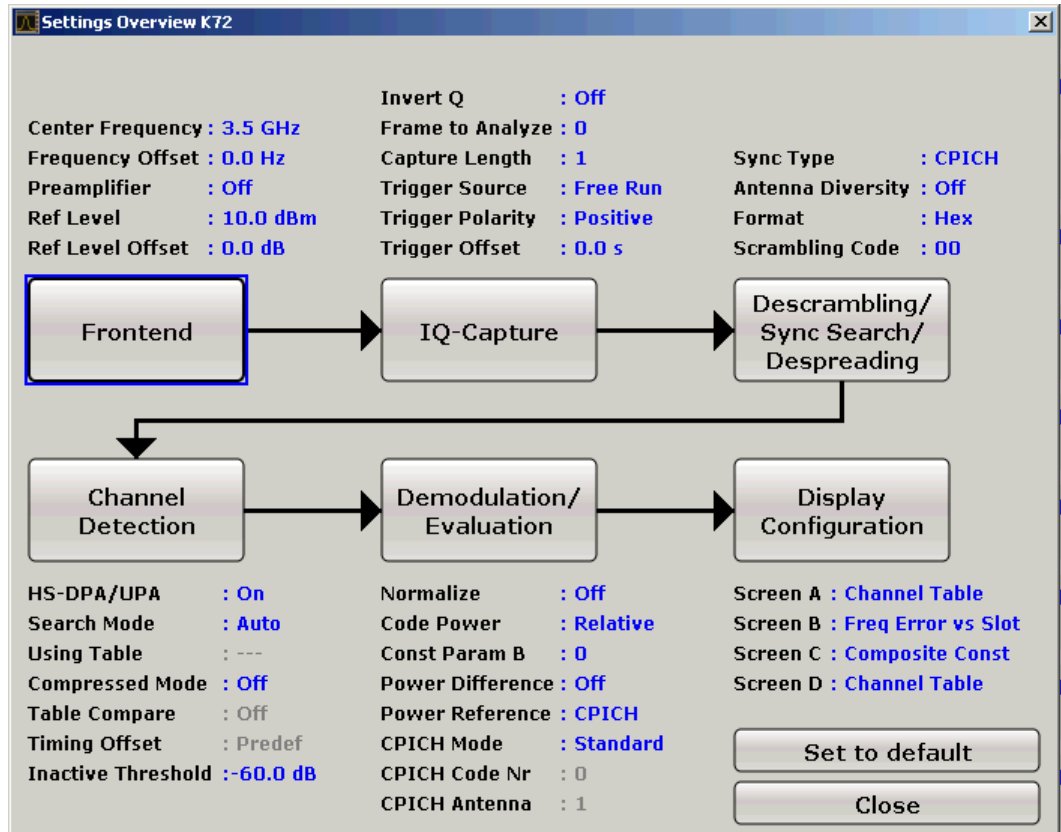
Frontend	refer to "Frontend Settings" on page 51
IQ-Capture	refer to "IQ Capture Settings" on page 53
Descrambling/Sync Search/Despreading	refer to "Sync/Scrambling Settings" on page 55
Channel Detection	refer to "Channel Detection Settings" on page 57
Demodulation/Evaluation	refer to "Demod Settings" on page 61
Display Configuration	refer to chapter 6.1.1, "Display Concept", on page 29

Frontend Settings

This softkey opens the "Frontend Settings" dialog box to modify the following parameters:

Frequency Settings

| Center Frequency | 15.0 GHz |
| Frequency Offset | 0.0 Hz |

Level Settings

Ref Level	-10.0 dBm
Ref Level Offset	0.0 dB
Preamplifier	○ On ● Off

Adjust Ref Level

Close

Center ← Frontend Settings
Opens an edit dialog box to enter the center frequency. The allowed range of values for the center frequency depends on the frequency span.

span > 0: $span_{min}/2 \leq f_{center} \leq f_{max} - span_{min}/2$

span = 0: $0 \text{ Hz} \leq f_{center} \leq f_{max}$

f_{max} and $span_{min}$ are specified in the data sheet.

Remote command:
[SENSe:]FREQuency:CENTer on page 199

Frequency Offset ← Frontend Settings
Opens an edit dialog box to enter a frequency offset that shifts the displayed frequency range by the specified offset.

The softkey indicates the current frequency offset. The allowed values range from -100 GHz to 100 GHz. The default setting is 0 Hz.

Remote command:
[SENSe:]FREQuency:OFFSet on page 200

Ref Level ← Frontend Settings
Opens an edit dialog box to enter the reference level in the current unit (dBm, dBμV, etc).

The reference level is the maximum value the AD converter can handle without distortion of the measured value. Signal levels above this value will not be measured correctly, which is indicated by the "IFOVL" status display.

Remote command:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel on page 179

Ref Level Offset ← Frontend Settings

Opens an edit dialog box to enter the arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the y-axis is changed accordingly. The setting range is ±200 dB in 0.1 dB steps.

Remote command:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet on page 180

Preamp On/Off ← Frontend Settings

Switches the preamplifier on and off.

If option R&S FSV-B22 is installed, the preamplifier is only active below 7 GHz.

If option R&S FSV-B24 is installed, the preamplifier is active for all frequencies.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:
INPut:GAIN:STATe on page 228

Adjust Ref Lvl ← Frontend Settings

Defines the optimal reference level for the current measurement automatically.

Remote command:
[SENSe:]ADJust:LEVel on page 194

IQ Capture Settings

Opens the "IQ Capture Settings" dialog box.
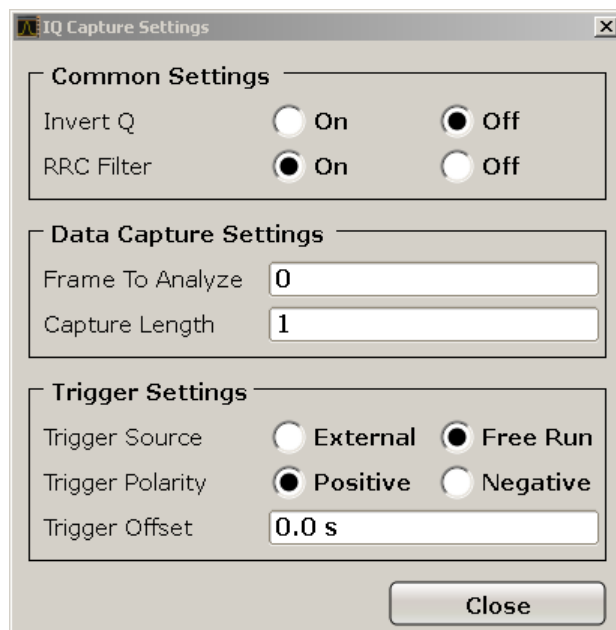
Invert Q ← IQ Capture Settings

Inverts the sign of the signal's Q-component. The default setting is OFF.

Remote command:
[SENSe:]CDPower:QINVert on page 190

RRC Filter ← IQ Capture Settings

Selects if a root raised cosine (RRC) receiver filter is used or not. This feature is useful if the RRC filter is implemented in the device under test (DUT).

"ON"   If an unfiltered WCDMA signal is received (normal case), the RRC filter should be used to get a correct signal demodulation. (Default settings)

"OFF"   If a filtered WCDMA signal is received, the RRC filter should not be used to get a correct signal demodulation. This is the case if the DUT filters the signal.

Remote command:

[SENSe:]CDPower:FILTer[:STATe] on page 184

Frame To Analyze ← IQ Capture Settings

Enter the Frame to analyze and to be displayed.

Remote command:

[SENSe:]CDPower:FRAMe[:LVALue] on page 185

Capture Length ← IQ Capture Settings

Enter the capture length (amount of frames to record).

Remote command:

[SENSe:]CDPower:IQLength on page 186

Trigger Source External ← IQ Capture Settings

Defines triggering via a TTL signal at the "EXT TRIG/GATE IN" input connector on the rear panel.

An edit dialog box is displayed to define the external trigger level.

Remote command:

TRIG:SOUR EXT, see TRIGger<n>[:SEQuence]:SOURce on page 232

Trigger Source Free Run ← IQ Capture Settings

The start of a sweep is not triggered. Once a measurement is completed, another is started immediately.

Remote command:

TRIG:SOUR IMM, see TRIGger<n>[:SEQuence]:SOURce on page 232

Trg/Gate Polarity ← IQ Capture Settings

Sets the polarity of the trigger/gate source.

The sweep starts after a positive or negative edge of the trigger signal. The default setting is "Pos". The setting applies to all trigger modes with the exception of the "Free Run", "Power Sensor" and "Time" mode.

For details also see "Using Gated Sweep Operation" in the base unit description.

"Pos"   Level triggering: the sweep is stopped by the logic "0" signal and restarted by the logical "1" signal after the gate delay time has elapsed.

"Neg"   Edge triggering: the sweep is continued on a "0" to "1" transition for the gate length duration after the gate delay time has elapsed.

Remote command:
TRIGger<n>[:SEQuence]:SLOPe on page 232

Trigger Offset ← IQ Capture Settings
Opens an edit dialog box to enter the time offset between the trigger signal and the start of the sweep.

offset > 0:	Start of the sweep is delayed
offset < 0:	Sweep starts earlier (pre-trigger)
	Only possible for span = 0 (e.g. I/Q Analyzer mode) and gated trigger switched off
	Maximum allowed range limited by the sweep time:
	$pretrigger_{max}$ = sweep time
	When using the R&S Digital I/Q Interface (R&S FSV-B17) with I/Q Analyzer mode, the maximum range is limited by the number of pretrigger samples.
	See the R&S Digital I/Q Interface(R&S FSV-B17) description in the base unit.

In the "External" or "IF Power" trigger mode, a common input signal is used for both trigger and gate. Therefore, changes to the gate delay will affect the trigger delay (trigger offset) as well.

Remote command:
TRIGger<n>[:SEQuence]:HOLDoff[:TIME] on page 231

Sync/Scrambling Settings
Opens the "Descrambling/Sync Search Settings" dialog box.
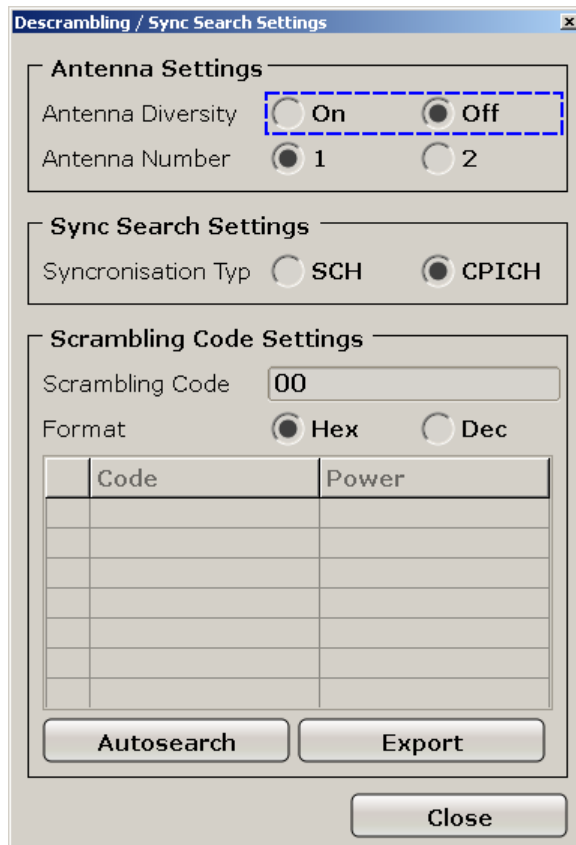
Antenna Diversity ← **Sync/Scrambling Settings**
This option switches the antenna diversity mode on and off.

Remote command:
[SENSe:]CDPower:ANTenna on page 183

Antenna Number ← **Sync/Scrambling Settings**
This option switches between diversity antennas 1 and 2. Depending on the softkey
settings, R&S FSV-K72 synchronizes to the CPICH of antenna 1 or antenna 2.

Remote command:
[SENSe:]CDPower:ANTenna on page 183

Synchronization Type ← **Sync/Scrambling Settings**
Enables synchronization with or without CPICH.

"CPICH"   R&S FSV-K72 assumes that the CPICH control channel is present in
                 the signal and attempts to synchronize to this channel. If the signal
                 does not contain CPICH, synchronization fails.

"SCH"   R&S FSV-K72 synchronizes to the signal without assuming the presence of a CPICH. This setting is required for measurements on test model 4 without CPICH. While this setting can also be used with other channel configurations, it should be noted that the probability of synchronization failure increases with the number of data channels.

Remote command:
[SENSe:]CDPower:STYPe on page 191

Scrambling Code ← Sync/Scrambling Settings
Enter the scrambling code. The scrambling codes are used to distinguish between different base stations. Each base station has its own scrambling code.

Remote command:
[SENSe:]CDPower:LCODe:DVALue on page 186

Format Hex/Dec ← Sync/Scrambling Settings
Switch the display format of the scrambling codes between hexadecimal and decimal.

Remote command:
[SENSe:]CDPower:LCODe:DVALue on page 186
[SENSe:]CDPower:LCODe[:VALue] on page 186

Scrambling Codes ← Sync/Scrambling Settings
This table includes all found scrambling codes from the last autosearch sequence. In the first column each row has a radio button to select a found scrambling code.

Remote command:
[SENSe:]CDPower:LCODe:SEARch:LIST on page 187

Autosearch ← Sync/Scrambling Settings
Starts a search on the measured signal for all scrambling codes. The scrambling code that leads to the highest signal power is chosen as the new scrambling code.

Searching requires that the correct center frequency and level are set. The scrambling code search can automatically determine the primary scrambling code number. The secondary scrambling code number is expected as 0. Alternative scrambling codes can not be detected. Therefore the range for detection is 0x0000 – 0x1FF0h, where the last digit is always 0.

Remote command:
[SENSe:]CDPower:LCODe:SEARch:[IMMediate]? on page 187

Export ← Sync/Scrambling Settings
Writes the detected scrambling codes together with their powers into a text file in the R&S user directory (c:\R_S\Instr\User\ScrCodes.txt).
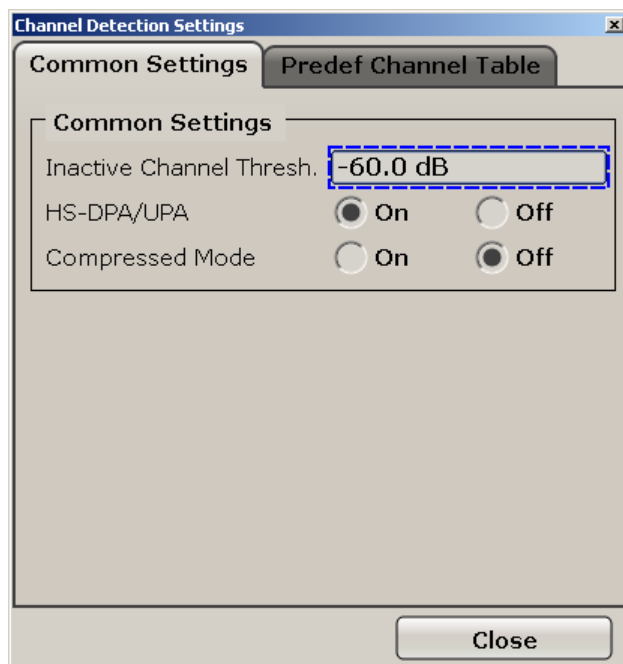
Channel Detection Settings
Opens the "Channel Detection Settings" dialog box which contains the following tabs:

- "Common Settings tab" on page 58
- "Predef Channel Table tab" on page 58

Common Settings tab ← Channel Detection Settings
This tab contains common settings for channel detection.

Inactive Channel Threshold ← Common Settings tab ← Channel Detection Settings
Set the minimum power that a single channel must have compared to the total signal in order to be recognized as an active channel.

Remote command:
[SENSe:]CDPower:ICTReshold on page 185

HS-DPA/UPA ← Common Settings tab ← Channel Detection Settings
If enabled, the application detects HSUPA/DPA-channels and shows them in the channel table.

Remote command:
[SENSe:]CDPower:HSDPamode on page 185

Compressed Mode ← Common Settings tab ← Channel Detection Settings
If compressed mode is switched on, some slots of a channel are suppressed. To keep the overall data rate, the slots just before or just behind a compressed gap can be sent with half spreading factor (SF/2).

Remote command:
[SENSe:]CDPower:PCONtrol on page 189

Predef Channel Table tab ← Channel Detection Settings
This tab contains settings for the predefined channel tables.
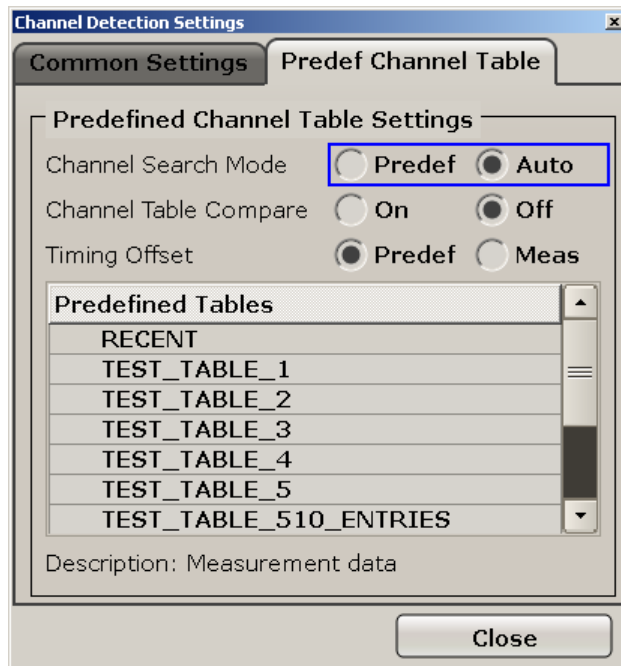
Channel Search Mode ← Predef Channel Table tab ← Channel Detection Settings

Defines the channel search mode.

"Predefined"   Searches in predefined channel tables

"Auto"   Channels are detected automatically

Remote command:
CONFigure:WCDPower[:BTS]:CTABle[:STATe] on page 171
CONFigure:WCDPower[:BTS]:CTABle:SELect on page 175
CONFigure:WCDPower[:BTS]:CTABle:SELect on page 175

Channel Table Compare ← Predef Channel Table tab ← Channel Detection Settings

If enabled, the R&S FSV-K72 uses predefined tables and not the standard mode for comparison.

Remote command:
CONFigure:WCDPower[:BTS]:CTABle:COMPare on page 172

Timing Offset ← Predef Channel Table tab ← Channel Detection Settings
Defines the timing offset.

"Predefined"   The R&S FSV-K72 uses a timing offset from a predefined table.

"MEAS"   The measurement values are used

Remote command:
CONFigure:WCDPower[:BTS]:CTABle:TOFFset on page 175

Predefined Tables ← Predef Channel Table tab ← Channel Detection Settings

The list shows all available channel tables and marks the current active table or the table to edit.

Remote command:

CONFigure:WCDPower[:BTS]:CTABle:CATalog? on page 171

New ← Channel Detection Settings

Opens the "New Channel Table" dialog box to define new channel table settings.
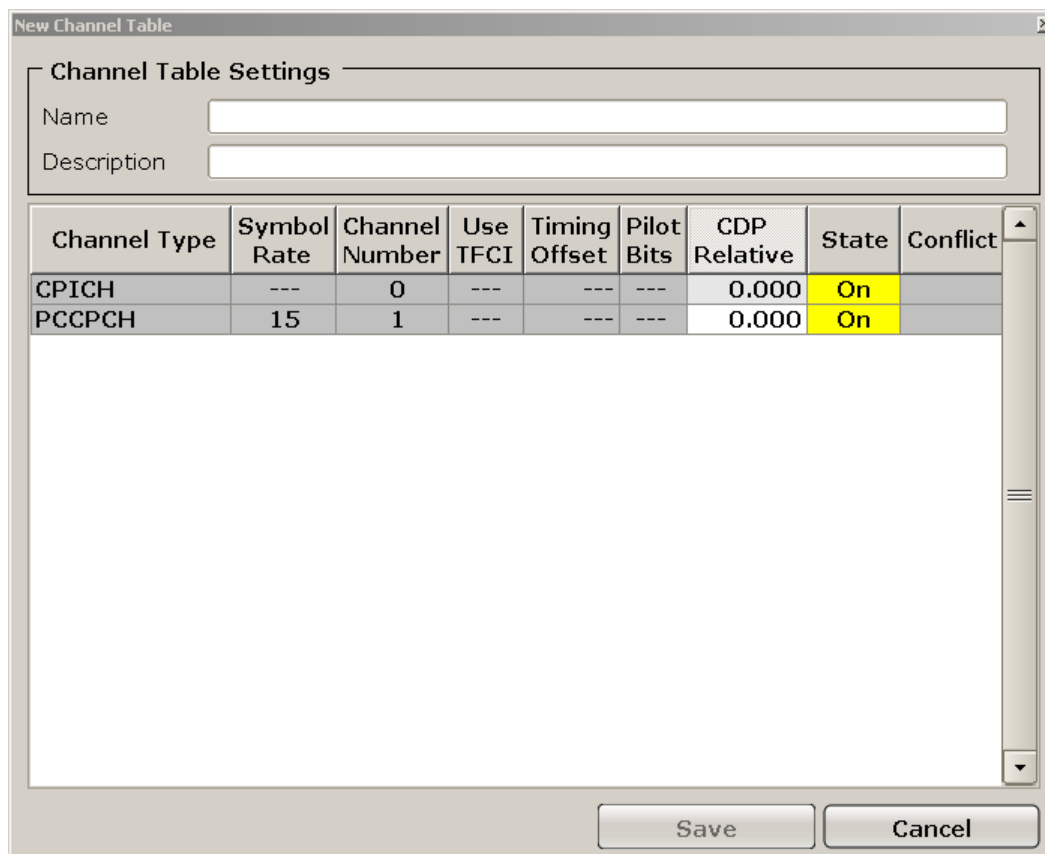
Enter "Name" and "Description" for the new channel table and define the settings in the table below.

Channel Type	Type of channel (active channels only)
Symbol Rate	Symbol rate at which the channel is transmitted
Channel Number	Number of channel spreading code (0 to [spreading factor-1])
Use TFCI	
Timing Offset	
Pilot Bits	Number of pilot bits of the channel (only valid for the control channel DPCCH)
CDP Relative	Channel relative (referred to the total power of the signal)

Status	Status display. Codes that are not assigned are marked as inactive channels.
Conflict	

Delete Channel ← New ← Channel Detection Settings
Removes the selected channel from the table.

Meas ← New ← Channel Detection Settings
Create a new channel table with the settings from the current measurement data.

Sort ← New ← Channel Detection Settings
Sorts the channel table entries.

Save ← New ← Channel Detection Settings
Saves the changes to the table and closes the "Channel Table Settings" dialog box.

Cancel ← New ← Channel Detection Settings
Closes the "Channel Table Settings" dialog box without saving the changes.

Add Channel ← New ← Channel Detection Settings
Adds a channel to the table.

Copy ← Channel Detection Settings
Opens the "Copy Channel Table" dialog box to copy the currently displayed channel table. Enter a name for the new table, edit the settings as described for a new table (see "New" on page 60) and select "Save".

Edit ← Channel Detection Settings
Opens the "Edit Channel Table" dialog box to edit the currently displayed channel table. Edit the settings as described for a new table (see "New" on page 60) and select "Save".

Delete ← Channel Detection Settings
Deletes the currently displayed channel table after a message is confirmed.

Restore Default Tables ← Channel Detection Settings
Restores the predefined channel tables delivered with the instrument.

Demod Settings
Opens the "Demodulation Settings" dialog box. This dialog box contains settings for demodulation and specific evaluation modes (display configuration).
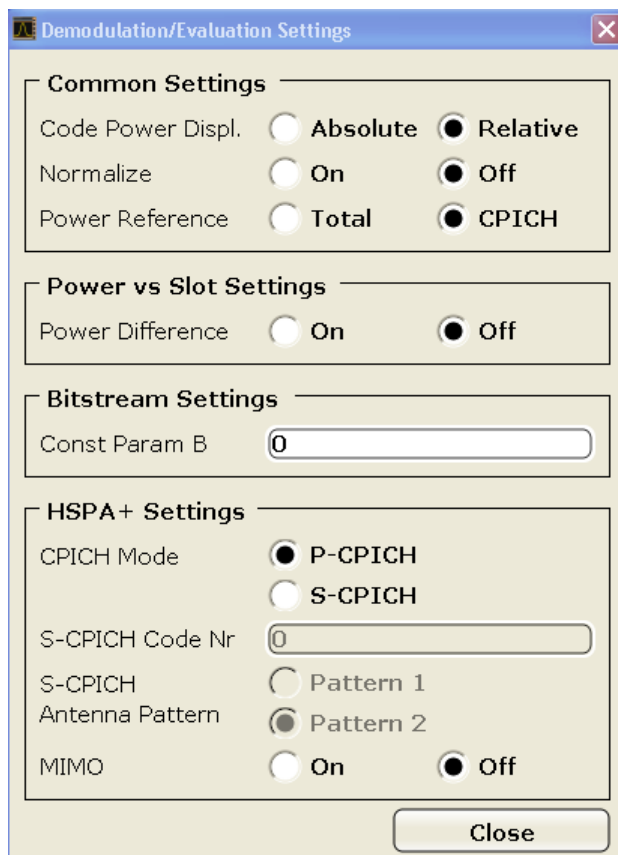
Common Settings ← Demod Settings
These settings are required for all evaluation modes.

Code Power Display ← Common Settings ← Demod Settings
Switches between showing the absolute power or the power relative to the chosen reference.

This parameter only affects the display mode "Code Domain Power".

Remote command:
[SENSe:]CDPower:PDIsplay on page 190

Normalize ← Common Settings ← Demod Settings
Change the elimination of the DC-offset. If enabled, the DC offset is eliminated. Otherwise the DC offset is not eliminated.

Remote command:
[SENSe:]CDPower:NORMalize on page 188

Power Reference ← Common Settings ← Demod Settings
Switch the power reference for the code domain power display mode between the total power and the power of the CPICH.

Remote command:
[SENSe:]CDPower:PREFerence on page 190

Power vs Slot Settings ← Demod Settings
These settings are required for the "Power vs Slot" evaluation.

Power Difference ← Power vs Slot Settings ← Demod Settings
Selects the indication of the slot power difference between the actual slot and the previous slot. To get the results it is necessary to activate the power versus slot measurement in the result display (see "Display Config" on page 64).

Remote command:
[SENSe:]CDPower:PDIFf on page 189

Bitstream Settings ← Demod Settings
These settings are required for "Bitstream" evaluation.

Const Param B ← Bitstream Settings ← Demod Settings
Set the constellation parameter B. According to 3GPP specification the mapping of 16QAM symbols to an assigned bit -stream depends on the constellation parameter B. This parameter can be adjusted to decide which bit mapping should be used for bitstream evaluation.

Remote command:
[SENSe:]CDPower:CPB on page 184

HSPA+ Settings ← Demod Settings
These settings are required for measurements that use the HSPA+ standard.

CPICH Mode ← Demod Settings
Defines whether the common pilot channel (CPICH) is defined by its default position or a user-defined position.

"P-CPICH"   Standard configuration (CPICH is always on channel 0)

"S-CPICH"   User-defined configuration. Enter the CPICH code number in the S-CPICH Code Nr field.

Remote command:
[SENSe:]CDPower:UCPich[:STATe] on page 192

S-CPICH Code Nr ← Demod Settings
If a user-defined CPICH definition is to be used, enter the code of the CPICH based on the spreading factor 256. Possible values are 0 to 255.

Remote command:
[SENSe:]CDPower:UCPich:CODE on page 191

S-CPICH Antenna Pattern ← Demod Settings
Defines the pattern used for evaluation .

Remote command:
[SENSe:]CDPower:UCPich:PATTern on page 192

MIMO ← Demod Settings
Activates or deactivates single antenna MIMO measurement mode.

If activated, HS-PDSCH channels with exclusively QPSK or exclusively 16 QAM on both transport streams are automatically detected and demodulated. The corresponding channel types are denoted as "HS-MIMO-QPSK" and "HS-MIMO-16QAM", respectively.

The MIMO constellations resulting on a single antenna consist of three amplitudes (-1, 0, 1) per dimension in the case of QPSK x QPSK, and seven amplitudes (-3, -2, -1, 0, 1, 2, 3) per dimension in the case of 16 QAM x 16 QAM. The symbol decisions of these constellations can be retrieved via the bitstream output. The mapping between bits and constellation points is given by the following table.

Table 6-4: Mapping between bits and constellation points for MIMO-QPSK

Constellation point (normalized)	Bit sequence
0,0	0,1,0,1
1,0	0,1,0,0
-1,0	0,1,1,1
0,1	0,0,0,1
1,1	0,0,0,0
-1,1	0,0,1,1
0,-1	1,1,0,1
1,-1	1,1,0,0
-1,-1	1,1,1,1

For MIMO-16QAM, the bit sequence is the same in both I and Q. Only one dimension is given here.

Table 6-5: Mapping between bits and constellation points for MIMO-16QAM

Constellation point (normalized)	Bit sequence
-3	1,1,1
-2	1,1,0
-1	1,0,0
0	1,0,1
1	0,0,1
2	0,0,0
3	0,1,0

Remote command:

[SENSe:]CDPower:MIMO on page 188

Display Config
Opens the "Display Configuration" dialog box in which you can define how the measurement results are displayed.
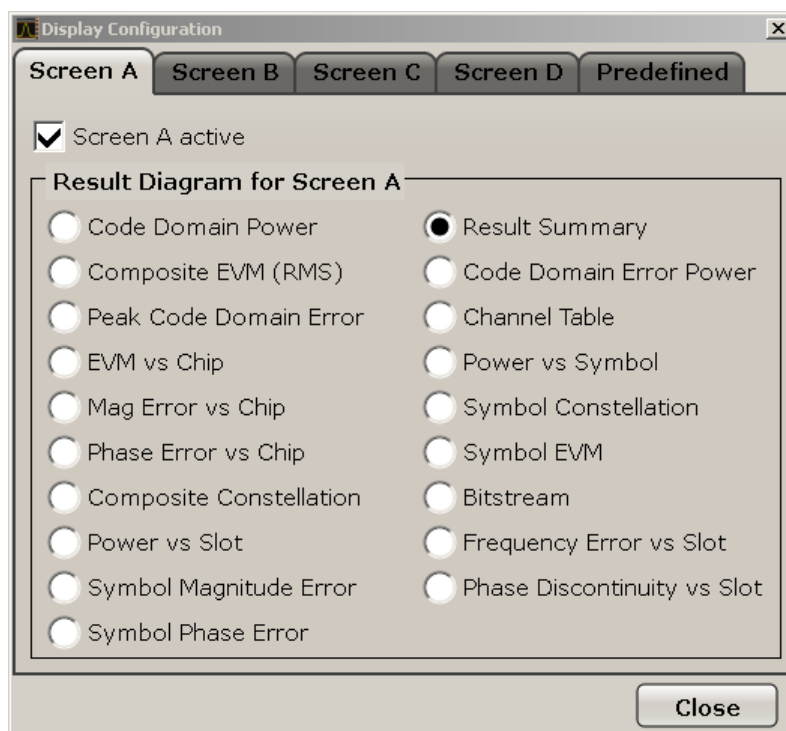
The code domain analyzer can show up to four result diagrams in four different screens (windows) at one time. For each screen, you can define which type of result diagram is to be displayed, or deactivate the screen temporarily.

The current configuration of the display, i.e. which screens are displayed and which result diagram is displayed in which screen, can be stored and retrieved later. Thus, you can easily switch between predefined display configurations.

For details see chapter 6.1.1, "Display Concept", on page 29.

For a description of available display modes, see chapter 6.1.2, "Measurement Modes in Code Domain Analyzer", on page 32.

Select Channel/Slot
Opens a dialog box to select a channel and a slot.
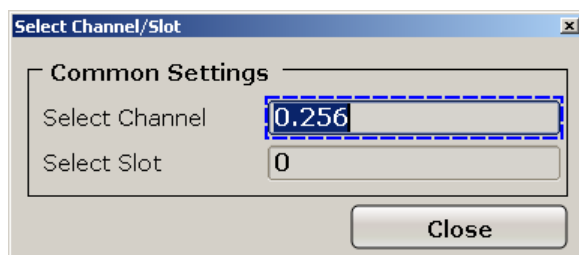
Select Channel ← Select Channel/Slot
Selects a channel for the calculation of the result diagrams "CDP PWR RELATIVE/ ABSOLUTE", "POWER VS SLOT", "SYMBOL CONST" and "SYMBOL EVM" (see also chapter 6.1.2, "Measurement Modes in Code Domain Analyzer", on page 32).

There are two ways to enter the channel numbers:

- Enter a channel number and spreading factor, separated by a decimal point.
  If the channel number and the spreading factor are entered simultaneously, the entered channel is selected and marked in red if an active channel is involved. For the display, the channel number entered is converted on the basis of spreading factor 512. For unused channels, the code resulting from the conversion is marked.
  Example: Enter *5.128*
  Channel 5 is marked at spreading factor 128 (30 ksps) if the channel is active, otherwise code 20 at spreading factor 512.
- Enter a channel number without a decimal point.
  In this case, the instrument interprets the entered code as based on spreading factor 512. If the code entered corresponds to a used channel, the entire associated channel is marked. If the code corresponds to an unused channel, only the code entered is marked.
  Example: Enter *20*
  Code 20 is marked at spreading factor 512 if there is no active channel on this code. If for instance channel 5 is active at spreading factor 128, the entire channel 5 is marked.
  If the entered code corresponds to an active channel, the entire associated channel is marked. If it corresponds to a gap between the channels, only the entered code is marked.
  If the code number is modified using the rotary knob, the red marking changes its position in the diagram only if the code number no longer belongs to the marked channel. The step width of the changed rotary knob position refers to a spreading factor of 512.

Remote command:
[SENSe:]CDPower:CODE on page 184

Select Slot ← **Select Channel/Slot**
Selects the slot for evaluation. This affects the following result diagrams (see also chapter 6.1.2, "Measurement Modes in Code Domain Analyzer", on page 32):

- Code Domain Power
- Peak Code Domain Error
- Result Summary
- Composite Constellation
- Code Domain Error Power
- Channel Table
- Power vs Symbol
- Symbol Const
- Symbol EVM
- Bitstream

Remote command:
[SENSe:]CDPower:SLOT on page 191

6.1.4 Softkeys of the Frequency Menu for CDA measurements – FREQ key (R&S FSV-K72)

The FREQ key opens a submenu to change the measurement frequency.

Some softkey functions are not available in CDP mode. Refer to chapter 6.3.7.2, "Softkeys of the Frequency Menu", on page 91 for information on the other softkeys available for RF measurements.

Center

Opens an edit dialog box to enter the center frequency. The allowed range of values for the center frequency depends on the frequency span.

span > 0: $span_{min}/2 \leq f_{center} \leq f_{max} - span_{min}/2$

span = 0: $0\ Hz \leq f_{center} \leq f_{max}$

f_{max} and $span_{min}$ are specified in the data sheet.

Remote command:
[SENSe:]FREQuency:CENTer on page 199

CF Stepsize

Opens an edit dialog box to enter a fixed step size for the center frequency.

The step size defines the value by which the center frequency is increased or decreased when the arrow keys are pressed. When you use the rotary knob, the center frequency changes in steps of 10% of the "Center Frequency Stepsize".

This softkey is available for code domain and power vs time measurements.

Remote command:
[SENSe:]FREQuency:CENTer:STEP on page 199

Frequency Offset

Opens an edit dialog box to enter a frequency offset that shifts the displayed frequency range by the specified offset.

The softkey indicates the current frequency offset. The allowed values range from -100 GHz to 100 GHz. The default setting is 0 Hz.

Remote command:
[SENSe:]FREQuency:OFFSet on page 200

6.1.5 Softkeys of the Amplitude Menu – AMPT key (R&S FSV-K72)

The AMPT key opens a submenu to set the level.

Some softkey functions are not available in CDP mode. Refer to the description of the AMPT key in the base unit for information on the other softkeys available for RF measurements.

The following options are available in the submenu:

Ref Level

Opens an edit dialog box to enter the reference level in the current unit (dBm, dBμV, etc).

The reference level is the maximum value the AD converter can handle without distortion of the measured value. Signal levels above this value will not be measured correctly, which is indicated by the "IFOVL" status display.

Remote command:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel on page 179

Scaling

Opens a submenu to define the amplitude scaling type.

Ref Value ← Scaling

The "Ref Value" softkey opens an edit dialog box to adjust the reference value.

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue on page 181

Y per Div ← Scaling

The "Y PER DIV" softkey opens an edit dialog box to change the range per division in the result diagram. The range is the length for one section of the y axis.

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:PDIVision on page 179

Ref Value Position ← Scaling

The "Ref Value Position" softkey opens an edit dialog box to adjust the position the reference value of the y-axis (0 – 100 %). 100 % is at the top of the screen, 0 % is at the bottom of the screen.

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition on page 180

Preamp On/Off

Switches the preamplifier on and off.

If option R&S FSV-B22 is installed, the preamplifier is only active below 7 GHz.

If option R&S FSV-B24 is installed, the preamplifier is active for all frequencies.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:
INPut:GAIN:STATe   on page 228

RF Atten Manual/Mech Att Manual
Opens an edit dialog box to enter the attenuation, irrespective of the reference level. If electronic attenuation is activated (option R&S FSV-B25 only; "El Atten Mode Auto" softkey), this setting defines the mechanical attenuation.

The mechanical attenuation can be set in 10 dB steps.

The RF attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). The range is specified in the data sheet. If the current reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

The RF attenuation defines the level at the input mixer according to the formula:

$level_{mixer} = level_{input} - RF\ attenuation$

Note: As of firmware version 1.61, the maximum mixer level allowed is **0 dBm**. Mixer levels above this value may lead to incorrect measurement results, which are indicated by the "OVLD" status display. The increased mixer level allows for an improved signal, but also increases the risk of overloading the instrument!

Remote command:
INPut:ATTenuation on page 222

RF Atten Auto/Mech Att Auto
Sets the RF attenuation automatically as a function of the selected reference level. This ensures that the optimum RF attenuation is always used. It is the default setting.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:
INPut:ATTenuation:AUTO on page 223

El Atten On/Off
This softkey switches the electronic attenuator on or off. This softkey is only available with option R&S FSV-B25.

When the electronic attenuator is activated, the mechanical and electronic attenuation can be defined separately. Note however, that both parts must be defined in the same mode, i.e. either both manually, or both automatically.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

- To define the mechanical attenuation, use the RF Atten Manual/Mech Att Manual or RF Atten Auto/Mech Att Auto softkeys.
- To define the electronic attenuation, use the El Atten Mode (Auto/Man) softkey.

Note: This function is not available for stop frequencies (or center frequencies in zero span) >7 GHz. In this case, the electronic and mechanical attenuation are summarized

and the electronic attenuation can no longer be defined individually. As soon as the stop or center frequency is reduced below 7 GHz, this function is available again. When the electronic attenuator is switched off, the corresponding RF attenuation mode (auto/manual) is automatically activated.

Remote command:
INPut:EATT:AUTO on page 228

El Atten Mode (Auto/Man)

This softkey defines whether the electronic attenuator value is to be set automatically or manually. If manual mode is selected, an edit dialog box is opened to enter the value. This softkey is only available with option R&S FSV-B25, and only if the electronic attenuator has been activated via the El Atten On/Off softkey.

Note: This function is not available for stop frequencies (or center frequencies in zero span) >7 GHz. In this case, the electronic and mechanical attenuation are summarized and the electronic attenuation can no longer be defined individually. As soon as the stop or center frequency is reduced below 7 GHz, electronic attenuation is available again. If the electronic attenuation was defined manually, it must be re-defined.

The attenuation can be varied in 1 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value.

To re-open the edit dialog box for manual value definition, select the "Man" mode again.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

Remote command:
INPut:EATT:AUTO on page 228
INPut:EATT on page 227

Ref Level Offset

Opens an edit dialog box to enter the arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the y-axis is changed accordingly. The setting range is ±200 dB in 0.1 dB steps.

Remote command:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet on page 180

Input (AC/DC)

Toggles the RF input of the R&S FSV between AC and DC coupling.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:
INPut:COUPling on page 223

6.1.6 Softkeys of the Sweep Menu for CDA Measurements – SWEEP key (R&S FSV-K72)

The menu of the SWEEP key contains options to switch between single measurement and continuous measurement and to control individual measurements.

The following chapter describes all softkeys available in the "Sweep" menu in "3GPP Base Station Measurement" Mode for Code Domain Analysis measurements. For all other measurements, the softkeys are described in chapter 6.3.7.6, "Softkeys of the Sweep Menu", on page 108.

Continuous Sweep
Sets the continuous sweep mode: the sweep takes place continuously according to the trigger settings. This is the default setting.

The trace averaging is determined by the sweep count value (see the "Sweep Count" softkey, "Sweep Count" on page 71).

Remote command:
INIT:CONT ON, see INITiate<n>:CONTinuous on page 221

Single Sweep
Sets the single sweep mode: after triggering, starts the number of sweeps that are defined by using the Sweep Count softkey. The measurement stops after the defined number of sweeps has been performed.

Remote command:
INIT:CONT OFF, see INITiate<n>:CONTinuous on page 221

Continue Single Sweep
Repeats the number of sweeps set by using the Sweep Count softkey, without deleting the trace of the last measurement.

This is particularly of interest when using the trace configurations "Average" or "Max Hold" to take previously recorded measurements into account for averaging/maximum search.

Remote command:
INITiate<n>:CONMeas on page 221

Sweep Count
Opens an edit dialog box to enter the number of sweeps to be performed in the single sweep mode. Values from 0 to 32767 are allowed. If the values 0 or 1 are set, one sweep is performed. The sweep count is applied to all the traces in a diagram.

If the trace configurations "Average", "Max Hold" or "Min Hold" are set, the sweep count value also determines the number of averaging or maximum search procedures.

In continuous sweep mode, if sweep count = 0 (default), averaging is performed over 10 sweeps. For sweep count =1, no averaging, maxhold or minhold operations are performed.

Remote command:
[SENSe:]SWEep:COUNt on page 205

6.1.7 Softkeys of the Trigger Menu – TRIG key (R&S FSV-K72)

The TRIG key opens the following submenu.

The following softkey functions are available for CDA measurements.

For RF measurements, see the description for the base unit.

Trigger Source Free Run
The start of a sweep is not triggered. Once a measurement is completed, another is started immediately.

Remote command:
TRIG:SOUR IMM, see TRIGger<n>[:SEQuence]:SOURce on page 232

Trigger Source External
Defines triggering via a TTL signal at the "EXT TRIG/GATE IN" input connector on the rear panel.

An edit dialog box is displayed to define the external trigger level.

Remote command:
TRIG:SOUR EXT, see TRIGger<n>[:SEQuence]:SOURce on page 232

Trigger Polarity
Sets the polarity of the trigger source.

The sweep starts after a positive or negative edge of the trigger signal. The default setting is "Pos". The setting applies to all modes with the exception of the "Free Run" and "Time" mode.

"Pos"	Level triggering: the sweep is stopped by the logic "0" signal and restarted by the logical "1" signal after the gate delay time has elapsed.
"Neg"	Edge triggering: the sweep is continued on a "0" to "1" transition for the gate length duration after the gate delay time has elapsed.

Remote command:
TRIGger<n>[:SEQuence]:SLOPe on page 232
[SENSe:]SWEep:EGATe:POLarity on page 205

Trigger Offset

Opens an edit dialog box to enter the time offset between the trigger signal and the start of the sweep.

offset > 0:	Start of the sweep is delayed
offset < 0:	Sweep starts earlier (pre-trigger)
	Only possible for span = 0 (e.g. I/Q Analyzer mode) and gated trigger switched off
	Maximum allowed range limited by the sweep time:
	$pretrigger_{max}$ = sweep time
	When using the R&S Digital I/Q Interface (R&S FSV-B17) with I/Q Analyzer mode, the maximum range is limited by the number of pretrigger samples.
	See the R&S Digital I/Q Interface(R&S FSV-B17) description in the base unit.

In the "External" or "IF Power" trigger mode, a common input signal is used for both trigger and gate. Therefore, changes to the gate delay will affect the trigger delay (trigger offset) as well.

Remote command:
`TRIGger<n>[:SEQuence]:HOLDoff[:TIME]` on page 231

6.1.8 Softkeys of the Trace Menu for CDA Measurements – TRACE key (R&S FSV-K72)

The TRACE key is used to configure the data acquisition for measurement and the analysis of the measurement data.

The following chapter describes all softkeys available in the "Trace" menu in "3GPP Base Station Measurement" Mode for Code Domain Analysis measurements.

For RF measurements, see the description for the base unit.

Clear Write

Overwrite mode: the trace is overwritten by each sweep. This is the default setting.

All available detectors can be selected.

Remote command:
`DISP:TRAC:MODE WRIT`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 177

Max Hold

The maximum value is determined over several sweeps and displayed. The R&S FSV saves the sweep result in the trace memory only if the new value is greater than the previous one.

The detector is automatically set to "Positive Peak".

This mode is especially useful with modulated or pulsed signals. The signal spectrum is filled up upon each sweep until all signal components are detected in a kind of envelope.

This mode is not available for statistics measurements.

Remote command:
`DISP:TRAC:MODE MAXH`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 177

Min Hold

The minimum value is determined from several measurements and displayed. The R&S FSV saves the smallest of the previously stored/currently measured values in the trace memory.

The detector is automatically set to "Negative Peak".

This mode is useful e.g. for making an unmodulated carrier in a composite signal visible. Noise, interference signals or modulated signals are suppressed whereas a CW signal is recognized by its constant level.

This mode is not available for statistics measurements.

Remote command:
`DISP:TRAC:MODE MINH`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 177

Average

The average is formed over several sweeps. The Sweep Count determines the number of averaging procedures.

All available detectors can be selected. If the detector is automatically selected, the sample detector is used (see chapter 5.2.3, "Detector Overview", on page 20).

This mode is not available for statistics measurements.

Remote command:
`DISP:TRAC:MODE AVER`, see `DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 177

View

The current contents of the trace memory are frozen and displayed.

Note: If a trace is frozen, the instrument settings, apart from level range and reference level (see below), can be changed without impact on the displayed trace. The fact that the displayed trace no longer matches the current instrument setting is indicated by the ★ icon on the tab label.

If the level range or reference level is changed, the R&S FSV automatically adapts the measured data to the changed display range. This allows an amplitude zoom to be made after the measurement in order to show details of the trace.

Remote command:
DISP:TRAC:MODE VIEW, see DISPlay[:WINDow<n>]:TRACe<t>:MODE on page 177

6.1.9 Softkeys of the Marker Menu – MKR key (R&S FSV-K72)

The MKR key opens a submenu for the marker settings.

Some softkey functions are not available in CDP mode. Refer to the description of the "Marker" menu in the base unit for information on the other softkeys available for RF measurements.

Markers are not available for the following result diagrams:

● Result Summary
● Channel Table

In all other result diagrams, up to four markers can be activated, and they can be defined as a marker or delta marker using the Marker Norm/Delta softkey.

Marker 1/2/3/4
Selects the corresponding marker and activates it.

Marker 1 is always a normal marker. After Marker 2 to 4 have been switched on, they are delta markers that are referenced to Marker 1. These markers can be converted into markers with absolute value displays using the "Marker Norm/Delta" softkey. When Marker 1 is the active marker, pressing the "Marker Norm/Delta" softkey switches on an additional delta marker. Pressing the "Marker 1" to "Marker 4" softkey again switches the corresponding marker off.

Remote command:
CALCulate<n>:MARKer<m>[:STATe] on page 161
CALCulate<n>:MARKer<m>:X on page 162
CALCulate<n>:MARKer<m>:Y? on page 163
CALCulate<n>:DELTamarker<m>[:STATe] on page 144
CALCulate<n>:DELTamarker<m>:X on page 145
CALCulate<n>:DELTamarker<m>:X:RELative? on page 145
CALCulate<n>:DELTamarker<m>:Y? on page 146

Marker Norm/Delta

Changes the active marker to a normal (norm) or delta marker (with respect to marker 1).

Remote command:

CALCulate<n>:MARKer<m>[:STATe] on page 161

CALCulate<n>:DELTamarker<m>[:STATe] on page 144

Marker Zoom

Activates or deactivates the zoom for the current active marker. With the zoom function, more details of the measurement signal can be seen. This softkey can only be selected if at least one of the markers is activated.

Remote command:

CALCulate<n>:MARKer<m>:FUNCtion:ZOOM on page 137

All Marker Off

Switches all markers off. It also switches off all functions and displays that are associated with the markers/delta markers.

Remote command:

CALCulate<n>:MARKer<m>:AOFF on page 158

6.1.10 Softkeys of the Marker To Menu – MKR-> key (R&S FSV-K72)

The MKR-> key opens a submenu for marker functions. The menu is not available for all result displays.

Some softkey functions are not available in CDP mode. Refer to the description of the "Marker To" menu in the base unit for information on the other softkeys available for RF measurements.

Select 1/2/3/4/Δ

Selects the normal marker or the delta marker and activates the marker. "Δ" stands for delta marker 1.

CALCulate<n>:MARKer<m>[:STATe] on page 161

CALCulate<n>:MARKer<m>:X on page 162

CALCulate<n>:MARKer<m>:Y? on page 163

Peak

Sets the active marker/delta marker to the highest maximum of the trace.

Remote command:

CALCulate<n>:MARKer<m>:MAXimum[:PEAK] on page 159

Next Peak

Sets the active marker/delta marker to the next maximum of the selected trace.

Remote command:

CALCulate<n>:MARKer<m>:MAXimum:NEXT on page 158

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 142

Next Peak Mode

Selects the mode of the Next Peak softkey.

Three settings are available:

"<"	Sets the active marker/delta marker to the next maximum left to the marker of the selected trace.
"abs"	Sets the active marker/delta marker to the next lower maximum of the selected trace.
">"	Sets the active marker/delta marker to the next maximum right to the marker of the selected trace.

Remote command:

CALC:MARK:MAX:LEFT (<): CALCulate<n>:MARKer<m>:MAXimum:LEFT
on page 158

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT on page 141

CALC:MARK:MAX:RIGH (>): CALCulate<n>:MARKer<m>:MAXimum:RIGHt
on page 159

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt on page 142

CALC:DELT:MAX:NEXT (abs): CALCulate<n>:MARKer<m>:MAXimum:NEXT
on page 158

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 142

CPICH

The "CPICH" softkey sets the marker to the CPICH channel. The softkey is only available for R&S FSV-K72.

CALCulate<n>:MARKer<m>:FUNCtion:CPICh on page 131

CALCulate<n>:MARKer<m>:Y? on page 163

PCCPCH

Sets the marker to the PCCPCH channel.

Remote command:

CALCulate<n>:MARKer<m>:FUNCtion:PCCPch on page 132

CALCulate<n>:MARKer<m>:Y? on page 163

Min

Sets the active marker/delta marker to the minimum of the selected trace.

Remote command:

CALCulate<n>:MARKer<m>:MINimum[:PEAK] on page 160

Next Min

Sets the active marker/delta marker to the next minimum of the selected trace.

Remote command:

CALCulate<n>:MARKer<m>:MINimum:NEXT on page 160

CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 143

Next Min Mode

Sets the mode for the Next Min softkey.

Three settings are available:

"<"	Sets the active marker/delta marker to the next minimum left to the marker of the selected trace.
"abs"	Sets the active marker/delta marker to the next higher minimum of the selected trace.
">"	Sets the active marker/delta marker to the next minimum right to the marker of the selected trace.

Remote command:

CALC:MARK:MIN:LEFT (>): CALCulate<n>:MARKer<m>:MINimum:LEFT
on page 159

CALCulate<n>:DELTamarker<m>:MINimum:LEFT on page 143

CALC:MARK:MIN:RIGH (>): CALCulate<n>:MARKer<m>:MINimum:RIGHt
on page 161

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt on page 144

CALC:MARK:MIN:NEXT (abs): CALCulate<n>:MARKer<m>:MINimum:NEXT
on page 160

CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 143

6.1.11   Softkeys of the Auto Set Menu – AUTO SET Key (R&S FSV-K72)

The AUTOSET key opens a menu to configure automatic settings.

The following softkey functions are available for CDA measurements.

For RF measurements, see the description for the base unit.

Auto All

Performs all automatic settings.

- "Auto Level" on page 79
- "Auto Scrambling Code" on page 79

Remote command:

[SENSe:]ADJust:ALL on page 192

Auto Level

Defines the optimal reference level for the current measurement automatically.

The measurement time for automatic leveling can be defined using the Settings softkey.

Remote command:

[SENSe:]ADJust:LEVel on page 194

Auto Scrambling Code

This softkey starts a calculation on the recorded signal with all scrambling codes. The scrambling code that leads to the highest signal power is chosen as the new scrambling code.

Remote command:

[SENSe:]CDPower:LCODe:SEARch:[IMMediate]? on page 187

Settings

Opens a submenu to define settings for automatic leveling.

Possible settings are:

- "Meas Time Manual" on page 79
- "Meas Time Auto" on page 79

Meas Time Manual ← Settings

Opens an edit dialog box to enter the duration of the level measurement in seconds. The level measurement is used to determine the optimal reference level automatically (see the "Auto Level" softkey, "Auto Level" on page 79). The default value is 1 ms.

Remote command:

[SENSe:]ADJust:CONFigure:LEVel:DURation on page 193

Meas Time Auto ← Settings

The level measurement is used to determine the optimal reference level automatically (see the Auto Level softkey).

This softkey resets the level measurement duration for automatic leveling to the default value of 100 ms.

Upper Level Hysteresis ← Settings

Defines an upper threshold the signal must exceed before the reference level is automatically adjusted when the "Auto Level" function is performed.

Remote command:

[SENSe:]ADJust:CONFiguration:HYSTeresis:UPPer on page 193

Lower Level Hysteresis ← Settings

Defines a lower threshold the signal must exceed before the reference level is automatically adjusted when the "Auto Level" function is performed.

Remote command:
[SENSe:]ADJust:CONFiguration:HYSTeresis:LOWer on page 193

6.1.12　Softkeys of the Input/Output Menu for CDA Measurements

The following chapter describes all softkeys available in the "Input/Output" menu for CDA measurements. For RF measurements, see chapter 6.3.7.7, "Softkeys of the Input/Output Menu for RF Measurements", on page 112.

Input (AC/DC)

Toggles the RF input of the R&S FSV between AC and DC coupling.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:
INPut:COUPling on page 223

Noise Source

Switches the supply voltage for an external noise source on or off. For details on connectors refer to the R&S FSV Quick Start Guide, "Front and Rear Panel" chapter.

Remote command:
DIAGnostic<n>:SERVice:NSOurce on page 220

Signal Source

Opens a dialog box to select the signal source.

For "Digital Baseband (I/Q)", the source can also be configured here.

Input Path ← **Signal Source**

Defines whether the "RF Radio Frequency" or the "Digital IQ" input path is used for measurements. "Digital IQ" is only available if option R&S FSV-B17 (R&S Digital I/Q Interface) is installed.

Note: Note that the input path defines the characteristics of the signal, which differ significantly between the RF input and digital input.

Remote command:
INPut:SELect on page 229

Connected Device ← **Signal Source**

Displays the name of the device connected to the optional R&S Digital I/Q Interface (R&S FSV-B17) to provide Digital IQ input. The device name cannot be changed here.

The device name is unknown.

Remote command:
INPut:DIQ:CDEVice on page 224

Input Sample Rate ← **Signal Source**

Defines the sample rate of the digital I/Q signal source. This sample rate must correspond with the sample rate provided by the connected device, e.g. a generator.

Remote command:
INPut:DIQ:SRATe on page 226

Full Scale Level ← **Signal Source**

The "Full Scale Level" defines the level that should correspond to an I/Q sample with the magnitude "1".

The level can be defined either in dBm or Volt.

Remote command:
INPut:DIQ:RANGe[:UPPer] on page 225

Level Unit ← **Signal Source**

Defines the unit used for the full scale level.

Remote command:
INPut:DIQ:RANGe[:UPPer]:UNIT on page 226

Adjust Reference Level to Full Scale Level ← **Signal Source**

If enabled, the reference level is adjusted to the full scale level automatically if any change occurs.

Remote command:
INPut:DIQ:RANGe:COUPling on page 225

Digital IQ Info

Displays a dialog box with information on the digital I/Q input and output connection via the optional R&S Digital I/Q Interface (R&S FSV-B17), if available. The information includes:

● Device identification
● Used port

- (Maximum) digital input/output sample rates and maximum digital input/output transfer rates
- Status of the connection protocol
- Status of the PRBS descewing test
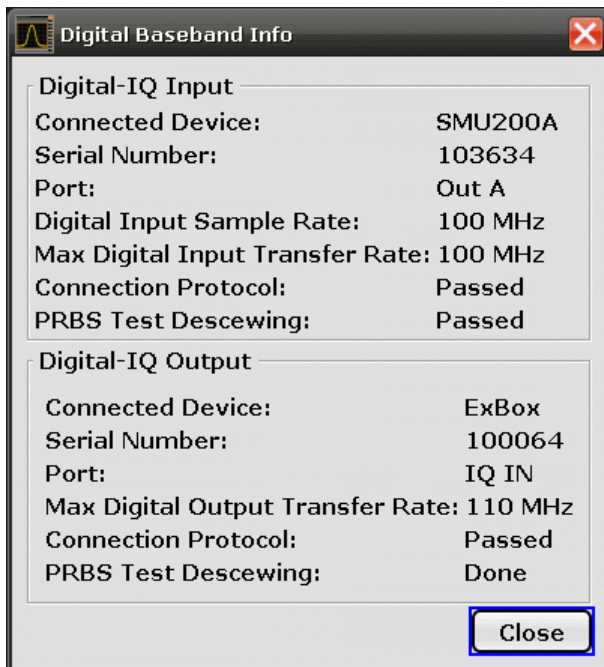
For details see "Interface Status Information" in "Instrument Functions - R&S Digital I/Q Interface (Option R&S FSV-B17)" in the description of the base unit.

Remote command:
INPut:DIQ:CDEVice on page 224

EXIQ

Opens a configuration dialog box for an optionally connected R&S EX-IQ-BOX and a submenu to access the main settings quickly.

Note: The EX-IQ-Box functionality is not supported for R&S FSV models 1321.3008Kxx.

If the optional R&S DigIConf software is installed, the submenu consists only of one key to access the software. **Note that R&S DigIConf requires a USB connection (not LAN!) from the R&S FSV to the R&S EX-IQ-BOX in addition to the R&S Digital I/Q Interface connection. R&S DigIConf version 2.10 or higher is required.**

For typical applications of the R&S EX-IQ-BOX see also the description of the R&S Digital I/Q Interface (R&S FSV-B17) in the base unit manual.

For details on configuration see the "R&S®Ex I/Q Box - External Signal Interface Module Manual".

For details on installation and operation of the R&S DigIConf software, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

TX Settings ← **EXIQ**

Opens the "EX-IQ-BOX Settings" dialog box to configure the R&S FSV for digital output to a connected device ("Transmitter" Type).

RX Settings ← **EXIQ**

Opens the "EX-IQ-BOX Settings" dialog box to configure the R&S FSV for digital input from a connected device ("Receiver" Type).

Send To ← **EXIQ**

The configuration settings defined in the dialog box are transferred to the R&S EX-IQ-BOX.

Firmware Update ← **EXIQ**

If a firmware update for the R&S EX-IQ-BOX is delivered with the R&S FSV firmware, this function is available. In this case, when you select the softkey, the firmware update is performed.

R&S Support ← **EXIQ**

Stores useful information for troubleshooting in case of errors.

This data is stored in the `C:\R_S\Instr\user\Support` directory on the instrument.

If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

DigIConf ← **EXIQ**

Starts the optional R&S DigIConf application. This softkey is only available if the optional software is installed.

To return to the R&S FSV application, press any key on the front panel. The application is displayed with the "EXIQ" menu, regardless of which key was pressed.

For details on the R&S DigIConf application, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

Note: If you close the R&S DigIConf window using the "Close" icon, the window is minimized, not closed.

If you select the "File > Exit" menu item in the R&S DigIConf window, the application is closed. Note that in this case the settings are lost and the EX-IQ-BOX functionality is no longer available until you restart the application using the "DigIConf" softkey in the R&S FSV once again.

Remote command:
Remote commands for the R&S DigIConf software always begin with `SOURce:EBOX`. Such commands are passed on from the R&S FSV to the R&S DigIConf automatically which then configures the R&S EX-IQ-BOX via the USB connection.
All remote commands available for configuration via the R&S DigIConf software are described in the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".
Example 1:
`SOURce:EBOX:*RST`
`SOURce:EBOX:*IDN?`
Result:
"Rohde&Schwarz,DigIConf,02.05.436 Build 47"
Example 2:
`SOURce:EBOX:USER:CLOCk:REFerence:FREQuency 5MHZ`
Defines the frequency value of the reference clock.

6.2 Time Alignment Error Measurement

The "Time Alignment Error" softkey activates the Time Alignment Error (TAE) measurement for the combined signals of both antennas of a base station.

The antenna signals of the two BTS transmitter branches are fed to the analyzer via a combiner. Each antenna must provide a common pilot channel, i.e. P-CPICH for antenna 1 and P-CPICH or S-CPICH for antenna 2. The figure 6-2 shows the measurement setup.
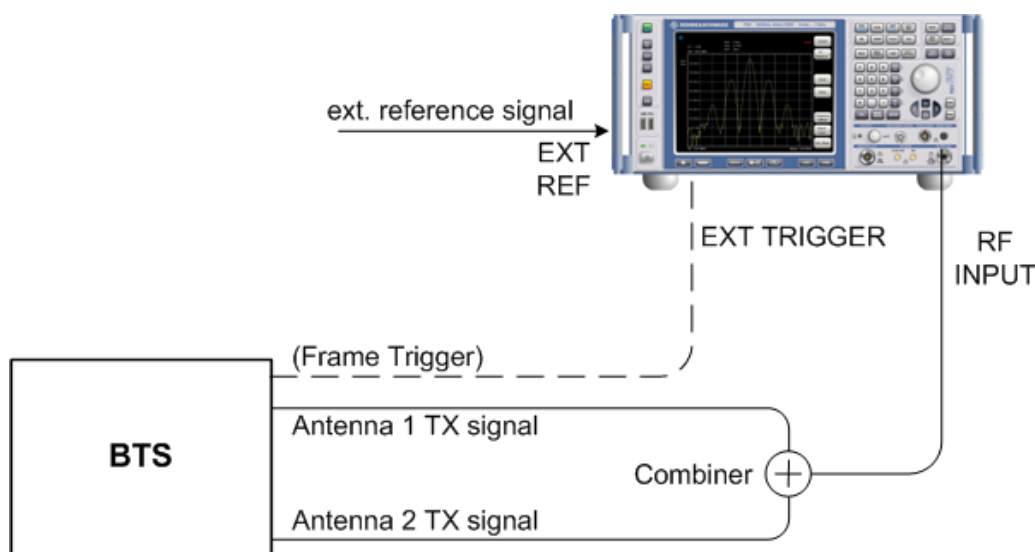
Fig. 6-2: Time Alignment Error Measurement setup

The settings for time alignment measurements are the same as for CDA measurements, although some settings may not be available. For a description see:

- "Frontend Settings" on page 51
- "IQ Capture Settings" on page 53
- "Sync/Scrambling Settings" on page 55
- "Demod Settings" on page 61

As a result, the measured time offset between the two signals in chips is displayed.

Remote commands:

`CONFigure:WCDPower:BTS:MEAS TAERror`

Activates the time alignment error measurement, see `CONFigure:WCDPower[:BTS]:MEASurement` on page 170.

`CALCulate:MARKer:FUNCtion:TAERror:RESult? TAERror`

Queries the results of the time alignment measurement, see `CALCulate<n>:MARKer<1>:FUNCtion:TAERror:RESult?` on page 134.

`STAT:QUES:SYNC[:EVEN]?`

Reads the information in a possible error situation, see `STATus:QUEStionable:SYNC[:EVENt]?` on page 208.

6.3 RF Measurements

6.3.1 Output Power Measurements

The R&S FSV measures the unweighted RF signal power in a bandwidth of:

$$f_{RW} = 5\,MHz \geq (1+\alpha) \cdot 3.84\,MHz \quad | \quad \alpha = 0.22$$

The power is measured in zero span mode (time domain) using a digital channel filter of 5 MHz in bandwidth. According to the 3GPP standard, the measurement bandwidth (5 MHz) is slightly larger than the minimum required bandwidth of 4.7 MHz. The bandwidth is displayed numerically below the screen.

CONFigure:WCDPower[:BTS]:MEASurement on page 170

6.3.2 Spectrum Emission Mask

The "Spectrum Emission Mask" measurement determines the power of the 3GPP FDD BTS signal in defined offsets from the carrier and compares the power values with a spectral mask specified by 3GPP.

This measurement is identical to the Spectrum Emission Mask measurements of the base system. By entering the measurement, the configuration to measure the 3GPP standard is loaded.

By default, the "Normal" base station standard is used. However, you can switch to the "Home" base station standard using the Standard softkey.

The following user-specific settings are not modified on the first access following presetting:

- Reference Level, Reference Level Offset
- Center Frequency, Frequency Offset
- Input Attenuation, Mixer Level
- All trigger settings

CONFigure:WCDPower[:BTS]:MEASurement on page 170

6.3.3 Ch Power ACLR

Selecting "Ch Power ACLR" activates the adjacent channel power measurement in the default setting according to 3GPP specifications (adjacent channel leakage ratio).

The R&S FSV measures the channel power and the relative power of the adjacent channels and of the alternate channels. The results are displayed below the screen.

The following user-specific settings are not modified on the first access following presetting:

- Reference Level, Reference Level Offset
- Center Frequency, Frequency Offset
- Input Attenuation, Mixer Level
- All trigger settings

Pressing the "Ch Power ACLR" softkey activates the analyzer mode with defined settings:

CHAN PWR/ACLR	CP/ACLR ON
CP/ACLR STANDARD	W-CDMA 3GPP FWD (By default, the "Normal" base station standard is used. However, you can switch to the "Home" base station standard using the Standard softkey.)
CP/ACLR CONFIG > NO. OF ADJ CHAN	2

To restore adapted measurement parameters, the following level parameters are saved on exiting and are set again on re-entering this measurement:

● Level parameters

● RBW, VBW

● Sweep time

● SPAN

● NO OF ADJ. CHANNELS

● FAST ACLR MODUS

For further details about the ACLR measurements refer to "Measuring Channel Power and Adjacent-Channel Power" in the base unit description.

CONFigure:WCDPower[:BTS]:MEASurement on page 170

Query of results:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult? on page 132

6.3.4 Occupied Bandwidth

The "Occupied Bandwidth" softkey activates the measurement of the bandwidth that the signal occupies.

The occupied bandwidth is defined as the bandwidth in which – in default settings -99 % of the total signal power is to be found. The percentage of the signal power to be included in the bandwidth measurement can be changed.

The occupied bandwidth (Occ BW) and the frequency markers are displayed in the marker information in the diagram grid.

The following user-specific settings are not modified on the first access following presetting:

● Reference Level, Reference Level Offset

● Center Frequency, Frequency Offset

● Input Attenuation, Mixer Level

● All trigger settings

Pressing the "Occupied Bandwidth" softkey activates the analyzer mode with defined settings. To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:

● Level parameters

● RBW, VBW

● Sweep time

● SPAN

For further details about the Occupied Bandwidth measurements refer to "Measuring the Occupied Bandwidth" in the base unit description.

CONFigure:WCDPower[:BTS]:MEASurement on page 170

Query of results:

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult? on page 132

6.3.5 CCDF

The CCDF softkey starts a measurement of the distribution function of the signal amplitudes (complementary cumulative distribution function). The CCDF and the Crest factor are displayed. For the purposes of this measurement, a signal section of user-definable length is recorded continuously in the zero span, and the distribution of the signal amplitudes is evaluated.

The following user-specific settings are not modified on the first access following presetting:

● Reference Level, Reference Level Offset

● Center Frequency, Frequency Offset

● Input Attenuation, Mixer Level

● All trigger settings

Pressing the "CCDF" softkey activates the analyzer mode with defined settings:

CCDF		
TRACE1	DETECTOR	SAMPLE
BW	RES BW MANUAL	10 MHz
	VIDEO BW MANUAL	5 MHz

To restore adapted measurement parameters, the following level parameters are saved on exiting and are set again on re-entering this measurement:

● Level parameters

● RBW

● NO OF SAMPLES

For further details about the CCDF measurements refer to "Defining Gated Triggering for APD and CCDF" of the base unit.

CONFigure:WCDPower[:BTS]:MEASurement on page 170

or

CALCulate<n>:STATistics:CCDF[:STATe] on page 166

Query of results:

CALCulate<n>:MARKer<m>:Y? on page 163

CALCulate<n>:STATistics:RESult<Trace> on page 167

6.3.6 RF Combi

This measurement combines the Adjacent Channel Power (chapter 6.3.3, "Ch Power ACLR", on page 86) measurement with chapter 6.3.4, "Occupied Bandwidth", on page 87 and chapter 6.3.2, "Spectrum Emission Mask", on page 86. The ACP and OBW are measured on trace 1 from which the SEM trace 2 is derived with integration method.

The advantage of the RF COMBI measurement is that all RF results are measured with a single measurement process. This measurement is faster than the three single measurements.
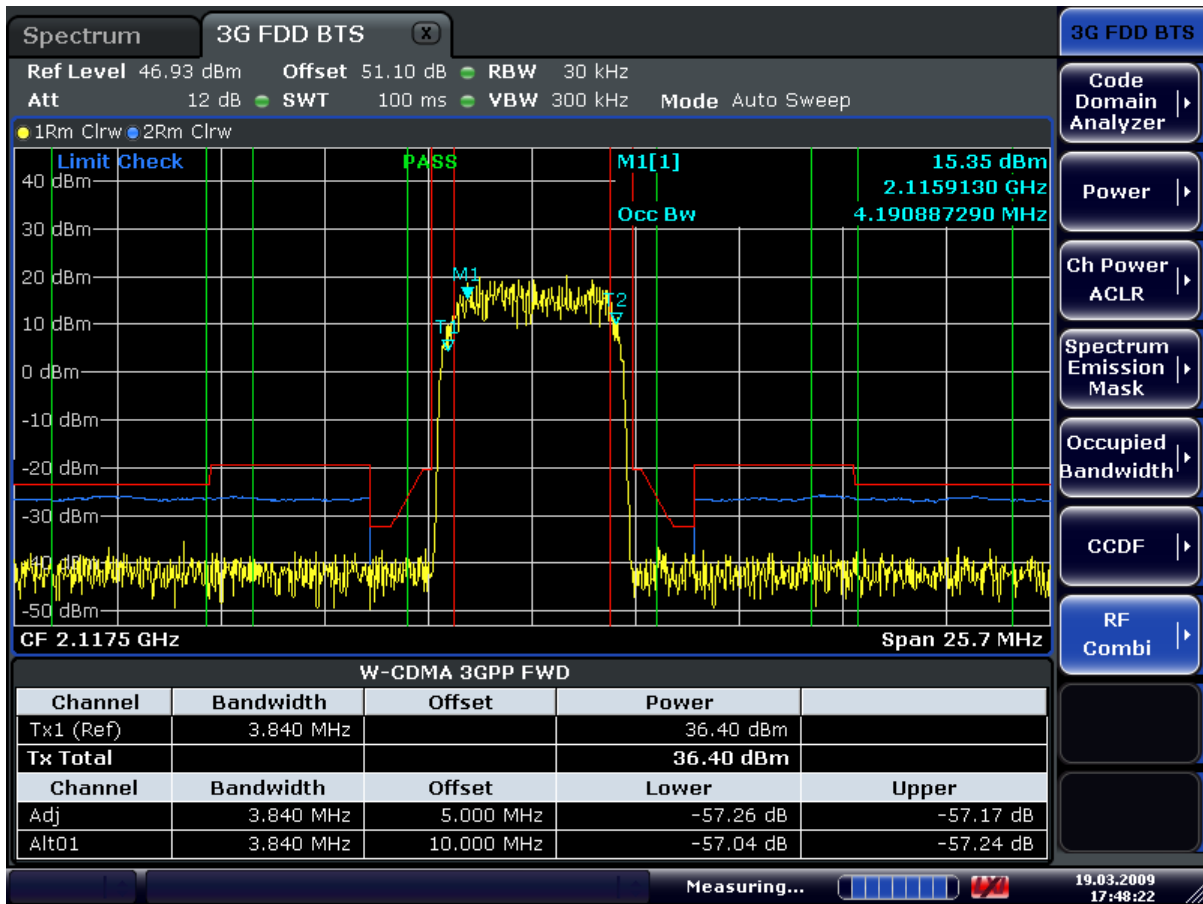
Fig. 6-3: RF Combi measurement

The following user-specific settings are not modified on the first access following pre-setting:

- Level parameters
- Center Frequency + Frequency Offset
- All trigger settings

CHAN PWR/ACP	CP/ACP ON (TRACE 1)	
CP/ACP STANDARD	W-CDMA 3GPP REV	
CP/ACP CONFIG	NO. OF ADJ CHAN	2
SPAN		25.5 MHz
DETECTOR		RMS
BW	RBW MANUAL	30 kHz
BW	SWEEP TIME MANUAL	100 ms
OCC BW	ACTIVE ON TRACE 1	
SEM	ACTIVE ON TRACE 2	

Using these settings, the analyzer can perform many functions featured in Spectrum mode.

To restore adapted measurement parameters, the following level parameters are saved on exiting and are set again on re-entering this measurement:

● RBW, VBW

● Sweep time

● SPAN

● NO OF ADJ. CHANNELS

CONFigure:WCDPower[:BTS]:MEASurement on page 170

6.3.7 Softkeys and Menus for RF Measurements (K72)

The following chapter describes the softkeys and menus available for RF measurements in 3GPP FDD BTS base station tests.

All menus not described here are the same as for the base unit, see the description there.

6.3.7.1 Softkeys of the MEAS Menu

The main measurement menus for the RF measurements are identical to the base unit. However, for SEM and ACLR measurements, an additional softkey is available to select the required standard.

Standard

Switches between Normal mode and Home BS (Home Base Station) mode. Switching this parameter changes the limits according to the specifications.

Remote command:
CONFigure:WCDPower[:BTS]:STanDard on page 176

6.3.7.2 Softkeys of the Frequency Menu

The following chapter describes all softkeys available in the "Frequency" menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is

only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Center

Opens an edit dialog box to enter the center frequency. The allowed range of values for the center frequency depends on the frequency span.

span > 0: $span_{min}/2 \leq f_{center} \leq f_{max} - span_{min}/2$

span = 0: $0\ Hz \leq f_{center} \leq f_{max}$

f_{max} and $span_{min}$ are specified in the data sheet.

Remote command:

[SENSe:]FREQuency:CENTer on page 199

CF Stepsize

Opens a submenu to set the step size of the center frequency.

The step size defines the value by which the center frequency is increased or decreased when the arrow keys are pressed. When you use the rotary knob the center frequency changes in steps of 10% of the "Center Frequency Stepsize".

The step size can be set to a fraction of the span (span > 0) or a fraction of the resolution bandwidth (span = 0) or it can be set to a fixed value manually.

Apart from the =Center, =Marker and Manual softkeys, the other softkeys are displayed depending on the selected frequency span.

This softkey is available for RF measurements.

0.1*Span (span > 0) ← CF Stepsize

Sets the step size for the center frequency to 10 % of the span.

Remote command:

FREQ:CENT:STEP:LINK SPAN, see [SENSe:]FREQuency:CENTer:STEP:LINK on page 199

FREQ:CENT:STEP:LINK:FACT 10PCT, see [SENSe:]FREQuency:CENTer:STEP: LINK:FACTor on page 200

0.1*RBW (span > 0) ← CF Stepsize
Sets the step size for the center frequency to 10 % of the resolution bandwidth.

This is the default setting.

Remote command:
FREQ:CENT:STEP:LINK RBW, see [SENSe:]FREQuency:CENTer:STEP:LINK on page 199
FREQ:CENT:STEP:LINK:FACT 10PCT, see [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor on page 200

0.5*Span (span > 0) ← CF Stepsize
Sets the step size for the center frequency to 50 % of the span.

Remote command:
FREQ:CENT:STEP:LINK SPAN, see [SENSe:]FREQuency:CENTer:STEP:LINK on page 199
FREQ:CENT:STEP:LINK:FACT 50PCT, see [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor on page 200

0.5*RBW (span > 0) ← CF Stepsize
Sets the step size for the center frequency to 50 % of the resolution bandwidth.

Remote command:
FREQ:CENT:STEP:LINK RBW, see [SENSe:]FREQuency:CENTer:STEP:LINK on page 199
FREQ:CENT:STEP:LINK:FACT 50PCT, see [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor on page 200

x*Span (span > 0) ← CF Stepsize
Opens an edit dialog box to set the step size for the center frequency as a percentage (%) of the span.

Remote command:
FREQ:CENT:STEP:LINK SPAN, see [SENSe:]FREQuency:CENTer:STEP:LINK on page 199
FREQ:CENT:STEP:LINK:FACT 20PCT, see [SENSe:]FREQuency:CENTer:STEP:LINK on page 199

x*RBW (span > 0) ← CF Stepsize
Opens an edit dialog box to set the step size for the center frequency as a percentage (%) of the resolution bandwidth. Values between 1 % and 100 % in steps of 1 % are allowed. The default setting is 10 %.

Remote command:
FREQ:CENT:STEP:LINK RBW, see [SENSe:]FREQuency:CENTer:STEP:LINK on page 199
FREQ:CENT:STEP:LINK:FACT 20PCT, see [SENSe:]FREQuency:CENTer:STEP:LINK on page 199

=Center ← CF Stepsize

Sets the step size to the value of the center frequency and removes the coupling of the step size to span or resolution bandwidth.

This function is especially useful for measurements of the signal harmonics. In this case, each stroke of the arrow key selects the center frequency of another harmonic.

=Marker ← CF Stepsize

Sets the step size to the value of the current marker and removes the coupling of the step size to span or resolution bandwidth.

This function is especially useful for measurements of the signal harmonics. In this case, each stroke of the arrow key selects the center frequency of another harmonic.

Manual ← CF Stepsize

Opens an edit dialog box to enter a fixed step size for the center frequency.

Remote command:
[SENSe:]FREQuency:CENTer:STEP on page 199

Start

Opens an edit dialog box to define the start frequency. The following range of values is allowed:

$f_{min} \leq f_{start} \leq f_{max} - span_{min}$

f_{min}, f_{max} and $span_{min}$ are specified in the data sheet.

Remote command:
[SENSe:]FREQuency:STARt on page 201

Stop

Opens an edit dialog box to define the stop frequency. The following range of values for the stop frequency is allowed:

$f_{min} + span_{min} \leq f_{stop} \leq f_{max}$

f_{min}, f_{max} and $span_{min}$ are specified in the data sheet.

Remote command:
[SENSe:]FREQuency:STOP on page 201

Frequency Offset

Opens an edit dialog box to enter a frequency offset that shifts the displayed frequency range by the specified offset.

The softkey indicates the current frequency offset. The allowed values range from -100 GHz to 100 GHz. The default setting is 0 Hz.

Remote command:
[SENSe:]FREQuency:OFFSet on page 200

6.3.7.3　Softkeys of the Span Menu for RF Measurements

The following chapter describes all softkeys available in the "Span" menu for RF measurements, except for "Power" measurements.

Span Manual

Opens an edit dialog box to enter the frequency span. The center frequency remains the same when you change the span.

The following range is allowed:

span = 0: 0 Hz

span >0: $span_{min} \leq f_{span} \leq f_{max}$

f_{max} and $span_{min}$ are specified in the data sheet.

Remote command:
[SENSe:]FREQuency:SPAN on page 201

Sweeptime Manual

Opens an edit dialog box to enter the sweep time.

Sweep time	
absolute max. sweep time value:	16000 s
absolute min. sweep time value:	zero span: 1 µs
	span > 0: depends on device model (refer to data sheet)

Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.

Numeric input is always rounded to the nearest possible sweep time. For rotary knob or UPARROW/DNARROW key inputs, the sweep time is adjusted in steps either downwards or upwards.

The manual input mode of the sweep time is indicated by a green bullet next to the "SWT" display in the channel bar. If the selected sweep time is too short for the selected bandwidth and span, level measurement errors will occur due to a too short settling time for the resolution or video filters. In this case, the R&S FSV displays the error message "UNCAL" and marks the indicated sweep time with a red bullet.

This softkey is available for RF measurements, but not for CCDF measurements.

Remote command:
SWE:TIME:AUTO OFF, see [SENSe:]SWEep:TIME:AUTO on page 206
[SENSe:]SWEep:TIME on page 205

Full Span

Sets the span to the full frequency range of the R&S FSV specified in the data sheet. This setting is useful for overview measurements.

Remote command:
[SENSe:]FREQuency:SPAN:FULL on page 201

Last Span

Sets the span to the previous value. With this function e.g. a fast change between overview measurement and detailed measurement is possible.

Remote command:

-

6.3.7.4 Softkeys of the Amplitude Menu

The following table shows all softkeys available in the "Amplitude" menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Ref Level

Opens an edit dialog box to enter the reference level in the current unit (dBm, dBµV, etc).

The reference level is the maximum value the AD converter can handle without distortion of the measured value. Signal levels above this value will not be measured correctly, which is indicated by the "IFOVL" status display.

Remote command:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel on page 179

Range

Opens a submenu to define the display range of the level axis.

This softkey and its submenu are available for RF measurements.

Range Log 100 dB ← Range

Sets the level display range to 100 dB.

Remote command:
Logarithmic scaling:
`DISP:WIND:TRAC:Y:SPAC LOG`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 181
Display range:
`DISP:WIND:TRAC:Y 100DB`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 178

Range Log 50 dB ← Range

Sets the level display range to 50 dB.

Remote command:
Logarithmic scaling:
`DISP:WIND:TRAC:Y:SPAC LOG`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 181
Display range:
`DISP:WIND:TRAC:Y 50DB`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 178

Range Log 10 dB ← Range

Sets the level display range to 10 dB.

Remote command:
Logarithmic scaling:
`DISP:WIND:TRAC:Y:SPAC LOG`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 181
Display range:
`DISP:WIND:TRAC:Y 10DB`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 178

Range Log 5 dB ← Range

Sets the level display range to 5 dB.

Remote command:
Logarithmic scaling:
`DISP:WIND:TRAC:Y:SPAC LOG`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing` on page 181
Display range:
`DISP:WIND:TRAC:Y 5DB`, see `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` on page 178

Range Log 1 dB ← Range
Sets the level display range to 1 dB.

Remote command:
Logarithmic scaling:
DISP:WIND:TRAC:Y:SPAC LOG, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 181
Display range:
DISP:WIND:TRAC:Y 1DB, see DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 178

Range Log Manual ← Range
Opens an edit dialog box to define the display range of a logarithmic level axis manually.

Remote command:
Logarithmic scaling:
DISP:WIND:TRAC:Y:SPAC LOG, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 181
Display range:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] on page 178

Range Linear % ← Range
Selects linear scaling for the level axis in %.

The grid is divided into decadal sections.

Markers are displayed in the selected unit ("Unit" softkey). Delta markers are displayed in % referenced to the voltage value at the position of marker 1. This is the default setting for linear scaling.

Remote command:
DISP:TRAC:Y:SPAC LIN, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 181

Range Lin. Unit ← Range
Selects linear scaling in dB for the level display range, i.e. the horizontal lines are labeled in dB.

Markers are displayed in the selected unit ("Unit" softkey). Delta markers are displayed in dB referenced to the power value at the position of marker 1.

Remote command:
DISP:TRAC:Y:SPAC LDB, see DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 181

Unit
Opens the "Unit" submenu to select the unit for the level axis.

The default setting is dBm.

If a transducer is switched on, the softkey is not available.

In general, the signal analyzer measures the signal voltage at the RF input. The level display is calibrated in RMS values of an unmodulated sine wave signal. In the default state, the level is displayed at a power of 1 mW (= dBm). Via the known input impedance (50 Ω or 75 Ω), conversion to other units is possible. The following units are available and directly convertible:

- dBm
- dBmV
- dBμV
- dBμA
- dBpW
- Volt
- Ampere
- Watt

Remote command:
CALCulate<n>:UNIT:POWer on page 169

Preamp On/Off
Switches the preamplifier on and off.

If option R&S FSV-B22 is installed, the preamplifier is only active below 7 GHz.

If option R&S FSV-B24 is installed, the preamplifier is active for all frequencies.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:
INPut:GAIN:STATe   on page 228

RF Atten Manual/Mech Att Manual
Opens an edit dialog box to enter the attenuation, irrespective of the reference level. If electronic attenuation is activated (option R&S FSV-B25 only; "El Atten Mode Auto" softkey), this setting defines the mechanical attenuation.

The mechanical attenuation can be set in 10 dB steps.

The RF attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). The range is specified in the data sheet. If the current reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

The RF attenuation defines the level at the input mixer according to the formula:

$level_{mixer} = level_{input} - RF$ attenuation

Note: As of firmware version 1.61, the maximum mixer level allowed is **0 dBm**. Mixer levels above this value may lead to incorrect measurement results, which are indicated by the "OVLD" status display. The increased mixer level allows for an improved signal, but also increases the risk of overloading the instrument!

Remote command:
INPut:ATTenuation on page 222

RF Atten Auto/Mech Att Auto

Sets the RF attenuation automatically as a function of the selected reference level. This ensures that the optimum RF attenuation is always used. It is the default setting.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:
INPut:ATTenuation:AUTO on page 223

El Atten On/Off

This softkey switches the electronic attenuator on or off. This softkey is only available with option R&S FSV-B25.

When the electronic attenuator is activated, the mechanical and electronic attenuation can be defined separately. Note however, that both parts must be defined in the same mode, i.e. either both manually, or both automatically.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

- To define the mechanical attenuation, use the RF Atten Manual/Mech Att Manual or RF Atten Auto/Mech Att Auto softkeys.
- To define the electronic attenuation, use the El Atten Mode (Auto/Man) softkey.

Note: This function is not available for stop frequencies (or center frequencies in zero span) >7 GHz. In this case, the electronic and mechanical attenuation are summarized and the electronic attenuation can no longer be defined individually. As soon as the stop or center frequency is reduced below 7 GHz, this function is available again. When the electronic attenuator is switched off, the corresponding RF attenuation mode (auto/manual) is automatically activated.

Remote command:
INPut:EATT:AUTO on page 228

El Atten Mode (Auto/Man)

This softkey defines whether the electronic attenuator value is to be set automatically or manually. If manual mode is selected, an edit dialog box is opened to enter the value. This softkey is only available with option R&S FSV-B25, and only if the electronic attenuator has been activated via the El Atten On/Off softkey.

Note: This function is not available for stop frequencies (or center frequencies in zero span) >7 GHz. In this case, the electronic and mechanical attenuation are summarized and the electronic attenuation can no longer be defined individually. As soon as the stop or center frequency is reduced below 7 GHz, electronic attenuation is available again. If the electronic attenuation was defined manually, it must be re-defined.

The attenuation can be varied in 1 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value.

To re-open the edit dialog box for manual value definition, select the "Man" mode again.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

Remote command:
INPut:EATT:AUTO on page 228
INPut:EATT on page 227

Ref Level Offset
Opens an edit dialog box to enter the arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the y-axis is changed accordingly. The setting range is ±200 dB in 0.1 dB steps.

Remote command:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet on page 180

Ref Level Position
Opens an edit dialog box to enter the reference level position, i.e. the position of the maximum AD converter value on the level axis. The setting range is from -200 to +200 %, 0 % corresponding to the lower and 100 % to the upper limit of the diagram.

Only available for RF measurements.

Remote command:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition on page 180

Grid Abs/Rel
Switches between absolute and relative scaling of the level axis (not available with "Linear" range).

Only available for RF measurements.

"Abs"	Absolute scaling: The labeling of the level lines refers to the absolute value of the reference level. Absolute scaling is the default setting.
"Rel"	Relative scaling: The upper line of the grid is always at 0 dB. The scaling is in dB whereas the reference level is always in the set unit (for details on unit settings see the "Unit" softkey).

Remote command:
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE on page 179

Noise Correction
If activated, the results are corrected by the instrument's inherent noise, which increases the dynamic range.

"ON"	A reference measurement of the instrument's inherent noise is carried out. The noise power measured is then subtracted from the power in the channel that is being examined. The inherent noise of the instrument depends on the selected center frequency, resolution bandwidth and level setting. Therefore, the correction function is disabled whenever one of these parameters is changed. A disable message is displayed on the screen. Noise correction must be switched on again manually after the change.
"OFF"	No noise correction is performed.

"AUTO"   Noise correction is performed. After a parameter change, noise correction is restarted automatically and a new correction measurement is performed.

Remote command:

[SENSe:]POWer:NCORrection on page 204

Input (AC/DC)

Toggles the RF input of the R&S FSV between AC and DC coupling.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:

INPut:COUPling on page 223

Input 50 Ω/75 Ω

Uses 50 Ω or 75 Ω as reference impedance for the measured levels. Default setting is 50 Ω.

The setting 75 Ω should be selected if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type (= 25 Ω in series to the input impedance of the instrument). The correction value in this case is 1.76 dB = 10 log (75 Ω/50 Ω).

All levels specified in this Operating Manual refer to the default setting of the instrument (50 Ω).

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:

INPut:IMPedance on page 229

6.3.7.5   Softkeys of the Bandwidth Menu

The following table shows all softkeys available in the "Bandwidth" menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

For Spurious Emission Measurements, the settings are defined in the "Sweep List" dialog, see the description in the base unit.

Res BW Manual

Opens an edit dialog box to enter a value for the resolution bandwidth. The available resolution bandwidths are specified in the data sheet.

For details on the correlation between resolution bandwidth and filter type refer to chapter 5.2.5, "Selecting the Appropriate Filter Type", on page 23.

Numeric input is always rounded to the nearest possible bandwidth. For rotary knob or UP/DNARROW key inputs, the bandwidth is adjusted in steps either upwards or downwards.

The manual input mode of the resolution bandwidth is indicated by a green bullet next to the "RBW" display in the channel bar.

This softkey is available for all RF measurements except for Power measurements.

Remote command:
[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO on page 195
[SENSe:]BANDwidth|BWIDth[:RESolution] on page 195

Res BW Auto

Couples the resolution bandwidth to the selected span (for span > 0). If you change the span, the resolution bandwidth is automatically adjusted.

This setting is recommended if you need the ideal resolution bandwidth in relation to a particular span.

This softkey is available for measuring the Adjacent Channel Power, the Occupied Bandwidth and the CCDF.

Remote command:
[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO on page 195

Video BW Manual

Opens an edit dialog box to enter the video bandwidth. The available video bandwidths are specified in the data sheet.

Numeric input is always rounded to the nearest possible bandwidth. For rotary knob or UP/DOWN key inputs, the bandwidth is adjusted in steps either upwards or downwards.

The manual input mode of the video bandwidth is indicated by a green bullet next to the "VBW" display in the channel bar.

Note: RMS detector and VBW.
If an RMS detector is used, the video bandwidth in the hardware is bypassed. Thus, duplicate trace averaging with small VBWs and RMS detector no longer occurs. However, the VBW is still considered when calculating the sweep time. This leads to a longer sweep time for small VBW values. Thus, you can reduce the VBW value to achieve more stable trace curves even when using an RMS detector. Normally, if the RMS detector is used the sweep time should be increased to get more stable trace curves. For details on detectors see chapter 5.2.3, "Detector Overview", on page 20.

This softkey is available for measuring the Adjacent Channel Power, the Spectrum Emission Mask and the Occupied Bandwidth.

Remote command:
[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO on page 197
[SENSe:]BANDwidth|BWIDth:VIDeo on page 197

Video BW Auto
Couples the video bandwidth to the resolution bandwidth. If you change the resolution bandwidth, the video bandwidth is automatically adjusted.

This setting is recommended if a minimum sweep time is required for a selected resolution bandwidth. Narrow video bandwidths result in longer sweep times due to the longer settling time. Wide bandwidths reduce the signal/noise ratio.

This softkey is available for measuring the Adjacent Channel Power, the Spectrum Emission Mask and the Occupied Bandwidth.

Remote command:
[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO on page 197

Sweeptime Manual
Opens an edit dialog box to enter the sweep time.

Sweep time	
absolute max. sweep time value:	16000 s
absolute min. sweep time value:	zero span: 1 µs
	span > 0: depends on device model (refer to data sheet)

Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.

Numeric input is always rounded to the nearest possible sweep time. For rotary knob or UPARROW/DNARROW key inputs, the sweep time is adjusted in steps either downwards or upwards.

The manual input mode of the sweep time is indicated by a green bullet next to the "SWT" display in the channel bar. If the selected sweep time is too short for the selected bandwidth and span, level measurement errors will occur due to a too short settling time for the resolution or video filters. In this case, the R&S FSV displays the error message "UNCAL" and marks the indicated sweep time with a red bullet.

This softkey is available for RF measurements, but not for CCDF measurements.

Remote command:
SWE:TIME:AUTO OFF, see [SENSe:]SWEep:TIME:AUTO on page 206

[SENSe:]SWEep:TIME on page 205

Sweeptime Auto

Couples the sweep time to the span, video bandwidth (VBW) and resolution bandwidth (RBW) (not available for zero span). If you change the span, resolution bandwidth or video bandwidth, the sweep time is automatically adjusted.

The R&S FSV always selects the shortest sweep time that is possible without falsifying the signal. The maximum level error is < 0.1 dB, compared to using a longer sweep time.

This softkey is available for measuring the Adjacent Channel Power, the Spectrum Emission Mask and the Occupied Bandwidth.

Remote command:
[SENSe:]SWEep:TIME:AUTO on page 206

Sweep Type

Opens a submenu to define the sweep type.

This softkey is available for measuring the Signal Power, the Adjacent Channel Power and the Occupied Bandwidth.

This function is not available in IQ Analyzer mode or for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

In frequency sweep mode, the analyzer provides several possible methods of sweeping:

- "Sweep" on page 105
- "FFT" on page 105 (not available with 5-Pole filters, channel filters or RRC filters, see chapter 5.2.5, "Selecting the Appropriate Filter Type", on page 23)
- "Auto" on page 106

Sweep ← Sweep Type

Sets the Sweep Type to standard analog frequency sweep.

In the standard sweep mode, the local oscillator is set to provide the spectrum quasi analog from the start to the stop frequency.

Remote command:
SWE:TYPE SWE, see [SENSe:]SWEep:TYPE on page 206

FFT ← Sweep Type

Sets the Sweep Type to FFT mode.

The FFT sweep mode samples on a defined frequency value and transforms it to the spectrum by fast Fourier transformation (FFT).

FFT is not available when using 5-Pole filters, Channel filters or RRC filters. In this case, sweep mode is used.

Note: The same applies when a tracking generator (internal or external, options R&S FSV-B9/B10) is active.

Remote command:
SWE:TYPE FFT, see [SENSe:]SWEep:TYPE on page 206

Auto ← Sweep Type
Automatically sets the fastest available Sweep Type for the current measurement. Auto mode is set by default.

Remote command:
SWE:TYPE AUTO, see [SENSe:]SWEep:TYPE on page 206

FFT Filter Mode ← Sweep Type
Defines the filter mode to be used for FFT filters by defining the partial span size. The partial span is the span which is covered by one FFT analysis.

Auto ← FFT Filter Mode ← Sweep Type
The firmware determines whether to use wide or narrow filters to obtain the best measurement results.

Remote command:
[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT on page 195

Narrow ← FFT Filter Mode ← Sweep Type
For an RBW ≤ 10kHz, the FFT filters with the smaller partial span are used. This allows you to perform measurements near a carrier with a reduced reference level due to a narrower analog prefilter.

Remote command:
[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT on page 195

Coupling Ratio
Opens a submenu to select the coupling ratios for functions coupled to the bandwidth.

This softkey and its submenu is available for measuring the Adjacent Channel Power, the Spectrum Emission Mask, the Occupied Bandwidth and the CCDF.

RBW/VBW Sine [1/1] ← Coupling Ratio
Sets the following coupling ratio:

"video bandwidth = resolution bandwidth"

This is the default setting for the coupling ratio resolution bandwidth/video bandwidth.

This is the coupling ratio recommended if sinusoidal signals are to be measured.

This setting takes effect if you define the video bandwidth automatically (Video BW Auto).

Remote command:
BAND:VID:RAT 1, see [SENSe:]BANDwidth|BWIDth:VIDeo:RATio
on page 197

RBW/VBW Pulse [.1] ← Coupling Ratio
Sets the following coupling ratio:

"video bandwidth = 10 × resolution bandwidth or"

"video bandwidth = 10 MHz (= max. VBW)."

This coupling ratio is recommended whenever the amplitudes of pulsed signals are to be measured correctly. The IF filter is exclusively responsible for pulse shaping. No additional evaluation is performed by the video filter.

This setting takes effect if you define the video bandwidth automatically (Video BW Auto).

Remote command:

`BAND:VID:RAT 10,` see `[SENSe:]BANDwidth|BWIDth:VIDeo:RATio` on page 197

RBW/VBW Noise [10] ← Coupling Ratio
Sets the following coupling ratio:

"video bandwidth = resolution bandwidth/10"

At this coupling ratio, noise and pulsed signals are suppressed in the video domain. For noise signals, the average value is displayed.

This setting takes effect if you define the video bandwidth automatically (Video BW Auto).

Remote command:

`BAND:VID:RAT 0.1,` see `[SENSe:]BANDwidth|BWIDth:VIDeo:RATio` on page 197

RBW/VBW Manual ← Coupling Ratio
Activates the manual input of the coupling ratio.

The resolution bandwidth/video bandwidth ratio can be set in the range 0.001 to 1000.

This setting takes effect if you define the video bandwidth automatically (Video BW Auto).

Remote command:

`BAND:VID:RAT 10,` see `[SENSe:]BANDwidth|BWIDth:VIDeo:RATio` on page 197

Span/RBW Auto [100] ← Coupling Ratio
Sets the following coupling ratio:

"resolution bandwidth = span/100"

This coupling ratio is the default setting of the R&S FSV.

This setting takes effect if you define the resolution bandwidth automatically (Res BW Auto).

Remote command:

`BAND:VID:RAT 0.001,` see `[SENSe:]BANDwidth|BWIDth:VIDeo:RATio` on page 197

Span/RBW Manual ← Coupling Ratio
Activates the manual input of the coupling ratio.

This setting takes effect if you define the resolution bandwidth automatically (Res BW Auto).

The span/resolution bandwidth ratio can be set in the range 1 to 10000.

Remote command:
BAND:RAT 0.1, see [SENSe:]BANDwidth|BWIDth[:RESolution]:RATio on page 196

Default Coupling ← Coupling Ratio
Sets all coupled functions to the default state ("AUTO").

In addition, the ratio "RBW/VBW" is set to "SINE [1/1]" and the ratio "SPAN/RBW" to *100.*

Remote command:
[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO on page 195
[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO on page 197
[SENSe:]SWEep:TIME:AUTO on page 206

Filter Type
Opens a submenu to select the filter type.

This softkey and its submenu are available for measuring the the Spectrum Emission Mask, the Occupied Bandwidth and the CCDF. Instead of opening a submenu, this softkey opens the "Sweep List" dialog box to select the filter type when measuring the Spectrum Emission Mask.

The submenu contains the following softkeys:

- Normal (3 dB)
- CISPR (6 dB)
- MIL Std (6 dB)
  Note that the 6 dB bandwidths are available only with option R&S FSV-K54.
- Channel
- RRC
- 5-Pole (not available for sweep type "FFT")

For detailed information on filters see chapter 5.2.5, "Selecting the Appropriate Filter Type", on page 23 and chapter 5.2.6, "List of Available RRC and Channel Filters", on page 23.

Remote command:
[SENSe:]BANDwidth|BWIDth[:RESolution]:TYPE on page 196

6.3.7.6   Softkeys of the Sweep Menu

The following table shows all softkeys available in the "Sweep" menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Continuous Sweep

Sets the continuous sweep mode: the sweep takes place continuously according to the trigger settings. This is the default setting.

The trace averaging is determined by the sweep count value (see the "Sweep Count" softkey, "Sweep Count" on page 71).

Remote command:

`INIT:CONT ON`, see `INITiate<n>:CONTinuous` on page 221

Single Sweep

Sets the single sweep mode: after triggering, starts the number of sweeps that are defined by using the Sweep Count softkey. The measurement stops after the defined number of sweeps has been performed.

Remote command:

`INIT:CONT OFF`, see `INITiate<n>:CONTinuous` on page 221

Continue Single Sweep

Repeats the number of sweeps set by using the Sweep Count softkey, without deleting the trace of the last measurement.

This is particularly of interest when using the trace configurations "Average" or "Max Hold" to take previously recorded measurements into account for averaging/maximum search.

Remote command:

`INITiate<n>:CONMeas` on page 221

Sweeptime Manual

Opens an edit dialog box to enter the sweep time.

Sweep time	
absolute max. sweep time value:	16000 s
absolute min. sweep time value:	zero span: 1 µs
	span > 0: depends on device model (refer to data sheet)

Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.

Numeric input is always rounded to the nearest possible sweep time. For rotary knob or UPARROW/DNARROW key inputs, the sweep time is adjusted in steps either downwards or upwards.

The manual input mode of the sweep time is indicated by a green bullet next to the "SWT" display in the channel bar. If the selected sweep time is too short for the selected bandwidth and span, level measurement errors will occur due to a too short settling time for the resolution or video filters. In this case, the R&S FSV displays the error message "UNCAL" and marks the indicated sweep time with a red bullet.

This softkey is available for RF measurements, but not for CCDF measurements.

Remote command:

SWE:TIME:AUTO OFF, see [SENSe:]SWEep:TIME:AUTO on page 206

[SENSe:]SWEep:TIME on page 205

Sweeptime Auto

Couples the sweep time to the span, video bandwidth (VBW) and resolution bandwidth (RBW) (not available for zero span). If you change the span, resolution bandwidth or video bandwidth, the sweep time is automatically adjusted.

The R&S FSV always selects the shortest sweep time that is possible without falsifying the signal. The maximum level error is < 0.1 dB, compared to using a longer sweep time.

This softkey is available for measuring the Adjacent Channel Power, the Spectrum Emission Mask and the Occupied Bandwidth.

Remote command:

[SENSe:]SWEep:TIME:AUTO on page 206

Sweep Type

Opens a submenu to define the sweep type.

This softkey is available for measuring the Signal Power, the Adjacent Channel Power and the Occupied Bandwidth.

This function is not available in IQ Analyzer mode or for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

In frequency sweep mode, the analyzer provides several possible methods of sweeping:

- "Sweep" on page 105
- "FFT" on page 105 (not available with 5-Pole filters, channel filters or RRC filters, see chapter 5.2.5, "Selecting the Appropriate Filter Type", on page 23)
- "Auto" on page 106

Sweep ← Sweep Type

Sets the Sweep Type to standard analog frequency sweep.

In the standard sweep mode, the local oscillator is set to provide the spectrum quasi analog from the start to the stop frequency.

Remote command:

SWE:TYPE SWE, see [SENSe:]SWEep:TYPE on page 206

FFT ← Sweep Type

Sets the Sweep Type to FFT mode.

The FFT sweep mode samples on a defined frequency value and transforms it to the spectrum by fast Fourier transformation (FFT).

FFT is not available when using 5-Pole filters, Channel filters or RRC filters. In this case, sweep mode is used.

Note: The same applies when a tracking generator (internal or external, options R&S FSV-B9/B10) is active.

Remote command:

SWE:TYPE FFT, see [SENSe:]SWEep:TYPE on page 206

Auto ← Sweep Type

Automatically sets the fastest available Sweep Type for the current measurement. Auto mode is set by default.

Remote command:

SWE:TYPE AUTO, see [SENSe:]SWEep:TYPE on page 206

FFT Filter Mode ← Sweep Type

Defines the filter mode to be used for FFT filters by defining the partial span size. The partial span is the span which is covered by one FFT analysis.

Auto ← FFT Filter Mode ← Sweep Type

The firmware determines whether to use wide or narrow filters to obtain the best measurement results.

Remote command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT on page 195

Narrow ← FFT Filter Mode ← Sweep Type

For an RBW ≤ 10kHz, the FFT filters with the smaller partial span are used. This allows you to perform measurements near a carrier with a reduced reference level due to a narrower analog prefilter.

Remote command:

[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT on page 195

Sweep Count

Opens an edit dialog box to enter the number of sweeps to be performed in the single sweep mode. Values from 0 to 32767 are allowed. If the values 0 or 1 are set, one sweep is performed. The sweep count is applied to all the traces in a diagram.

If the trace configurations "Average", "Max Hold" or "Min Hold" are set, the sweep count value also determines the number of averaging or maximum search procedures.

In continuous sweep mode, if sweep count = 0 (default), averaging is performed over 10 sweeps. For sweep count =1, no averaging, maxhold or minhold operations are performed.

Remote command:

[SENSe:]SWEep:COUNt on page 205

Sweep Points

Opens an edit dialog box to enter the number of measured values to be collected during one sweep.

- Entry via rotary knob:
    - In the range from 101 to 1001, the sweep points are increased or decreased in steps of 100 points.
    - In the range from 1001 to 32001, the sweep points are increased or decreased in steps of 1000 points.
- Entry via keypad:
    All values in the defined range can be set.

The default value is 691 sweep points.

Remote command:
[SENSe:]SWEep:POINts on page 205

6.3.7.7   Softkeys of the Input/Output Menu for RF Measurements

The following chapter describes all softkeys available in the "Input/Output" menu for RF measurements. For CDA measurements, see chapter 6.1.12, "Softkeys of the Input/Output Menu for CDA Measurements", on page 80.

Input (AC/DC)

Toggles the RF input of the R&S FSV between AC and DC coupling.

This function is not available for input from the R&S Digital I/Q Interface (option R&S FSV-B17).

Remote command:
INPut:COUPling on page 223

Noise Source

Switches the supply voltage for an external noise source on or off. For details on connectors refer to the R&S FSV Quick Start Guide, "Front and Rear Panel" chapter.

Remote command:
DIAGnostic<n>:SERVice:NSOurce on page 220

Video Output

Sends a video output signal according to the measured level to the connector on the rear panel of the R&S FSV.

Note: Video output does not return valid values in IQ or FFT mode.

Remote command:
OUTP:IF VID, see OUTPut:IF[:SOURce] on page 233

Power Sensor

For precise power measurement a power sensor can be connected to the instrument via the front panel (USB connector) or the rear panel (power sensor, option R&S FSV-B5). The Power Sensor Support firmware option (R&S FSV-K9) provides the power measurement functions for this test setup.

This softkey is only available if the R&S FSV option Power Sensor (R&S FSV-K9) is installed.

For details see the chapter "Instrument Functions Power Sensor (K9)" in the base unit description.

This softkey is available for RF measurements.

Trigger Out

Sets the Trigger Out port in the Additional Interfaces (option R&S FSV-B5 only) to low or high. Thus, you can trigger an additional device via the external trigger port, for example.

Remote command:

OUTPut:TRIGger on page 233

7 Measurement Examples (R&S FSV-K72)

This chapter gives an overview of the chapter 7.1, "Basic Settings in Code Domain Measurement Mode", on page 114 and explains some basic 3GPP°FDD base station tests. It describes how operating and measurement errors can be avoided using correct presetting. The measurements are performed with an R&S FSV equipped with option R&S FSV-K72.

Key settings are shown as examples to avoid measurement errors. Following the correct setting, the effect of an incorrect setting is shown.

The following measurements are performed:

- chapter 7.2, "Measurement 1: Measurement of the Signal Channel Power", on page 115
- chapter 7.3, "Measurement 2: Measurement of the Spectrum Emission Mask", on page 116
- chapter 7.4, "Measurement 3: Measurement of the Relative Code Domain Power", on page 117
- chapter 7.5, "Measurement 4: Triggered Measurement of Relative Code Domain Power", on page 119
- chapter 7.6, "Measurement 5: Measurement of the Composite EVM", on page 120
- chapter 7.7, "Measurement 6: Measurement of Peak Code Domain Error", on page 121
- chapter 7.8, "Measurement 7: Measurement of the Trigger To Frame Time", on page 122

The measurements are performed using the following units and accessories:

- The R&S FSV with Application Firmware R&S FSV-K72: 3GPP FDD BTS base station test
- The Vector Signal Generator R&S SMU with option R&S SMU-B45: digital standard 3GPP (options R&S SMU-B20 and R&S SMU-B11 required)
- 1 coaxial cable, 50Ω, approx. 1 m, N connector
- 1 coaxial cable, 50Ω, approx. 1 m, BNC connector

7.1 Basic Settings in Code Domain Measurement Mode

In the default mode after a PRESET, the R&S FSV is in the analyzer mode. The following default settings of the code domain measurement are activated, provided that the code domain analyzer mode is selected.

Parameter	Setting
Digital standard	W-CDMA 3GPP FWD
Sweep	CONTINUOUS

Parameter	Setting
CDP mode	CODE CHAN AUTOSEARCH
Trigger settings	FREE RUN
Trigger offset	0
Scrambling code	0
Threshold value	-60 dB
Symbol rate	15 ksps
Code number	0
Slot number	0
Display	Screen A: CODE DOMAIN POWER Screen B: RESULT SUMMARY

7.2 Measurement 1: Measurement of the Signal Channel Power

The R&S FSV measures the unweighted RF signal power in a bandwidth of:

$$f_{BW} = 5\,MHz \geq (1+\alpha) \cdot 3.84\,MHz \quad | \quad \alpha = 0.22$$

The power is measured in the zero span mode (time domain measurement) using a digital channel filter of 5 MHz in bandwidth, according to the 3GPP standard.

1. Test setup
   Connect the RF output of the R&S SMU to the RF input of the R&S FSV (coaxial cable with N connectors).

2. Settings on the R&S SMU
   [**PRESET**]
   [**LEVEL**: 0 dBm]
   [**FREQ**: 2.1175 GHz]
   [Baseband]
   [3GPP FDD BTS]
   [Test Setup]
   [Test_Model_1_32channels]
   STATE: ON

3. Settings on the R&S FSV
   [**PRESET**]
   [**CENTER**: 2.1175 GHz]
   [**AMPT**: 0 dBm]
   [MODE: 3G FDD BTS]
   [**MEAS**: POWER]

4. Measurement on the R&S FSV

The following is displayed:

● Time domain trace of the WCDMA signal.

● Signal channel power within a bandwidth of 5 MHz (in the marker info field)

7.3 Measurement 2: Measurement of the Spectrum Emission Mask

The 3GPP specification defines a measurement that monitors compliance with a spectral mask in a range of at least ± 12.5 MHz around the WCDMA carrier. To assess the power emissions in the specified range, the signal power is measured in the range near the carrier by means of a 30 kHz filter, and in the ranges far away from the carrier by means of a 1 MHz filter. The resulting trace is compared to a limit line defined in the 3GPP specification.

1. Test setup
   Connect the RF output of the R&S SMU to the RF input of the R&S FSV (coaxial cable with N connectors).

2. Settings on the R&S SMU
   [**PRESET**]
   [**LEVEL**: 0 dBm]
   [**FREQ**: 2.1175 GHz]
   [Baseband]
   [3GPP FDD BS]
   [Test Setup]
   [Test_Model_1_32channels]
   STATE: ON

3. Settings on the R&S FSV
   [**PRESET**]
   [**CENTER**: 2.1175 GHz]
   [**AMPT**: 0 dBm]
   [MODE: 3G FDD BTS]
   [**MEAS**: Spectrum Emission Mask]

4. Measurement on the R&S FSV

The following is displayed:

● Spectrum of the 3GPP FDD BTS signal

● Limit line defined in the standard

● Information on limit line violations (passed/failed)

7.4 Measurement 3: Measurement of the Relative Code Domain Power

A code domain power measurement on one of the test models (model 1 with 32 channels) is shown in the following. To demonstrate the effects, the basic parameters of the CDP measurements permitting an analysis of the signal are changed one after the other from values adapted to the measurement signal to non-adapted values.

1. Test setup

    a) Connect the RF output of the R&S SMU to the RF input of the R&S FSV (coaxial cable with N connectors).

    b) Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).

2. Settings on the R&S SMU
    [**PRESET**]
    [**LEVEL**: 0 dBm]
    [**FREQ**: 2.1175 GHz]
    [Baseband]
    [3GPP FDD BS]
    [Test Setup]
    [Test_Model_1_32channels]
    STATE: ON

3. Settings on the R&S FSV
    [**PRESET**]
    [**CENTER**: 2.1175 GHz]
    [**AMPT**: 10 dBm]
    [MODE: 3G FDD BTS]
    [SETTINGS: SCRAMBLING CODE 0]

4. Measurement on the R&S FSV

The following is displayed:

- Screen A: Code domain power of signal (test model 1 with 32 channels)
- Screen B: Numeric results of CDP measurement

Setting: Synchronization of the Reference Frequencies

Synchronization of the reference oscillators both of the DUT and the analyzer strongly reduces the measured frequency error.

1. Test setup
    Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).

2. Settings on the R&S SMU
    See chapter 7.3, "Measurement 2: Measurement of the Spectrum Emission Mask",
    on page 116

3. Settings on the R&S FSV
    See chapter 7.3, "Measurement 2: Measurement of the Spectrum Emission Mask",
    on page 116
    In addition:
    SETUP: REFERENCE EXT

4. Measurement on the R&S FSV
    The displayed frequency error should be < 10 Hz

> **Note**
>
> The reference frequencies of the analyzer and of the DUT should be synchronized.

Setting: Behaviour with Deviating Center Frequency Setting

In the following, the behaviour of the DUT and the analyzer with an incorrect center fre-
quency setting is shown.

1. Test setup
    Tune the center frequency of the signal generator in 0.5 kHz steps and watch the
    analyzer screen:

2. Measurement on the R&S FSV

    a) A CDP measurement on the analyzer is still possible with a frequency error of
        up to approx. 1 kHz. Up to 1 kHz, a frequency error causes no apparent differ-
        ence in the accuracy of the code domain power measurement.
    b) Above a frequency error of 1 kHz, the probability of impaired synchronization
        increases. With continuous measurements, all channels are at times displayed
        in blue with almost the same level.
    c) Above a frequency error of approx. 2 kHz, a CDP measurement cannot be per-
        formed. The R&S FSV displays all possible codes in blue with a similar level.

►   Settings on the R&S SMU
    Set the signal generator center frequency to 2.1175 GHz again:
    FREQ: 2.1175 GHz

> **Note**
>
> The analyzer center frequency should not differ from the DUT frequency by more than
> 2 kHz.

Setting: Behaviour with Incorrect Scrambling Code

A valid CDP measurement can be carried out only if the scrambling code set on the
analyzer is identical to that of the transmitted signal.

1. Test setup
   SELECT BS/MS
   BS 1: ON
   SCRAMBLING CODE: 0001
   (The scrambling code is set to 0000 on the analyzer.)

2. Settings on the R&S SMU
   The CDP display shows all possible codes with approximately the same level.

3. Settings on the R&S FSV
   Set scrambling code to new value.
   [MEAS CONFIG]
   [Sync/Scrambling Settings]
   [Scrambling Code 01]

4. Measurement on the R&S FSV
   The CDP display shows the test model again.

> **Note**
>
> The scrambling code setting of the analyzer must be identical to that of the measured signal.

7.5 Measurement 4: Triggered Measurement of Relative Code Domain Power

If the code domain power measurement is performed without external triggering, a section of approximately 20 ms of the test signal is recorded at an arbitrary moment to detect the start of a 3GPP FDD BTS frame in this section. Depending on the position of the frame start, the required computing time can be quite long. Applying an external (frame) trigger can reduce the computing time.

1. Test setup
   a) Connect the RF output of the R&S SMU to the input of the R&S FSV.
   b) Connect the reference input (EXT REF IN/OUT) on the rear panel of the R&S FSV to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).
   c) Connect the external trigger input on the rear panel of the R&S FSV (EXT TRIG GATE) to the external trigger output on the rear panel of the R&S SMU (TRIGOUT1 of PAR DATA).

2. Settings on the R&S SMU
   See chapter 7.4, "Measurement 3: Measurement of the Relative Code Domain Power", on page 117

3. Settings on the R&S FSV

In addition:
[**TRIG** EXTERN]

4. Measurement on the R&S FSV

The following is displayed:

- Screen A: Code domain power of signal (test model 1 with 32 channels)
- Screen B: Numeric results of CDP measurement
- Trigger to Frame: Offset between trigger event and start of 3GPP FDD BTS frame

The repetition rate of the measurement increases considerably compared to the repetition rate of a measurement without an external trigger.

Setting: Trigger Offset

A delay of the trigger event referenced to the start of the 3GPP FDD BTS frame can be compensated by modifying the trigger offset.

1. Settings on the R&S FSV:
   [**TRIG**] -> [**TRIGGER OFFSET**] -> 100 µs

2. Measurement on the R&S FSV:
   The Trigger to Frame parameter in the numeric results table (screen B) changes:
   Trigger to Frame -> -100 µs

Note

A trigger offset compensates analog delays of the trigger event.

7.6 Measurement 5: Measurement of the Composite EVM

The 3GPP specification defines the composite EVM measurement as the average square deviation of the total signal:

An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The square deviation yields the composite EVM.

1. Test setup

   a) Connect the RF output of the R&S SMU to the input of the R&S FSV.
   b) Connect the reference input (EXT REF IN/OUT) on the rear panel of the R&S FSV to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).

c) Connect the external trigger input on the rear panel of the R&S FSV (EXT TRIG GATE) to the external trigger output on the rear panel of the R&S SMU (TRIGOUT1 of PAR DATA).

2. Settings on the R&S SMU
[**PRESET**]
[**LEVEL**: 0 dBm]
[**FREQ**: 2.1175 GHz]

a) [Baseband]
b) [3GPP FDD BS]
c) [Test Setup]
d) [Test_Model_1_32channels]
STATE: ON

3. Settings on the R&S FSV
[**PRESET**]
[**CENTER**: 2.1175 GHz]
[**REF**: 10 dBm]
[MODE: 3G FDD BTS]
[**TRIG** EXTERN]
[RESULTS COMPOSITE EVM]
[MEAS CONFIG]
[Result Diagrams]
[Screen B: Composite EVM]

4. Measurement on the R&S FSV

The following is displayed:

- Screen A: Code domain power of signal
- Screen B: Composite EVM (EVM for total signal)

7.7 Measurement 6: Measurement of Peak Code Domain Error

The peak code domain error measurement is defined in the 3GPP specification for WCDMA signals.

An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The difference of the two signals is projected onto the classes of the different spreading factors. The peak code domain error measurement is obtained by summing the symbols of each difference signal slot and searching for the maximum error code.

1. Test setup

a) Connect the RF output of the R&S SMU to the input of the R&S FSV.

b) Connect the reference input (EXT REF IN/OUT) on the rear panel of the R&S FSV to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).

c) Connect the external trigger input on the rear panel of the R&S FSV (EXT TRIG GATE) to the external trigger output on the rear panel of the R&S SMU (TRIGOUT1 of PAR DATA).

2. Settings on the R&S SMU
[**PRESET**]
[**LEVEL**: 0 dBm]
[**FREQ**: 2.1175 GHz]
[Baseband]
[3GPP FDD BS]
[Test Setup]
[Test_Model_1_32channels]
[STATE: ON]

3. Settings on the R&S FSV
[**PRESET**]
[**CENTER**: 2.1175 GHz]
[**REF**: 0 dBm]
[3G FDD BTS]
[**TRIG** EXTERN]
[MEAS CONFIG]
[Result Diagrams]
[Screen B: Composite EVM]

4. Measurement on the R&S FSV

The following is displayed:

● Screen A: Code domain power of signal (Test model 1 with 32 channels)

● Screen B: Peak code domain error (projection of error onto the class with spreading factor 256)

7.8 Measurement 7: Measurement of the Trigger To Frame Time

The trigger to frame (TTF) time measurement yields the time between an external trigger event and the start of the 3GPP WCDMA frame. The result is displayed in the result summary. The trigger event is expected in a time range of one slot (667 μs) before the frame start. The resolution and absolute accuracy depend on the analyzer type and the measurement mode.

Resolution of the TTF time measurement

The resolution of the TTF time depends on the analyzer type that is used and the applied trace statistic mode. By using an average mode, the resolution can be increased. The higher the number of sweeps is, the higher is the resolution at the expense of measurement time. In the average mode, the TTF time is averaged for a number of sweeps (TRACE -> SWEEP COUNT). If the TTF time of the applied signal does not change during for this number of sweeps, the trigger resolution can be improved.

Absolute accuracy of theTTF time measurement

The absolute accuracy of the TTF time measurement depends on the level of the trigger pulse. The analyzer is calibrated to display the minimum deviation at a trigger pulse level of 4 V. The trigger threshold for an external trigger event is 1.4 V. Due to an internal lowpass between the back panel and the trigger detector, the trigger pulse is delayed in correlation to its own level.

Trace statistic in the result summary display

The trace statistic functions can be enabled by focussing SCREEN B. After screen B is focussed, the "Trace" menu can be called (by pressing the TRACE key). In the "Trace" menu, the type of trace statistic can be selected.

The parameter "SWEEP COUNT" determines the number of sweeps. If measured with the trace statistic, the channel table is automatically switched to predefined mode. The last measured channel table is used and stored to "RECENT". In this case, any change in the signal channel configuration does not influence the displayed channel table.

1. Test setup

   a) Connect the RF output of the R&S SMU to the input of the R&S FSV.
   b) Connect the reference input (EXT REF IN/OUT) on the rear panel of the R&S FSV to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).
   c) Connect the external trigger input on the rear panel of the R&S FSV (EXT TRIG GATE) to the external trigger output on the rear panel of the R&S SMU (TRIGOUT1 of PAR DATA).

2. Settings on the R&S SMU
   [PRESET]
   [LEVEL: 0 dBm]
   [FREQ: 2.1175 GHz]
   Baseband
   3GPP FDD BS
   Test Setup
   Test_Model_1_32channels
   STATE: ON

3. Settings on the R&S FSV
   [PRESET]
   [CENTER: 2.1175 GHz]

[REF: 0 dBm]
[3G FDD BTS]
[TRIG EXTERN]
[Result Diagrams]
[Screen B: Result Summary
[Change Focus to Screen B]]
[TRACE AVERAGE]
[SWEEP COUNT <numeric value>]

4. Measurement on the R&S FSV

The following is displayed:

- Screen A: Code domain power of signal (Test model 1 with 32 channels)
- Screen B: Result summary with trace statistic evaluation

8 Remote Control Commands

In this section all remote control commands specific to the base station test option R&S FSV-K72 are described in detail. For details on conventions used in this chapter refer to chapter 8.1, "Notation", on page 126.

For further information on analyzer or basic settings commands, refer to the corresponding subsystem in the base unit description.

In particular, the following subsystems are identical to the base unit; refer to the base unit description:

● CALCulate:DELTamarker
● CALCulate:MARKer (except for the specific commands described in chapter 8.2, "CALCulate subsystem (R&S FSV-K72)", on page 128)
● DISPlay subsystem
● FORMat subsystem
● INITiate subsystem
● INPut subsystem
● MMEM subsystem
● OUTput subsystem
● SENSe subsystem (except for the specific commands described in chapter 8.6, "SENSe subsystem (R&S FSV-K72)", on page 182)
● TRIGger subsystem

8.1   Notation

In the following sections, all commands implemented in the instrument are first listed and then described in detail, arranged according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

Individual Description

The individual description contains the complete notation of the command. An example for each command, the *RST value and the SCPI information are included as well.

The options and operating modes for which a command can be used are indicated by the following abbreviations:

Abbreviation	Description
A	spectrum analysis
A-F	spectrum analysis – span > 0 only (frequency mode)
A-T	spectrum analysis – zero span only (time mode)
ADEMOD	analog demodulation (option R&S FSV-K7)
BT	Bluetooth (option R&S FSV-K8)
CDMA	CDMA 2000 base station measurements (option R&S FSV-K82)
EVDO	1xEV-DO base station analysis (option R&S FSV-K84)
GSM	GSM/Edge measurements (option R&S FSV-K10)
IQ	IQ Analyzer mode
OFDM	WiMAX IEEE 802.16 OFDM measurements (option R&S FSV-K93)
OFDMA/WiBro	WiMAX IEEE 802.16e OFDMA/WiBro measurements (option R&S FSV-K93)
NF	Noise Figure measurements (R&S FSV-K30)
PHN	Phase Noise measurements (R&S FSV-K40)
PSM	Power Sensor measurements (option R&S FSV-K9)
SFM	Stereo FM measurements (optionR&S FSV-K7S)
SPECM	Spectogram mode (option R&S FSV-K14)
TDS	TD-SCDMA base station / UE measurements (option R&S FSV-K76/K77)
VSA	Vector Signal Analysis (option R&S FSV-K70)

| WCDMA | 3GPP Base Station measurements (option R&S FSV-K72), 3GPP UE measurements (option R&S FSV-K73) |
| WLAN | WLAN TX measurements (option R&S FSV-K91) |

The spectrum analysis mode is implemented in the basic unit. For the other modes, the corresponding options are required.

Upper/Lower Case Notation

Upper/lower case letters are used to mark the long or short form of the key words of a command in the description. The instrument itself does not distinguish between upper and lower case letters.

Special Characters

| | | A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used. |

Example:

```
SENSe:FREQuency:CW|:FIXed
```

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:

```
SENSe:FREQuency:CW 1E3
```

```
SENSe:FREQuency:FIXed 1E3
```

A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.

Example: Selection of the parameters for the command

```
[SENSe<1…4>:]AVERage<1…4>:TYPE VIDeo | LINear
```

| [] | Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards. |
| | Parameters in square brackets can be incorporated optionally in the command or omitted as well. |

| {} | Parameters in braces can be incorporated optionally in the command, either not at all, once or several times. |

Description of Parameters

Due to the standardization, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<…>) and is briefly explained in the following.

For details see the chapter "SCPI Command Structure" in the base unit description.

<Boolean>

This keyword refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword OFF or by the numeric value 0, the "on" state is indicated by ON or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

<numeric_value> <num>

These keywords mark parameters which may be entered as numeric values or be set using specific keywords (character data). The following keywords given below are permitted:

- MAXimum: This keyword sets the parameter to the largest possible value.
- MINimum: This keyword sets the parameter to the smallest possible value.
- DEFault: This keyword is used to reset the parameter to its default value.
- UP: This keyword increments the parameter value.
- DOWN: This keyword decrements the parameter value.

The numeric values associated to MAXimum/MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example:

```
SENSe:FREQuency:CENTer? MAXimum
```

Returns the maximum possible numeric value of the center frequency as result.

<arbitrary block program data>

This keyword is provided for commands the parameters of which consist of a binary data block.

8.2 CALCulate subsystem (R&S FSV-K72)

The CALCulate subsystem contains commands for converting instrument data, transforming and carrying out corrections. These functions are carried out subsequent to data acquisition, i.e. following the SENSe subsystem.

Note that most commands in the CALCulate subsystem are identical to the base unit; only the commands specific to this option are described here.

8.2.1   CALCulate:FEED subsystem

The CALCulate:FEED subsystem selects the result display for the different screens in the code domain analyzer. This corresponds to the result display selection in manual operation.

CALCulate<n>:FEED <Evaluation>

This command selects the evaluation mode for the different screens.

For a description of the evaluation modes see chapter 6.1.2, "Measurement Modes in Code Domain Analyzer", on page 32.

Suffix:

<n>   window

Parameters:

<Evaluation>

'XPOW:CDP' | 'XPOW:CDP:ABSolute' | 'XPOW:CDP:RATio' | 'XPOW:CDP:OVERview | 'XPOWer:CDEP' | 'XTIMe:CDPower:CHIP:EVM' | 'XTIMe:CDPower:CHIP:MAGNitude' | 'XTIMe:CDPower:CHIP:PHASe' | 'XTIM:CDP:ERR:SUMM' | 'XTIM:CDP:ERR:CTABle' | 'XTIM:CDP:ERR:PCDomain' | 'XTIM:CDP:MACCuracy' | 'XTIM:CDP:PVSYmbol' | 'XTIM:CDP:COMP:CONStellation' | 'XTIM:CDP:FVSLot' | 'XTIM:CDP:PVSLot' | 'XTIM:CDP:PVSLot:ABSolute' | 'XTIM:CDP:PVSLot:RATio' | 'XTIM:CDP:BSTReam' | 'XTIM:CDP:SYMB:CONStellation' | 'XTIM:CDP:SYMB:EVM' | 'XTIMe:CDPower:SYMBol:EVM:PHASe' | 'XTIMe:CDPower:SYMBol:EVM:MAGNitude' | XTIM:CDP:PSVS

'XPOW:CDEPower'
Result display of code domain error power as bar graph

'XPOW:CDP'
Result display of code domain power as bar graph [absolute scaling]

'XPOW:CDP:ABSolute'
Result display of code domain power as bar graph [absolute scaling]

'XTIM:CDP:BSTReam'
Result display of bit stream

'XTIMe:CDP:CHIP:EVM'
Result display error vector magnitude (EVM) versus chip

'XTIMe:CDP:CHIP:MAGNitude'
Result display magnitude error versus chip

'XTIMe:CDPower:CHIP:PHASe'
Result display phase error versus chip

'XTIM:CDP:COMP:CONStellation'
Result display of composite constellation

'XTIM:CDP:ERR:CTABle'
Result display of channel assignment table

'XTIM:CDP:ERR:PCDomain'
Result display of peak code domain error

'XTIM:CDP:ERR:SUMMary'
Result display in tabular form

'XTIM:CDP:FVSLot'
Result display of frequency error versus slot

'XTIM:CDP:MACCuracy'
Result display of composite EVM (error vector magnitude referenced to the overall signal)

'XPOW:CDP:OVERview'

Result display of code domain power ratio as bar graph [relative scaling]

'XTIM:CDP:PSVS'

Result display of phase discontinuity versus slot

'XTIM:CDP:PVSLot'

Result display of power versus slot

'XTIM:CDP:PVSLot:ABSolute'

Result display of power versus slot [absolute scaling]

'XTIM:CDP:PVSLot:RATio'

Result display of power versus slot [absolute scaling]

'XTIM:CDP:PVSYmbol'

Result display of power versus symbol

'XPOW:CDP:RATio'

Result display of code domain power as bar graph [relative scaling]

'XTIM:CDP:SYMB:CONStellation'

Result display of symbol constellation

'XTIM:CDP:SYMB:EVM'

Result display of symbol error vector magnitude

'XTIMe:CDPower:SYMBol:EVM:MAGNitude'

Result display of the symbol magnitude error

'XTIMe:CDPower:SYMBol:EVM:PHASe'

Result display of the symbol phase error

*RST: depends on the active screen

Example:	CALC3:FEED 'XTIM:CDP:ERR:SUMM'
	Activates the result summary in screen C.
Mode:	WCDMA

8.2.2 CALCulate:MARKer:FUNCtion subsystem

The CALCulate:MARKer:FUNCtion subsystem checks the marker functions in the instrument.

CALCulate<n>:MARKer<m>:FUNCtion:CPICh

This command sets the marker to channel 0.

This command is only available in code domain power and code domain error power result diagrams.

Suffix:

<n>	window; depends on the selected display mode for which the marker is to be valid
<m>	marker number; only 1 allowed

Example: CALC:MARK:FUNC:CPIC

Mode: WCDMA

Manual operation: See "CPICH" on page 77

CALCulate<n>:MARKer<m>:FUNCtion:PCCPch

This command sets the marker to the position of the PCCPCH.

This command is only available in code domain power and code domain error power result diagrams.

Suffix:

<n>	window; depends on the selected display mode for which the marker is to be valid
<m>	marker number; only 1 allowed

Example: CALC:MARK:FUNC:PCCP

Mode: WCDMA

Manual operation: See "PCCPCH" on page 77

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult? <ResultType>

This command queries the result of the performed power measurement in the window specified by the suffix <n>. If necessary, the measurement is switched on prior to the query.

The channel spacings and channel bandwidths are configured in the SENSe:POWer subsystem.

To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Parameters:

<ResultType>   ACPower | CPOWer

ACPower
Adjacent-channel power measurement
Results are output in the following sequence, separated by commas:
Power of transmission channel
Power of lower adjacent channel
Power of upper adjacent channel
Power of lower alternate channel 1
Power of upper alternate channel 1
Power of lower alternate channel 2
Power of upper alternate channel 2
The number of measured values returned depends on the number of adjacent/alternate channels selected with `[SENSe:`
`]POWer:ACHannel:ACPairs`.
With logarithmic scaling (RANGE "LOG"), the power is output in the currently selected level unit; with linear scaling (RANGE "LIN dB" or "LIN %"), the power is output in W. If `[SENSe:]POWer:`
`ACHannel:MODE` is set to "REL", the adjacent/alternate-channel power is output in dB.

CPOWer
Channel power measurement
In a Spectrum Emission Mask measurement, the query returns the power result for the reference range, if this power reference type is selected.
With logarithmic scaling (RANGE LOG), the channel power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the channel power is output in W.

CALCulate<n>:MARKer<m>:FUNCtion:POWer:SELect <MeasType>

This command selects – and switches on – the specified power measurement type in the window specified by the suffix <n>.

The channel spacings and channel bandwidths are configured in the `SENSe:POWer` subsystem.

Note: If CPOWer is selected, the number of adjacent channels (`[SENSe:]POWer:`
`ACHannel:ACPairs`) is set to 0. If ACPower is selected, the number of adjacent channels is set to 1, unless adjacent-channel power measurement is switched on already.

The channel/adjacent-channel power measurement is performed for the trace selected with `[SENSe:]POWer:TRACe`.

The occupied bandwidth measurement is performed for the trace on which marker 1 is positioned. To select another trace for the measurement, marker 1 is to be positioned on the desired trace by means of `CALCulate<n>:MARKer<m>:TRACe`.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Parameters:

<MeasType>	ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CNO

ACPower
Adjacent-channel power measurement with a single carrier signal

CPOWer
Channel power measurement with a single carrier signal (equivalent to adjacent-channel power measurement with "NO. OF ADJ CHAN" = 0)

MCACpower
Channel/adjacent-channel power measurement with several carrier signals

OBANdwidth | OBWidth
Measurement of occupied bandwidth

CN
Measurement of carrier-to-noise ratio

CN0
Measurement of carrier-to-noise ratio referenced to 1 Hz bandwidth

Example:	`CALC:MARK:FUNC:POW:SEL ACP` Switches on adjacent-channel power measurement.

CALCulate<n>:MARKer<1>:FUNCtion:TAERror:RESult? <ResultType>

This command queries the result of a time alignment measurement (see chapter 6.2, "Time Alignment Error Measurement", on page 84).

Suffix:

<n>	irrelevant

Query parameters:

<ResultType>	**TAERror** Returns the time offset between the two antenna signals in chips.

Example:	`CALC:MARK:FUNC:TAER:RES? TAER`
Usage:	Query only
Mode:	WCDMA

CALCulate\<n\>:MARKer\<m\>:FUNCtion:WCDPower[:BTS]:RESult? \<Results\>

This command queries the measured and calculated results of the 3GPP FDD BTS code domain power measurement.

Suffix:

\<n\>	irrelevant
\<m\>	1
	irrelevant

Parameters:

<Results>   ACHannels | ARCDerror | CDPabsolute | CDPRelative |
                   CERRor | CHANnel | CSLot | EVMPeak | EVMRms | FERRor |
                   IOFFset | IQIMbalance | IQOFfset | MACCuracy | MPIC |
                   MTYPe | PCDerror | PSYMbol | PTOTal | QOFFset | RCDerror |
                   RHO | SRATe | TFRame | TOFFset

ACHannels
Number of active channels

ARCDerror
relative code domain error averaged over all channels with modulation type 64QAM

CDPabsolute
channel power absolute

CDPRelative
channel power relative

CERRor
chip rate error

CHANnel
channel number

CSLot
channel slot number

EVMPeak
error vector magnitude peak

EVMRms
error vector magnitude RMS

FERRor
frequency error in Hz

IOFFset
imaginary part of the I/Q offset

IQIMbalance
I/Q imbalance

IQOFfset
I/Q offset

MACCuracy
composite EVM

MPIC
average power of inactive channels

MTYPe
modulation type:
2 – QPSK
4 – 16 QAM
5 – 64 QAM
15 – NONE

PCDerror

peak code domain error

PSYMbol
number of pilot bits

PTOTal
total power

QOFFset
real part of the I/Q offset

RCDerror
relative code domain error

RHO
rho value for every slot

SRATe
symbol rate

TFRame
trigger to frame

TOFFset
timing offset

The parameter specifies the required evaluation method.

Example:	CALC:MARK:FUNC:WCDP:RES? PTOT
Usage:	Query only
Mode:	WCDMA

CALCulate<n>:MARKer<m>:FUNCtion:ZOOM <State>

If marker zoom is activated, the number of channels displayed on the screen in code domain power and code domain error power result diagram is reduced to 64.

The currently selected marker defines the center of the displayed range.

Suffix:

<n>	irrelevant
<m>	1...4 marker number

Parameters:

<State>	ON	OFF *RST: OFF
Example:	CALC:MARK:FUNC:ZOOM ON
Mode:	WCDMA
Manual operation:	See "Marker Zoom" on page 76

8.2.3 Other CALCulate Commands

CALCulate<n>:CDPower:Mapping <SignalBranch>

This command adjusts the mapping for the result displays Code Domain Power and Code Domain Error Power.

Suffix:

<n>   1...4
                            window

Parameters:

<SignalBranch>   I | Q | AUTO

                            I
                            The I branch of the signal will be used for evaluation

                            Q
                            The Q branch of the signal will be used for evaluation

                            AUTO
                            The branch selected by the dialog "Selected Channel" will be used for evaluation.

                            *RST: AUTO

Example: CALC:CDP:MAPPING AUTO

Mode: CDMA, WCDMA

8.2.4 Other CALCulate Commands Referenced in this Manual

8.2.4.1 CALCulate:DELTamarker subsystem

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X <Reference>

This command defines the horizontal position of the fixed delta marker reference point. The coordinates of the reference may be anywhere in the diagram.

When measuring the phase noise, the command defines the frequency reference for delta marker 2.

Suffix:

<n>   Selects the measurement window.

<m>   Selects the marker.

Parameters:

<Reference>   Numeric value that defines the horizontal position of the reference.
                         For frequency domain measurements, it is a frequency in Hz.
                         For time domain measurements, it is a point in time in s.

                         *RST: Fixed reference: OFF

Example: CALC:DELT:FUNC:FIX:RPO:X 128 MHz
                         Sets the frequency reference to 128 MHz.

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y <RefPointLevel>

This command defines the vertical position of the fixed delta marker reference point. The coordinates of the reference may be anywhere in the diagram.

When measuring the phase noise, the command defines the level reference for delta marker 2.

Suffix:

<n>   Selects the measurement window.

<m>   Selects the marker.

Parameters:

<RefPointLevel>   Numeric value that defines the vertical position of the reference.
                         The unit and value range is variable.

                         *RST: Fixed reference: OFF

Example: CALC:DELT:FUNC:FIX:RPO:Y -10dBm

Sets the reference point level for delta markers to -10 dBm.

CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed[:STATe] <State>

This command switches the relative measurement to a fixed reference value on or off. Marker 1 is activated previously and a peak search is performed, if necessary. If marker 1 is activated, its position becomes the reference point for the measurement. The reference point can then be modified with the CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:X commands and CALCulate<n>:DELTamarker<m>:FUNCtion:FIXed:RPOint:Y independently of the position of marker 1 and of a trace. It applies to all delta markers as long as the function is active.

Suffix:

<n>   Selects the measurement window.

<m>   Selects the marker.

Parameters:

<State>   ON | OFF

                *RST: OFF

Example: CALC:DELT:FUNC:FIX ON
                Switches on the measurement with fixed reference value for all delta markers.
                CALC:DELT:FUNC:FIX:RPO:X 128 MHZ
                Sets the frequency reference to 128 MHz.
                CALC:DELT:FUNC:FIX:RPO:Y 30 DBM
                Sets the reference level to +30 dBm.

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise:AUTO <State>

This command turns an automatic peak search for the fixed reference marker at the end of a sweep on and off.

Suffix:

<n>   Selects the measurement window.

<m>   irrelevant

Parameters:

<State>   ON | OFF

                *RST: OFF

Example: CALC:DELT:FUNC:PNO:AUTO ON
                Activates an automatic peak search for the reference marker in a phase-noise measurement.

CALCulate<n>:DELTamarker<m>:FUNCtion:PNOise[:STATe] <State>

This command turns the phase noise measurement at the delta marker position on and off.

The correction values for the bandwidth and the log amplifier are taken into account in the measurement.

The reference marker for phase noise measurements is either a normal marker or a fixed reference. If necessary, the command turns on the reference marker

A fixed reference point can be modified with the CALCulate<n>:DELTamarker<m>: FUNCtion:FIXed:RPOint:X and CALCulate<n>:DELTamarker<m>:FUNCtion: FIXed:RPOint:Y commands independent of the position of marker 1 and of a trace.

Suffix:

<n>	Selects the measurement window.
<m>	irrelevant
	Note: marker 2 is always the deltamarker for phase noise measurement results.

Parameters:

<State>	ON	OFF
	*RST: OFF

Example: CALC:DELT:FUNC:PNO ON

Switches on the phase-noise measurement with all delta markers.

CALC:DELT:FUNC:FIX:RPO:X 128 MHZ

Sets the frequency reference to 128 MHz.

CALC:DELT:FUNC:FIX:RPO:Y 30 DBM

Sets the reference level to +30 dBm

CALCulate<n>:DELTamarker<m>:LINK <State>

This command links delta marker 1 to marker 1.

If you change the horizontal position of the marker, so does the delta marker.

Suffix:

<n>	Selects the measurement window.
<m>	1
	irrelevant

Parameters:

<State>	ON	OFF
	*RST: OFF

Example: CALC:DELT:LINK ON

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT

This command positions the delta marker to the next smaller trace maximum on the left of the current value (i.e. descending X values). The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.
Example:	CALC:DELT:MAX:LEFT
	Sets delta marker 1 to the next smaller maximum value to the left of the current value.
Manual operation:	See "Next Peak Mode" on page 77

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

This command positions the delta marker to the next smaller trace maximum. The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.
Example:	CALC:DELT2:MAX:NEXT
	Sets delta marker 2 to the next smaller maximum value.
Manual operation:	See "Next Peak" on page 77
	See "Next Peak Mode" on page 77

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

This command positions the delta marker to the current trace maximum. If necessary, the corresponding delta marker is activated first.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.
Example:	CALC:DELT3:MAX
	Sets delta marker 3 to the maximum value of the associated trace.

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt

This command positions the delta marker to the next smaller trace maximum on the right of the current value (i.e. ascending X values). The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.
Example:	CALC:DELT:MAX:RIGH
	Sets delta marker 1 to the next smaller maximum value to the right of the current value.
Manual operation:	See "Next Peak Mode" on page 77

CALCulate<n>:DELTamarker<m>:MINimum:LEFT

This command positions the delta marker to the next higher trace minimum on the left of the current value (i.e. descending X values). The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.
Example:	CALC:DELT:MIN:LEFT
	Sets delta marker 1 to the next higher minimum to the left of the current value.
Manual operation:	See "Next Min Mode" on page 78

CALCulate<n>:DELTamarker<m>:MINimum:NEXT

This command positions the delta marker to the next higher trace minimum. The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.
Example:	CALC:DELT2:MIN:NEXT
	Sets delta marker 2 to the next higher minimum value.
Manual operation:	See "Next Min" on page 78
	See "Next Min Mode" on page 78

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

This command positions the delta marker to the current trace minimum. The corresponding delta marker is activated first, if necessary.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Example:	CALC:DELT3:MIN
	Sets delta marker 3 to the minimum value of the associated trace.

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt

This command positions the delta marker to the next higher trace minimum on the right of the current value (i.e. ascending X values). The corresponding delta marker is activated first, if necessary.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Example:	CALC:DELT:MIN:RIGH
	Sets delta marker 1 to the next higher minimum value to the right of the current value.
Manual operation:	See "Next Min Mode" on page 78

CALCulate<n>:DELTamarker<m>[:STATe] <State>

This command turns delta markers on and off.

If the corresponding marker was a normal marker, it is turned into a delta marker.

No suffix at DELTamarker turns on delta marker 1.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Parameters:	
<State>	ON	OFF
	*RST: OFF

Example:	CALC:DELT1 ON
	Switches marker 1 to delta marker mode.
Manual operation:	See "Marker 1/2/3/4" on page 75
	See "Marker Norm/Delta" on page 76

CALCulate<n>:DELTamarker<m>:TRACe <TraceNumber>

This command selects the trace a delta marker is positioned on.

The corresponding trace must have a trace mode other than "Blank".

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Parameters:

<TraceNumber>	**1 ... 6**
	Trace number the marker is positioned on.

Example:	CALC:DELT3:TRAC 2
	Assigns delta marker 3 to trace 2.

CALCulate<n>:DELTamarker<m>:X <Position>

This command positions a delta marker on a particular coordinate on the x-axis.

The position is an absolute value.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Parameters:

<Position>	0 to maximum frequency or sweep time

Example:	CALC:DELT:X?
	Outputs the absolute frequency/time of delta marker 1.

Manual operation:	See "Marker 1/2/3/4" on page 75

CALCulate<n>:DELTamarker<m>:X:RELative?

This command queries the x-value of the selected delta marker relative to marker 1 or to the reference position (for CALC:DELT:FUNC:FIX:STAT ON). The command activates the corresponding delta marker, if necessary.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Example:	CALC:DELT3:X:REL?
	Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

Usage:	Query only

Manual operation:	See "Marker 1/2/3/4" on page 75

CALCulate<n>:DELTamarker<m>:Y?

This command queries the measured value of a delta marker. The corresponding delta marker is activated, if necessary. The output is always a relative value referred to marker 1 or to the reference position (reference fixed active).

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the delta marker and the query of the y value. This is only possible in single sweep mode.

Depending on the unit defined with `CALC:UNIT:POW` or on the activated measuring functions, the query result is output in the units below:

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`INIT;*WAI`
Starts a sweep and waits for its end.
`CALC:DELT2 ON`
Switches on delta marker 2.
`CALC:DELT2:Y?`
Outputs measurement value of delta marker 2.

Usage: Query only

Manual operation: See "Marker 1/2/3/4" on page 75

8.2.4.2   CALCulate:LIMit subsystem

CALCulate<n>:LIMit<k>:ACPower:ACHannel:ABSolute <LowerLimit>,
     <UpperLimit>

This command defines the absolute limit value for the lower/upper adjacent channel during adjacent-channel power measurement (Adjacent Channel Power).

Note that the absolute limit value has no effect on the limit check as soon as it is below the relative limit value defined with `CALCulate<n>:LIMit<k>:ACPower:ACHannel[:RELative]`. This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

Suffix:

<n>	Selects the measurement window.
<k>	irrelevant

Parameters:

<LowerLimit>, <UpperLimit>	first value: -200DBM to 200DBM; limit for the lower and the upper adjacent channel
	*RST: -200DBM

Example: `CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM`
Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dBm.

CALCulate<n>:LIMit<k>:ACPower:ACHannel:ABSolute:STATe <State>

This command activates the limit check for the adjacent channel when adjacent-channel power measurement (Adjacent Channel Power) is performed. Before the command, the limit check for the channel/adjacent-channel measurement must be globally switched on using `CALCulate<n>:LIMit<k>:ACPower[:STATe]`.

The result can be queried with `CALCulate<n>:LIMit<k>:ACPower:ACHannel:RESult`. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

Suffix:

<n>	Selects the measurement window.
<k>	irrelevant

Parameters:

<State>	ON	OFF
	*RST: OFF

Example: CALC:LIM:ACP:ACH 30DB, 30DB
Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.
CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM
Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dBm.
CALC:LIM:ACP ON
Switches on globally the limit check for the channel/adjacent-channel measurement.
CALC:LIM:ACP:ACH:REL:STAT ON
Switches on the check of the relative limit values for adjacent channels.
CALC:LIM:ACP:ACH:ABS:STAT ON
Switches on the check of absolute limit values for the adjacent channels.
INIT;*WAI
Starts a new measurement and waits for the sweep end.
CALC:LIM:ACP:ACH:RES?
Queries the limit check result in the adjacent channels.

CALCulate\<n>:LIMit\<k>:ACPower:ACHannel[:RELative] <LowerLimit>,
    <UpperLimit>

This command defines the relative limit of the upper/lower adjacent channel for adjacent-channel power measurements. The reference value for the relative limit value is the measured channel power.

It should be noted that the relative limit value has no effect on the limit check as soon as it is below the absolute limit value defined with the CALCulate\<n>:LIMit\<k>: ACPower:ACHannel:ABSolute command. This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

Suffix:

\<n>   Selects the measurement window.

\<k>   irrelevant

Parameters:

\<LowerLimit>,   0 to 100dB; the value for the lower limit must be lower than the
\<UpperLimit>   value for the upper limit

                       *RST: 0 dB

Example: CALC:LIM:ACP:ACH 30DB, 30DB
Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.

CALCulate\<n>:LIMit\<k>:ACPower:ACHannel:RESult

This command queries the result of the limit check for the upper/lower adjacent channel when adjacent channel power measurement is performed.

If the power measurement of the adjacent channel is switched off, the command produces a query error.

Suffix:

<n>	Selects the measurement window.
<k>	irrelevant

Return values:

Result	The result is returned in the form <result>, <result> where <result> = PASSED | FAILED, and where the first returned value denotes the lower, the second denotes the upper adjacent channel.

Example: `CALC:LIM:ACP:ACH 30DB, 30DB`
Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.
`CALC:LIM:ACP:ACH:ABS –35DBM, –35DBM`
Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dB.
`CALC:LIM:ACP ON`
Switches on globally the limit check for the channel/adjacent channel measurement.
`CALC:LIM:ACP:ACH:STAT ON`
Switches on the limit check for the adjacent channels.
`INIT;*WAI`
Starts a new measurement and waits for the sweep end.
`CALC:LIM:ACP:ACH:RES?`
Queries the limit check result in the adjacent channels.

CALCulate<n>:LIMit<k>:ACPower:ACHannel[:RELative]:STATe <State>

This command activates the limit check for the relative limit value of the adjacent channel when adjacent-channel power measurement is performed. Before this command, the limit check must be activated using `CALCulate<n>:LIMit<k>:ACPower[: STATe]`.

The result can be queried with `CALCulate<n>:LIMit<k>:ACPower:ACHannel: RESult`. Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

Suffix:

<n>	Selects the measurement window.
<k>	irrelevant

Parameters:

<State>	ON | OFF	
	*RST:	OFF

Example: `CALC:LIM:ACP:ACH 30DB, 30DB`
                     Sets the relative limit value for the power in the lower and upper
                     adjacent channel to 30 dB below the channel power.
                     `CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM`
                     Sets the absolute limit value for the power in the lower and
                     upper adjacent channel to -35 dBm.
                     `CALC:LIM:ACP ON`
                     Switches on globally the limit check for the channel/adjacent
                     channel measurement.
                     `CALC:LIM:ACP:ACH:STAT ON`
                     Switches on the check of the relative limit values for adjacent
                     channels.
                     `CALC:LIM:ACP:ACH:ABS:STAT ON`
                     Switches on the check of absolute limit values for the adjacent
                     channels.
                     `INIT;*WAI`
                     Starts a new measurement and waits for the sweep end.
                     `CALC:LIM:ACP:ACH:RES?`
                     Queries the limit check result in the adjacent channels.

CALCulate<n>:LIMit<k>:ACPower:ALTernate<Channel>:ABSolute <LowerLimit>,
       <UpperLimit>

This command defines the absolute limit value for the lower/upper alternate adjacent-
channel power measurement (Adjacent Channel Power).

Note that the absolute limit value for the limit check has no effect as soon as it is below
the relative limit value defined with `CALCulate<n>:LIMit<k>:ACPower:`
`ACHannel[:RELative]`. This mechanism allows automatic checking of the absolute
basic values defined in mobile radio standards for the power in adjacent channels.

Suffix:
<n>   Selects the measurement window.

<k>   irrelevant

<Channel>   1...11
                     the alternate channel

Parameters:
<LowerLimit>,   first value: -200DBM to 200DBM; limit for the lower and the
<UpperLimit>   upper alternate adjacent channel

                     *RST: -200DBM

Example: `CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM`
                     Sets the absolute limit value for the power in the lower and
                     upper second alternate adjacent channel to -35 dBm.

CALCulate<n>:LIMit<k>:ACPower:ALTernate<channel>[:RELative] <LowerLimit>, <UpperLimit>

This command defines the limit for the alternate adjacent channels for adjacent channel power measurements. The reference value for the relative limit value is the measured channel power.

Note that the relative limit value has no effect on the limit check as soon as it is below the absolute limit defined with CALCulate<n>:LIMit<k>:ACPower: ALTernate<Channel>:ABSolute. This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

Suffix:

<n>	Selects the measurement window.
<k>	irrelevant
<Channel>	1...11 the alternate channel

Parameters:

<LowerLimit>, <UpperLimit>	first value: 0 to 100dB; limit for the lower and the upper alternate adjacent channel
	*RST: 0 DB

Example: CALC:LIM:ACP:ALT2 30DB, 30DB
Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.

CALCulate<n>:LIMit<k>:ACPower:ALTernate<Channel>[:RELative]:STATe <State>

This command activates the limit check for the alternate adjacent channels for adjacent channel power measurements. Before the command, the limit check must be activated using CALCulate<n>:LIMit<k>:ACPower[:STATe].

The result can be queried with CALCulate<n>:LIMit<k>:ACPower: ALTernate<channel>[:RELative]. Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are obtained.

Suffix:

<n>	Selects the measurement window.
<k>	irrelevant
<Channel>	1...11 the alternate channel

Parameters:

<State>	ON | OFF
	*RST: OFF

Example:	CALC:LIM:ACP:ALT2 30DB, 30DB
	Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.
	CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM
	Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.
	CALC:LIM:ACP ON
	Switches on globally the limit check for the channel/adjacent channel measurement.
	CALC:LIM:ACP:ALT2:STAT ON
	Switches on the check of the relative limit values for the lower and upper second alternate adjacent channel.
	CALC:LIM:ACP:ALT2:ABS:STAT ON
	Switches on the check of absolute limit values for the lower and upper second alternate adjacent channel.
	INIT;*WAI
	Starts a new measurement and waits for the sweep end.
	CALC:LIM:ACP:ALT2:RES?
	Queries the limit check result in the second alternate adjacent channels.

CALCulate<n>:LIMit<k>:ACPower[:STATe] <State>

This command switches on and off the limit check for adjacent-channel power measurements. The commands CALCulate<n>:LIMit<k>:ACPower:ACHannel[:RELative]:STATe or CALCulate<n>:LIMit<k>:ACPower:ALTernate<Channel>[:RELative]:STATe must be used in addition to specify whether the limit check is to be performed for the upper/lower adjacent channel or for the alternate adjacent channels.

Suffix:

<n>	Selects the measurement window.
<k>	irrelevant

Parameters:

<State>	ON	OFF
	*RST: OFF

Example:	CALC:LIM:ACP ON
	Switches on the ACLR limit check.

CALCulate<n>:LIMit<k>:FAIL?

This command queries the result of a limit check.

Note that for SEM measurements, the limit line suffix <k> is irrelevant, as only one specific SEM limit line is checked for the currently relevant power class.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps.

Suffix:

<n>   irrelevant

<k>   limit line

Return values:

<Result>   **0**

                                        PASS

                                        1

                                        FAIL

Example: INIT;*WAI

                                        Starts a new sweep and waits for its end.

                                        CALC:LIM3:FAIL?

                                        Queries the result of the check for limit line 3.

Usage: Query only

8.2.4.3   CALCulate:LIMit:ESPectrum subsystem

The CALCulate:LIMit:ESPectrum subsystem defines the limit check for the Spectrum Emission Mask.

CALCulate<n>:LIMit<k>:ESPectrum:LIMits <Limits>

This command sets or queries up to 4 power classes in one step.

Suffix:

<n>   irrelevant

<k>   irrelevant

Parameters:

<Limits>   1–3 numeric values between -200 and 200, separated by commas

                                        -200, <0-3 numeric values between -200 and 200, in ascending order, separated by commas>, 200

Example: `CALC:LIM:ESP:LIM -50,50,70`
Defines the following power classes:
`<-200, -50>`
`<-50, 50>`
`<50, 70>`
`<70, 200>`
Query:
`CALC:LIM:ESP:LIM?`
Response:
`-200,-50,50,70,200`

CALCulate<n>:LIMit<k>:ESPectrum:MODE <Mode>

This command activates or deactivates the automatic selection of the limit line in the Spectrum Emission Mask measurement.

Suffix:

<n>   1...4
        window

<k>   irrelevant

Parameters:

<Mode>   AUTO | MANUAL

        AUTO
        The limit line depends on the measured channel power.

        MANUAL
        One of the three specified limit lines is set. The selection is made with the chapter 8.2.4.3, "CALCulate:LIMit:ESPectrum subsystem", on page 153 command.

        *RST: AUTO

Example: `CALC:LIM:ESP:MODE AUTO`
Activates automatic selection of the limit line.

CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>[:EXCLusive] <State>

This command sets the power classes used in the spectrum emission mask measurement. It is only possible to use power classes for which limits are defined. Also, either only one power class at a time or all power classes together can be selected.

Suffix:

<n>   irrelevant

<k>   irrelevant

<Class>   1...4
        the power class to be evaluated

Parameters:

<State>   ON | OFF

        *RST: OFF

Example: CALC:LIM:ESP:PCL1 ON
                      Activates the first defined power class.

CALCulate\<n>:LIMit\<k>:ESPectrum:PCLass\<Class>:COUNt \<NoPowerClasses>

This command sets the number of power classes to be defined.

Suffix:

\<n>	irrelevant
\<k>	irrelevant
\<Class>	irrelevant

Parameters:

\<NoPowerClasses>   1 to 4

*RST: 1

Example: CALC:LIM:ESP:PCL:COUN 2
                      Two power classes can be defined.

CALCulate\<n>:LIMit\<k>:ESPectrum:PCLass\<Class>:LIMit[:STATe] \<State>

This command defines which limits are evaluated in the measurement.

Suffix:

\<n>	irrelevant
\<k>	irrelevant
\<Class>	1...4 the power class to be evaluated

Parameters:

\<State>   ABSolute | RELative | AND | OR

ABSolute
Evaluates only limit lines with absolute power values

RELative
Evaluates only limit lines with relative power values

AND
Evaluates limit lines with relative and absolute power values. A
negative result is returned if both limits fail.

OR
Evaluates limit lines with relative and absolute power values. A
negative result is returned if at least one limit failed.

*RST: REL

Example: CALC:LIM:ESP:PCL:LIM ABS

CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>:MAXimum <Level>

This command sets the upper limit level for one power class. The unit is dBm. The limit always ends at + 200 dBm, i.e. the upper limit of the last power class can not be set. If more than one power class is in use, the upper limit must equal the lower limit of the next power class.

Suffix:

<n>	irrelevant
<k>	irrelevant
<Class>	1...4 the power class to be evaluated

Parameters:

<Level>	**<numeric value>** *RST: +200

Example:	CALC:LIM:ESP:PCL1:MAX -40 dBm Sets the maximum power value of the first power class to -40 dBm.

CALCulate<n>:LIMit<k>:ESPectrum:PCLass<Class>:MINimum <Level>

This command sets the minimum lower level limit for one power class. The unit is dBm. The limit always start at – 200 dBm, i.e. the first lower limit can not be set. If more than one power class is in use, the lower limit must equal the upper limit of the previous power class.

Suffix:

<n>	irrelevant
<k>	irrelevant
<Class>	1...4 the power class to be evaluated

Parameters:

<Level>	**<numeric_value>** *RST: -200 for class1, otherwise +200

Example:	CALC:LIM:ESP:PCL2:MIN -40 dBm Sets the minimum power value of the second power class to -40 dBm.

CALCulate<n>:LIMit<k>:ESPectrum:RESTore

This command restores the predefined limit lines for the Spectrum Emission Mask

measurement. All modifications made to the predefined limit lines are lost and the factory-set values are restored.

Suffix:

<n>	1...4
	window
<k>	irrelevant

Example: CALC:LIM:ESP:REST

Resets the limit lines for the Spectrum Emission Mask to the default setting.

CALCulate<n>:LIMit<k>:ESPectrum:VALue <Power>

This command activates the manual limit line selection and specifies the expected power as a value. Depending on the entered value, one of the predefined limit lines is selected.

Suffix:

<n>	1...4
	window
<k>	irrelevant

Parameters:

<Power>	33 | 28 | 0
	33
	$P \geq 33$
	28
	$28 < P < 33$
	0
	$P < 28$
	*RST: 0

Example: CALC:LIM:ESP:VAL 33

Activates manual selection of the limit line and selects the limit line for P = 33.

8.2.4.4 CALCulate:MARKer subsystem

CALCulate<n>:MARKer<m>:AOFF

This command all markers off, including delta markers and marker measurement functions.

Suffix:

<n>   Selects the measurement window.

<m>   depends on mode
                             irrelevant

Example: CALC:MARK:AOFF
                         Switches off all markers.

Usage: Event

Manual operation: See "All Marker Off" on page 76

CALCulate<n>:MARKer<m>:MAXimum:LEFT

This command positions a marker to the next smaller trace maximum on the left of the current position (i.e. in descending X values).

If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>   Selects the measurement window.

<m>   Selects the marker.

Example: CALC:MARK2:MAX:LEFT
                         Positions marker 2 to the next lower maximum value to the left
                         of the current value.

Usage: Event

Manual operation: See "Next Peak Mode" on page 77

CALCulate<n>:MARKer<m>:MAXimum:NEXT

This command positions the marker to the next smaller trace maximum.

If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>   Selects the measurement window.

<m>   Selects the marker.

Example:	CALC:MARK2:MAX:NEXT
	Positions marker 2 to the next lower maximum value.

Usage:	Event

Manual operation:	See "Next Peak" on page 77
	See "Next Peak Mode" on page 77

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

This command positions the marker on the current trace maximum.

The corresponding marker is activated first or switched to the marker mode.

If no maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	depends on mode
	Selects the marker.

Example:	CALC:MARK2:MAX
	Positions marker 2 to the maximum value of the trace.

Usage:	Event

Manual operation:	See "Peak" on page 77

CALCulate<n>:MARKer<m>:MAXimum:RIGHt

This command positions a marker to the next smaller trace maximum on the right of the current value (i.e. in ascending X values).

If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Example:	CALC:MARK2:MAX:RIGH
	Positions marker 2 to the next lower maximum value to the right of the current value.

Usage:	Event

Manual operation:	See "Next Peak Mode" on page 77

CALCulate<n>:MARKer<m>:MINimum:LEFT

This command positions a marker to the next higher trace minimum on the left of the current value (i.e. in descending X direction).

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Example: CALC:MARK2:MIN
Positions marker 2 to the minimum value of the trace.
CALC:MARK2:MIN:LEFT
Positions marker 2 to the next higher minimum value to the left of the current value.

Usage: Event

Manual operation: See "Next Min Mode" on page 78

CALCulate<n>:MARKer<m>:MINimum:NEXT

This command positions ae marker to the next higher trace minimum.

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Example: CALC:MARK2:MIN
Positions marker 2 to the minimum value of the trace.
CALC:MARK2:MIN:NEXT
Positions marker 2 to the next higher maximum value.

Usage: Event

Manual operation: See "Next Min" on page 78
See "Next Min Mode" on page 78

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

This command positions the marker on the current trace minimum.

The corresponding marker is activated first or switched to marker mode, if necessary.

If no minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	depends on mode
Selects the marker.

Example: CALC:MARK2:MIN
Positions marker 2 to the minimum value of the trace.

Usage:	Event
Manual operation:	See "Min" on page 78

CALCulate<n>:MARKer<m>:MINimum:RIGHt

This command positions a marker to the next higher trace minimum on the right of the current value (i.e. in ascending X direction).

If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.
Example:	CALC:MARK2:MIN Positions marker 2 to the minimum value of the trace. CALC:MARK2:MIN:RIGH Positions marker 2 to the next higher minimum value to the right of the current value.
Usage:	Event
Manual operation:	See "Next Min Mode" on page 78

CALCulate<n>:MARKer<m>[:STATe] <State>

This command turns markers on and off.

If the corresponding marker number is currently active as a deltamarker, it is turned into a normal marker.

Suffix:

<n>	Selects the measurement window.
<m>	depends on mode Selects the marker.

Parameters:

<State>	ON | OFF *RST: OFF
Example:	CALC:MARK3 ON Switches on marker 3 or switches to marker mode.
Manual operation:	See "Marker 1/2/3/4" on page 75 See "Marker Norm/Delta" on page 76 See "Select 1/2/3/4/Δ" on page 76

CALCulate<n>:MARKer<m>:TRACe <Trace>

This command selects the trace a marker is positioned on.

The corresponding trace must have a trace mode other than "Blank".

If necessary, the corresponding marker is switched on prior to the assignment.

Suffix:

<n>	Selects the measurement window.
<m>	depends on mode Selects the marker.

Parameters:

<Trace>	**1 ... 6** Trace number the marker is positioned on.

Example:	CALC:MARK3:TRAC 2 Assigns marker 3 to trace 2.

CALCulate<n>:MARKer<m>:X <Position>

This command positions a marker on a particular coordinate on the x-axis.

If marker 2, 3 or 4 is selected and used as delta marker, it is switched to marker mode.

Suffix:

<n>	Selects the measurement window.
<m>	Selects the marker.

Parameters:

<Position>	Numeric value that defines the marker position on the x-axis. The unit is either Hz (frequency domain) or s (time domain) or dB (statistics). Range: The range depends on the current x-axis range.

Example:	CALC:MARK2:X 1.7MHz Positions marker 2 to frequency 1.7 MHz.

Manual operation:	See "Marker 1/2/3/4" on page 75 See "Select 1/2/3/4/∆" on page 76

CALCulate<n>:MARKer<m>:X:SLIMits[:STATe] <State>

This command turns marker search limits on and off.

If the power measurement in zero span is active, this command limits the evaluation range on the trace.

Suffix:

<n>	Selects the measurement window.
<m>	marker

Parameters:

<State>	ON	OFF *RST: OFF

Example: CALC:MARK:X:SLIM ON
                      Switches on search limitation.

CALCulate\<n\>:MARKer\<m\>:X:SLIMits:ZOOM \<State\>

This command sets the limits of the marker search range to the zoom area.

Note: The function is only available if the search limit for marker and delta marker is switched on (see CALCulate\<n\>:MARKer\<m\>:X:SLIMits[:STATe]).

Suffix:

\<n\>	irrelevant
\<m\>	irrelevant

Parameters:

\<State\>	ON | OFF
	*RST: OFF

Example: CALC:MARK:X:SLIM:ZOOM ON
                      Switches the search limit function on.
                      CALC:MARK:X:SLIM:RIGH 20MHz
                      Sets the right limit of the search range to 20 MHz.

CALCulate\<n\>:MARKer\<m\>:Y?

This command queries the measured value of a marker.

The corresponding marker is activated before or switched to marker mode, if necessary.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps.

Suffix:

\<n\>	Selects the measurement window.
\<m\>	Selects the marker.

Return values:

\<Result\>	The measured value of the selected marker is returned.

Example: INIT:CONT OFF
                      Switches to single sweep mode.
                      CALC:MARK2 ON
                      Switches marker 2.
                      INIT;*WAI
                      Starts a sweep and waits for the end.
                      CALC:MARK2:Y?
                      Outputs the measured value of marker 2.

Usage: Query only

Manual operation:　　See "Marker 1/2/3/4" on page 75
　　　　　　　　　　　　See "Select 1/2/3/4/Δ" on page 76
　　　　　　　　　　　　See "CPICH" on page 77
　　　　　　　　　　　　See "PCCPCH" on page 77

8.2.4.5　CALCulate:PSE subsystem

CALCulate<n>:PEAKsearch|PSEarch[:IMMediate]

This command switches the spurious limit check off.

If you want to read out the values peak values including the delta to a limit, you have to switch on the limit again.

This command is only for FSP compatibility, and not necessary to use on the R&S FSV.

Suffix:

<n>　　　　　　　　　　irrelevant

Example:　　　　　CALC:PSE
　　　　　　　　　　　Starts to determine the list.

CALCulate<n>:PEAKsearch|PSEarch:AUTO <State>

This command activates or deactivates the list evaluation.

Suffix:

<n>　　　　　　　　　　Selects the measurement window.

Parameters:

<State>　　　　　　　ON | OFF
　　　　　　　　　　　*RST:　　　ON

Example:　　　　　CALC:ESP:PSE:AUTO OFF
　　　　　　　　　　　Deactivates the list evaluation.

CALCulate<n>:PEAKsearch|PSEarch:MARGin <Margin>

This command sets the margin used for the limit check/peak search.

Suffix:

<n>　　　　　　　　　　Selects the measurement window.

Parameters:

<Margin>	-200 to 200 dB
	*RST: 200 dB
Example:	CALC:ESP:PSE:MARG 100
	Sets the margin to 100 dB.

CALCulate<n>:PEAKsearch|PSEarch:PSHow

This command marks all peaks with blue squares in the diagram.

Suffix:

<n>	Selects the measurement window.

Parameters:

<State>	ON	OFF
	*RST: OFF
Example:	CALC:ESP:PSE:PSH ON
	Marks all peaks with blue squares.

CALCulate<n>:PEAKsearch|PSEarch:SUBRanges <NumberPeaks>

This command sets the number of peaks per range that are stored in the list. Once the selected number of peaks has been reached, the peak search is stopped in the current range and continued in the next range.

Suffix:

<n>	irrelevant

Parameters:

<NumberPeaks>	1 to 50
	*RST: 25
Example:	CALC:PSE:SUBR 10
	Sets 10 peaks per range to be stored in the list.

8.2.4.6 CALCulate:STATistics subsystem

CALCulate\<n\>:STATistics:CCDF[:STATe] \<State\>

This command switches on or off the measurement of the complementary cumulative distribution function (CCDF). On activating this function, the APD measurement is switched off.

Suffix:

\<n\>   irrelevant

Parameters:

\<State\>   ON | OFF

                          *RST: OFF

Example: CALC:STAT:CCDF ON

                          Switches on the CCDF measurement.

CALCulate\<n\>:STATistics:NSAMples \<NoMeasPoints\>

This command sets the number of measurement points to be acquired for the statistical measurement functions.

Suffix:

\<n\>   irrelevant

Parameters:

\<NoMeasPoints\>   100 to 1E9

                          *RST: 100000

Example: CALC:STAT:NSAM 500

                          Sets the number of measurement points to be acquired to 500.

CALCulate\<n\>:STATistics:PRESet

This command resets the scaling of the X and Y axes in a statistical measurement. The following values are set:

x-axis ref level:	-20 dBm
x-axis range APD:	100 dB
x-axis range CCDF:	20 dB
y-axis upper limit:	1.0
y-axis lower limit:	1E-6

Suffix:

\<n\>   irrelevant

Example: CALC:STAT:PRES

                          Resets the scaling for statistical functions

CALCulate<n>:STATistics:RESult<Trace> <ResultType>

This command reads out the results of statistical measurements of a recorded trace.

Suffix:

<n>   irrelevant

<Trace>   1...6
                        trace

Parameters:

<ResultType>   MEAN | PEAK | CFACtor | ALL

                        MEAN
                        Average (=RMS) power in dBm measured during the measurement time.

                        PEAK
                        Peak power in dBm measured during the measurement time.

                        CFACtor
                        Determined CREST factor (= ratio of peak power to average power) in dB.

                        ALL
                        Results of all three measurements mentioned before, separated by commas: <mean power>,<peak power>,<crest factor>

                        The required result is selected via the following parameters:

Example: `CALC:STAT:RES2? ALL`
                        Reads out the three measurement results of trace 2. Example of answer string: 5.56,19.25,13.69 i.e. mean power: 5.56 dBm, peak power 19.25 dBm, CREST factor 13.69 dB

CALCulate<n>:STATistics:SCALe:AUTO ONCE

This command optimizes the level setting of the instrument depending on the measured peak power, in order to obtain maximum instrument sensitivity.

To obtain maximum resolution, the level range is set as a function of the measured spacing between peak power and the minimum power for the APD measurement and of the spacing between peak power and mean power for the CCDF measurement. In addition, the probability scale for the number of test points is adapted.

Subsequent commands have to be synchronized with *WAI, *OPC or *OPC? to the end of the auto range process which would otherwise be aborted.

Suffix:

<n>   irrelevant

Example: `CALC:STAT:SCAL:AUTO ONCE;*WAI`
                        Adapts the level setting for statistical measurements.

CALCulate<n>:STATistics:SCALe:X:RANGe <Value>

This command defines the level range for the x-axis of the measurement diagram. The setting is identical to the level range setting defined with the `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]` command.

Suffix:

<n>   irrelevant

Parameters:

<Value>   10dB to 200dB

                       *RST: 100dB

Example: CALC:STAT:SCAL:X:RANG 20dB

CALCulate<n>:STATistics:SCALe:X:RLEVel <Value>

This command defines the reference level for the x-axis of the measurement diagram. The setting is identical to the reference level setting using the `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` command.

With the reference level offset <> 0 the indicated value range of the reference level is modified by the offset.

The unit depends on the setting performed with `CALCulate<n>:UNIT:POWer`.

Suffix:

<n>   irrelevant

Parameters:

<Value>   -120dBm to 20dBm

                       *RST: -20dBm

Example: CALC:STAT:SCAL:X:RLEV –60dBm

CALCulate<n>:STATistics:SCALe:Y:LOWer <Value>

This command defines the lower limit for the y-axis of the diagram in statistical measurements. Since probabilities are specified on the y-axis, the entered numeric values are dimensionless.

Suffix:

<n>   selects the screen

Parameters:

<Value>   1E-9 to 0.1

                       *RST: 1E-6

Example: CALC:STAT:SCAL:Y:LOW 0.001

CALCulate<n>:STATistics:SCALe:Y:UNIT <Unit>

This command defines the scaling type of the y-axis.

Suffix:

<n>	selects the screen

Parameters:

<Unit>	PCT | ABS
	*RST: ABS

Example:	`CALC:STAT:SCAL:Y:UNIT PCT`
	Sets the percentage scale.

CALCulate<n>:STATistics:SCALe:Y:UPPer <Value>

This command defines the upper limit for the y-axis of the diagram in statistical measurements. Since probabilities are specified on the y-axis, the entered numeric values are dimensionless.

Suffix:

<n>	irrelevant

Parameters:

<Value>	1E-8 to 1.0
	*RST: 1.0

Example:	`CALC:STAT:SCAL:Y:UPP 0.01`

8.2.4.7 Other Referenced CALCulate Commands

CALCulate<n>:UNIT:POWer <Unit>

This command selects the unit of the y-axis.

The unit applies to all measurement windows.

Suffix:

<n>	irrelevant

Parameters:

<Unit>	DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere
	*RST: dBm

Example:	`CALC:UNIT:POW DBM`
	Sets the power unit to dBm.

Manual operation:	See "Unit" on page 98

8.3 CONFigure:WCDPower subsystem (R&S FSV-K72)

This subsystem comprises the commands for configuring the code domain power measurements. Only the numeric suffix 1 is permissible in CONFigure.

CONFigure:WCDPower[:BTS]:MEASurement <Type>

This command selects the type of 3GPP FDD BTS base station tests.

Parameters:

<Type>　　　　　ACLR | ESPectrum | WCDPower | POWer | OBANdwith | CCDF | RFCombi | TAERror

ACLR
Adjacent-channel power measurement (standard 3GPP WCDMA Forward) with predefined settings

ESPectrum
Measurement of spectrum emission mask

WCDPower
Code domain power measurement. This selection has the same effect as command `INSTrument:SELect`

POWer
Channel power measurement (standard 3GPP WCDMA Forward) with predefined settings

OBANdwith
Measurement of occupied power bandwidth

CCDF
Measurement of complementary cumulative distribution function

RFCombi
Combined Adjacent Channel Power (Ch Power ACLR) measurement with Occupied Bandwidth and Spectrum Emission Mask

TAERror
Time Alignment Error measurement

*RST:　　　OFF

Example:　　　　`CONF:WCDP:MEAS POW`

Mode:	WCDMA

CONFigure:WCDPower[:BTS]:CTABle[:STATe] <State>

This command switches the channel table on or off. When switch-on takes place, the measured channel table is stored under the name RECENT and is switched on. After the RECENT channel table is switched on, another channel table can be selected with the command `CONFigure:WCDPower[:BTS]:CTABle:SELect` on page 175.

Parameters:

<State>	ON | OFF
	*RST: OFF

Example:	CONF:WCDP:CTAB ON
Mode:	WCDMA
Manual operation:	See "Channel Search Mode" on page 59

CONFigure:WCDPower[:BTS]:CTABle:CATalog?

This command reads out the names of all channel tables stored on the hard disk.

Return values:

<Result>	<Sum of file lengths of all subsequent files>,<free memory on hard disk>, <1st file name>,<1st file length>,<2nd file name>,<2nd file length>,….,<nth file name>, <nth file length>

Example:	CONF:WCDP:CTAB:CAT?
Usage:	Query only
Mode:	WCDMA
Manual operation:	See "Predefined Tables" on page 60

CONFigure:WCDPower[:BTS]:CTABle:COMMent <Comment>

This command defines a comment for the selected channel table:

Prior to this command, the name of the channel table has to be defined with command `CONFigure:WCDPower[:BTS]:CTABle:NAME` on page 175 and the values of the table have to be defined with command `CONFigure:WCDPower[:BTS]:CTABle:DATA` on page 173.

Parameters:
<Comment>

Example:	`CONF:WCDP:CTAB:NAME 'NEW_TAB'`
	Defines the channel table name.
	`CONF:WCDP:CTAB:DATA`
	`8,0,0,0,0,0,1,0.00,8,1,0,0,0,0,1,0.00,7,1,0,`
	`256,8,0,1,0.00`
	Defines the table values.
	`CONF:WCDP:CTAB:COMM 'Comment for table 1'`
	Defines a comment for the table.
Mode:	WCDMA

CONFigure:WCDPower[:BTS]:CTABle:COMPare <State>

This command switches between normal predefined mode and predefined channel table compare mode.

In the compare mode a predefined channel table model can be compared with the measurement in respect to power, pilot length and timing offset of the active channels.

Comparision is a submode of predefined channel table measurement. It only influences the measurement if the "Channel Search Mode" is set to *Predefined* (see "Channel Search Mode" on page 59). If the compare mode is selected, the power values, pilot lengths and timing offsets are measured and are compared with the values from the predefined channel table. The "Timing Offset" setting is disabled in this case. These results are visualized in the corresponding columns of the "CHANNEL TABLE" result display (see chapter 6.1.2.2, "Channel Table", on page 34). The following columns are displayed in the channel table:

- **PilotL** is the substraction of PilotLengthMeasured - PilotLengthPredefined
- **PwrRel** is the substraction of PowerRelMeasured - PowerRelPredefined
- **T Offs** is the substraction of TimingOffsetMeasured - TimingOffsetPredefined

For non-active channels dashes are shown.

Parameters:

<State>	ON | OFF
	ON
	predefined channel table compare mode
	OFF
	normal predefined mode
	*RST: OFF
Example:	`CONF:WCDP:CTAB:COMP ON`
Mode:	WCDMA
Manual operation:	See "Channel Table Compare" on page 59

CONFigure:WCDPower[:BTS]:CTABle:COPY <FileName>

This command copies one channel table onto another one. The channel table to be copied is selected with command `CONFigure:WCDPower[:BTS]:CTABle:NAME` on page 175.

The name of the channel table may contain a maximum of 8 characters.

Parameters:

<FileName>   <file_name> = name of the new channel table

Example: CONF:WCDP:CTAB:NAME 'NEW_TAB'
                          Defines the channel table name to be copied.
                          CONF:WCDP:CTAB:COPY 'CTAB_2'
                          Copies channel table 'NEW_TAB' to 'CTAB_2'.

Usage: Event

Mode: WCDMA

CONFigure:WCDPower[:BTS]:CTABle:DATA <CodeClass>, <CodeNumber>, <UseTFCI>, <TimingOffset>, <PilotLength>, <ChannelType>, <Status>, <CDPRelative>

This command defines or queries the values of the selected channel table. Each line of the table consists of 8 values.

Channels PICH, CPICH and PCCPCH may only be defined once. If channel CPICH or PCCPCH is missing in the command, it is automatically added at the end of the table.

Prior to this command, the name of the channel table has to be defined with the command `CONFigure:WCDPower[:BTS]:CTABle:NAME` on page 175.

Parameters:

<CodeClass>   Range: 2 to 9

<CodeNumber>   Range: 0 to 511

<UseTFCI>   0 | 1

                         0
                         not used

                         1
                         used

<TimingOffset>   Step width: 256; for code class 9: 512

                         Range: 0 to 38400

<PilotLength>   code class 9: 4
                         code class 8: 2,4, 8
                         code class 7: 4, 8
                         code class 5/6: 8
                         code class 2/3/4: 16

\<ChannelType\>	**0** DPCH Dedicated Physical Channel of a standard WCDMA Frame **1** PICH Paging Indication Channel **2** SCCPCH Secondary Common Control Physical Channel **3** HS_SCCH HSDPA: High Speed Shared Control Channel **4** HS_PDSCH HSDPA: High Speed Physical Downlink Shared Channel **5** CHAN any other QPSK modulated channel without pilot symbols **10** CPRSD Dedicated Physical Channel (DPCH) in compressed mode **11** CPR-TPC DPCH in compressed mode TPC symbols are sent in the first slot of the gap. **12** CPR-SF/2 DPCH in compressed mode using half spreading factor (SF/2). **13** CPR-SF/2-TPC DPCH in compressed mode using half spreading factor (SF/2).TPC symbols are sent in the first slot of the gap. **14** E-HICH: Enhanced HARQ Hybrid Acknowledgement Indicator Channel E-RGCH: Enhanced Relative Grant Channel **15** EAGCH E-AGCH: Enhanced Absolute Grant Channel **16** SCPICH Secondary Common Pilot Channel
\<Status\>	**0** not active **1** active
\<CDPRelative\>	for queries: CDP relative value; for settings: any value
Example:	CONF:WCDP:CTAB:NAME 'NEW_TAB' Defines the channel table name. CONF:WCDP:CTAB:DATA 8,0,0,0,0,0,1,0.00,8,1,0,0,0,0,1,0.00,7,1,0, 256,8,0,1,0.00
Mode:	WCDMA

CONFigure:WCDPower[:BTS]:CTABle:DELete

This command deletes the selected channel table. The channel table to be deleted is selected with the command `CONFigure:WCDPower[:BTS]:CTABle:NAME` on page 175.

Example:	`CONF:WCDP:CTAB:NAME 'NEW_TAB'`
	Defines the channel table name to be deleted.
	`CONF:WCDP:CTAB:DEL`
	Deletes the table.
Mode:	WCDMA

CONFigure:WCDPower[:BTS]:CTABle:NAME <Name>

This command selects an existing channel table or creates the name of a new channel table file.

Parameters:

<Name>	<file name>
	*RST: RECENT
Example:	`CONF:WCDP:CTAB:NAME 'NEW_TAB'`
Mode:	WCDMA

CONFigure:WCDPower[:BTS]:CTABle:SELect <FileName>

This command selects a predefined channel table file. Before using this command, the RECENT channel table must be switched on first with the command `CONFigure:WCDPower[:BTS]:CTABle[:STATe]` on page 171.

Parameters:

<FileName>	*RST: RECENT
Example:	`CONF:WCDP:CTAB ON`
	Switches the channel table on.
	`CONF:WCDP:CTAB:SEL 'CTAB_1'`
	Selects the predefined channel table 'CTAB_1'.
Mode:	WCDMA
Manual operation:	See "Channel Search Mode" on page 59

CONFigure:WCDPower[:BTS]:CTABle:TOFFset <Mode>

This command specifies whether the timing offset and pilot length are measured or if the values are taken from the predefined table.

Parameters:

<Mode>   PRED | MEAS

                       PRED
                       The timing offset and pilot length values from the predefined
                       table are used.

                       MEAS
                       The timing offset and the pilot length are measured by the appli-
                       cation. The channel configuration is specified via the predefined
                       channel table.

Example: CONF:WCDP:CTAB:TOFF MEAS

Mode: WCDMA

Manual operation: See "Timing Offset" on page 59

CONFigure:WCDPower[:BTS]:STanDard <Type>

Switches between Normal mode and Home BS (Home Base Station) mode for ACP
and SEM measurements. Switching this parameter changes the limits according to the
specifications.

Parameters:

<Type>   HOME | NORMal

                       HOME
                       Home Base Station

                       NORMal
                       Normal mode

                       *RST: NORMal

Example: CONF:WCDP:BTS:STD HOME

Mode: WCDMA

Manual operation: See "Standard" on page 91

8.4 DISPlay subsystem (R&S FSV-K72)

The DISPlay subsystem controls the selection and presentation of textual and graphic
information as well as of measurement data on the display.

DISPlay[:WINDow<n>]:STATe <State>

Activates/deactivates the window specified by the suffix <n>. The other measurements are not aborted but continue running in the background:

Suffix:

<n>   window

Parameters:

<State>   ON | OFF

                           *RST: OFF

Example: DISP:WIND3:STAT ON

                           Turns on a third measurement screen.

Mode: CDMA, EVDO, TDS, WCDMA

DISPlay[:WINDow<n>]:TRACe<t>:MODE <Mode>

This command defines the type of display and the evaluation of the traces. WRITE corresponds to the Clr/Write mode of manual operation. The trace is switched off (= BLANK in manual operation) with DISPlay[:WINDow<n>]:TRACe<t>[:STATe].

The number of measurements for AVERage, MAXHold and MINHold is defined with the [SENSe:]AVERage<n>:COUNt or [SENSe:]SWEep:COUNt commands. It should be noted that synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t>   trace

Parameters:

<Mode>   WRITe | VIEW | AVERage | MAXHold | MINHold | BLANk

                           *RST: WRITe for TRACe1, STATe OFF for
                                        TRACe2/3/4/5/6

                           For details on trace modes refer to chapter 5.2.4, "Trace Mode Overview", on page 21.

Example: INIT:CONT OFF

                           Switching to single sweep mode.

                           SWE:COUN 16

                           Sets the number of measurements to 16.

                           DISP:TRAC3:MODE MAXH

                           Switches on the calculation of the maximum peak for trace 3.

                           INIT;*WAI

                           Starts the measurement and waits for the end of the 16 sweeps.

Manual operation:	See "Clear Write" on page 21
	See "Max Hold" on page 21
	See "Min Hold" on page 22
	See "Average" on page 22
	See "View" on page 22

DISPlay[:WINDow<n>]:TRACe<t>[:STATe] <State>

This command switches on or off the display of the corresponding trace. The other measurements are not aborted but continue running in the background.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<t>	trace

Parameters:

<State>	ON | OFF
	*RST: ON for TRACe1, OFF for TRACe2 to 6

Example:	DISP:TRAC3 ON
Manual operation:	See "Blank" on page 22

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe] <Range>

This command defines the display range of the y-axis with logarithmic scaling.

The command works only for a logarithmic scaling. You can select the scaling with DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing on page 181.

Suffix:

<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<t>	irrelevant

Parameters:

<Range>	Range: 10 to 200
	*RST: 100
	Default unit: dB

Example:	DISP:TRAC:Y 110dB
Manual operation:	See "Range Log 100 dB" on page 97
	See "Range Log 50 dB" on page 97
	See "Range Log 10 dB" on page 97
	See "Range Log 5 dB" on page 97
	See "Range Log 1 dB" on page 98
	See "Range Log Manual" on page 98

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MODE <Mode>

This command selects the type of scaling of the y-axis.

When SYSTem:DISPlay:UPDate is turned off, this command has no immediate effect on the screen.

Suffix:

<n>   window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<t>   irrelevant

Parameters:

<Mode>   **ABSolute**
                  absolute scaling of the y-axis
                  RELative
                  relative scaling of the y-axis
                  *RST: ABS

Example: DISP:TRAC:Y:MODE REL

Manual operation: See "Grid Abs/Rel " on page 101

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:PDIVision <Value>

This remote command determines the grid spacing on the Y axis for all diagrams, where possible.

Suffix:

<n>   irrelevant

<t>   irrelevant

Parameters:

<Value>   numeric value; the unit depends on the result display
                  *RST: depends on the result display

Example: DISP:TRAC:Y:PDIV 10
                  Sets the grid spacing to 10 units (for example 10 dB in the Code Domain Power result display).

Mode: CDMA, BT, EVDO, TDS, WCDMA

Manual operation: See "Y per Div" on page 68

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel <ReferenceLevel>

This command defines the reference level.

With the reference level offset ≠ 0, the value range of the reference level is modified by the offset.

Suffix:

<n>   irrelevant.

<t>	irrelevant

Parameters:

<ReferenceLevel>	The unit is variable.
	Range: see datasheet
	*RST: -10dBm

Example:	DISP:TRAC:Y:RLEV –60dBm

Manual operation:	See "Ref Level" on page 52

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Value>

This command defines a reference level offset.

Suffix:

<n>	irrelevant.

<t>	irrelevant

Parameters:

<Value>	Range: -200 to 200
	*RST: 0
	Default unit: dB

Example:	DISP:TRAC:Y:RLEV:OFFS –10dB

Manual operation:	See "Ref Level Offset" on page 53

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition <Position>

This command defines the position of the reference level on the display grid..

When using a tracking generator (only with option R&S FSV-B9 or -B10, requires active normalization), and in Bluetooth mode (option R&S FSV-K8) this command defines the position of the reference value for all windows.

Suffix:

<n>	Selects the measurement window.

<t>	irrelevant

Parameters:

<Position>	0 PCT corresponds to the lower display border, 100% corresponds to the upper display border.
	Range: 0 to 100
	*RST: Spectrum mode: 100 PCT, with tracking generator or time display: 50 PCT
	Default unit: PCT

Example:	DISP:TRAC:Y:RPOS 50PCT

Manual operation:	See "Ref Value Position" on page 68
	See "Ref Level Position" on page 101

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue <Value>

The command defines the power value assigned to the reference position in the grid.

When using a tracking generator, this command requires active normalization.

Suffix:

<n>   irrelevant

<t>   irrelevant

Parameters:

<Value>   *RST: 0 dB, coupled to reference level

Example: `DISP:TRAC:Y:RVAL -20dBm`
                        Defines a reference position of -20 dBm.

Manual operation: See "Ref Value" on page 68

DISPlay[:WINDow<n>]:TRACe<t>:Y:SPACing <ScalingType>

This command selects the scaling of the y-axis.

Suffix:

<n>   Selects the measurement window.

<t>   irrelevant

Parameters:

<ScalingType>   **LOGarithmic**
                        Logarithmic scaling.
                        LINear
                        Linear scaling in %.
                        LDB
                        Linear scaling in dB.
                        *RST: LOGarithmic

Example: `DISP:TRAC:Y:SPAC LIN`
                        Select a linear scale.

Manual operation: See "Range Log 100 dB" on page 97
                        See "Range Log 50 dB" on page 97
                        See "Range Log 10 dB" on page 97
                        See "Range Log 5 dB" on page 97
                        See "Range Log 1 dB" on page 98
                        See "Range Log Manual" on page 98
                        See "Range Linear %" on page 98
                        See "Range Lin. Unit" on page 98

8.5 INSTrument subsystem

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

INSTrument[:SELect] <Mode>

This command switches between the measurement modes by means of text parameters.

Parameters:

<Mode>   **BWCD**
                        3G FDD BTS Mode (R&S FSV-K72 option)

INSTrument:NSELect <Mode>

This command switches between the measurement modes by means of numbers.

Parameters:

<Mode>   **8**
                        3G FDD BTS Mode (R&S FSV-K72 option)

8.6 SENSe subsystem (R&S FSV-K72)

The SENSe subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword SENSe is optional, which means that it is not necessary to include the SENSe node in command sequences.

Note that most commands in the SENSe subsystem are identical to the base unit; only the commands specific to this option are described here.

8.6.1 SENSe:CDPower Subsystem

This subsystem controls the parameters for the code domain mode. The numeric suffix in SENSe<source> is not significant in this subsystem.

[SENSe:]CDPower:ANTenna <Mode>

This command activates or deactivates the antenna diversity mode and selects the antenna to be used.

Parameters:

<Mode>	OFF | 1 | 2
	*RST: OFF

Example:	CDP:ANT 1

Mode:	WCDMA

Manual operation:	See "Antenna Diversity" on page 56
	See "Antenna Number" on page 56

[SENSe:]CDPower:ASEQuence

Automatically adjusts the amplitude settings to the signal

Example: SENS:CDP:ASEQ

Mode: WCDMA

[SENSe:]CDPower:CPB <Value>

This command selects the constellation parameter B. According to 3GPP specification, the mapping of 16QAM symbols to an assigned bit pattern depends on the constellation parameter B.

Parameters:

<Value>   <numeric value>

                      *RST: 0

Example: SENS:CDP:ANT 1

Mode: WCDMA

Manual operation: See "Const Param B" on page 63

[SENSe:]CDPower:CODE <CodeNumber>

This command sets the code number. The code number refers to code class 9 (spreading factor 512).

Parameters:

<CodeNumber>   <numeric value>

                      *RST: 0

Example: SENS:CDP:CODE 30

Mode: WCDMA

Manual operation: See "Select Channel" on page 65

[SENSe:]CDPower:FILTer[:STATe] <State>

This command selects if a root raised cosine (RRC) receiver filter is used or not. This feature is useful if the RRC filter is implemented in the device under test (DUT).

Parameters:

<State>   **ON**
                      If an unfiltered WCDMA signal is received (normal case), the RRC filter should be used to get a correct signal demodulation.
                      OFF
                      If a filtered WCDMA signal is received, the RRC filter should not be used to get a correct signal demodulation. This is the case if the DUT filters the signal.
                      *RST: ON

Example:	SENS:CDP:FILT:STAT OFF

Mode: WCDMA

Manual operation: See "RRC Filter" on page 54

[SENSe:]CDPower:FRAMe[:LVALue] <Value>

Selects the frame to be analyzed.

Parameters:

<Value>   <numeric value> [0 ... CAPTURE_LENGTH – 1]

\   *RST: 0

Example: SENS:CDP:FRAM 1

Mode: WCDMA

Manual operation: See "Frame To Analyze" on page 54

[SENSe:]CDPower:HSDPamode <State>

This command selects if the HS-DPCCH channel is searched or not.

Parameters:

<State>   ON | OFF

ON
The high speed channels can be detected. A detection of the modulation type (QPSK /16QAM) is done instead of a detection of pilot symbols.

OFF
The high speed channel can not be detected. A detection of pilot symbols is done instead a detection of the modulation type (QPSK /16QAM)

\   *RST: ON

Example: SENS:CDP:HSDP OFF

Mode: WCDMA

Manual operation: See "HS-DPA/UPA" on page 58

[SENSe:]CDPower:ICTReshold <Value>

This command sets the threshold value from which a channel is treated as active. The level entered refers to the total signal power.

Parameters:

<Value>   <numeric value>

\   *RST: -60 dB

Example: SENS:CDP:ICTR -100

Mode: WCDMA

Manual operation: See "Inactive Channel Threshold" on page 58

[SENSe:]CDPower:IQLength <CaptureLength>

This command specifies the number of frames that are captured by one sweep.

Parameters:

<CaptureLength>	Range:	1 to 100
	*RST:	1

Example: SENS:CDP:IQLength 3

Mode: WCDMA

Manual operation: See "Capture Length" on page 54

[SENSe:]CDPower:LEVel:ADJust

This command adjusts the reference level to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S FSV or limiting the dynamic range by an S/N ratio that is too small.

Example: CDP:LEV:ADJ
Adjusts the reference level.

Mode: CDMA, EVDO, TDS, WCDMA

[SENSe:]CDPower:LCODe[:VALue] <ScramblingCode>

This command defines the scrambling code in hexadecimal format.

Parameters:

<ScramblingCode>	*RST:	0

Example: SENS:CDP:LCOD:#H2
Defines the scrambling code in hexadecimal format.

Mode: WCDMA

Manual operation: See "Format Hex/Dec" on page 57

[SENSe:]CDPower:LCODe:DVALue <ScramblingCode>

This command defines the scrambling code in decimal format.

Parameters:

<ScramblingCode>	<numeric value>	
	*RST:	0

Example: SENS:CDP:LCOD:DVAL 3
Defines the scrambling code in decimal format.

Mode: WCDMA

Manual operation:	See "Scrambling Code" on page 57
	See "Format Hex/Dec" on page 57

[SENSe:]CDPower:LCODe:SEARch:[IMMediate]?

This command automatically searches for the scrambling codes that lead to the highest signal power. The code with the highest power is stored as the new scrambling code for further measurements.

Searching requires that the correct center frequency and level are set. The scrambling code search can automatically determine the primary scrambling code number. The secondary scrambling code number is expected as 0. Alternative scrambling codes can not be detected. Therefore the range for detection is 0x0000 – 0x1FF0h, where the last digit is always 0.

If the search is successful (PASS), a code was found and can be queried using [SENSe:]CDPower:LCODe:SEARch:LIST.

Parameters:	
<Status>	**PASSed**
	Scrambling code(s) found.
	FAILed
	No scrambling code found.
Example:	SENS:CDP:LCOD:SEAR?
	Searches the scrambling code that leads to the highest signal power and returns the status of the search.
Usage:	Query only
Mode:	WCDMA
Manual operation:	See "Autosearch" on page 57
	See "Auto Scrambling Code" on page 79

[SENSe:]CDPower:LCODe:SEARch:LIST

This command returns the automatic search sequence (see [SENSe:]CDPower:LCODe:SEARch:[IMMediate]? on page 187).

Return values:	
Return value	<Code (decimal)>,<Code (hexadecimal)>,<CPICH power (dBm)> for each detected scrambling code
	A comma separated result table of the highest power values and the corresponding scrambling codes in decimal and hexadecimal format.
Example:	SENS:CDP:LCOD:SEAR:LIST?
	Result:
	16,0×10,-18.04,32,0×20,-22.87,48,0×30,-27.62,
	64,0×40,-29.46
	(Explanation in table below)

Mode: WCDMA

Manual operation: See "Scrambling Codes" on page 57

code (dec)	code(hex)	CPICH power (dBm)
16,	0x10,	-18.04
32,	0x20,	-22.87
48,	0x30,	-27.62
64,	0x40,	-29.46

[SENSe:]CDPower:MAPPing <SignalComponent>

This command switches between I and Q component of the signal.

Parameters:

<SignalComponent>   I | Q

*RST: Q

Example: CDP:MAPP Q

Mode: CDMA, WCDMA

[SENSe:]CDPower:MIMO <State>

Activates or deactivates single antenna MIMO measurement mode.

Channels that have modulation type MIMO-QPSK or MIMO-16QAM are only recognized as active channels if this setting is ON.

For details see "MIMO" on page 63.

Parameters:

<State>   ON | OFF

*RST: OFF

Example: SENS:CDP:MIMO ON

Mode: WCDMA

Manual operation: See "MIMO" on page 63

[SENSe:]CDPower:NORMalize <State>

This command switches elimination of I/Q offset on or off.

Parameters:

<State>   ON | OFF

*RST: OFF

Example: SENS:CDP:NORM ON
Activates the elimination of the I/Q offset.

Mode:	WCDMA
Manual operation:	See "Normalize" on page 62

[SENSe:]CDPower:PCONtrol <Position>

This command determines the power control measurement position. An enhanced channel search is used to consider the properties of compressed mode channels.

Parameters:

<Position>	SLOT | PILot
	SLOT The slot power is averaged from the beginning of the slot to the end of the slot.
	PILot The slot power is averaged from the beginning of the pilot symbols of the previous slot to the beginning of the pilot symbols of the current slot.
	*RST: PILot
Example:	SENS:CDP:PCON SLOT Switch to power averaging from slot start to the end of the slot. An enhanced channel search is used to consider the properties of compressed mode channels. SENS:CDP:PCON PIL Switch to power averaging from the pilot symbols of the previous slot number to the start of the pilots of the displayed slot number. The channel search only considers standard channels.
Mode:	WCDMA
Manual operation:	See "Compressed Mode" on page 58

[SENSe:]CDPower:PDIFf <State>

This command activates or deactivates the slot power difference calculation of the POWER VERSUS SLOT display. The slot power difference between the actual and the previous slot is displayed, if the power versus slot display is enabled

Parameters:

<State>	ON | OFF
	ON The slot power difference to the previous slot is displayed (POWER VS SLOT display).
	OFF The slot power of each slot is displayed (POWER VS SLOT display)
	*RST: OFF
Example:	SENS:CDP:PDIF ON

Mode:	WCDMA
Manual operation:	See "Power Difference" on page 63

[SENSe:]CDPower:PDIsplay <Mode>

This command switches between showing the absolute or relative power to the chosen reference.

Parameter only affects the display mode code domain power.

Parameters:

<Mode>	ABS | REL
	*RST: ABS
Example:	SENS:CDP:PDIS ABS
Mode:	WCDMA
Manual operation:	See "Code Power Display" on page 62

[SENSe:]CDPower:PREFerence <Mode>

This command switches between the use of total power or CPICH power as the reference for the relative CDP measurement values.

Parameters:

<Mode>	TOTal | CPICh
	*RST: TOTal
Example:	SENS:CDP:PREF CPIC
Mode:	WCDMA
Manual operation:	See "Power Reference" on page 62

[SENSe:]CDPower:QINVert <State>

This command inverts the Q component of the signal.

Parameters:

ON | OFF	*RST: OFF
Example:	CDP:QINV ON
	Activates inversion of Q component.
Mode:	CDMA, EVDO, TDS, WCDMA
Manual operation:	See "Invert Q" on page 53

[SENSe:]CDPower:SFACtor <SpreadingFactor>

This command defines the spreading factor. The spreading factor is only significant for display mode PEAK CODE DOMAIN ERROR

Parameters:

<SpreadingFactor>   4 | 8 | 16 | 32 | 64 | 128 | 256 | 512

                  *RST: 512

Example: SENS:CDP:SFACtor 16

Mode: WCDMA

[SENSe:]CDPower:SLOT <SlotNumber>

This command sets the slot number of the common pilot channels (CPICH).

Parameters:

<SlotNumber>   <numeric value>

                  *RST: 0

Example: SENS:CDP:SLOT 3

Mode: WCDMA

Manual operation: See "Select Slot" on page 66

[SENSe:]CDPower:STYPe <Type>

This command selects the type of synchronization. If CPICh is selected, the synchronization is carried out to CPICH. For this type of synchronization, the CPICH must be present in the transmit signal. If SCHannel is selected, the synchronization is carried out without CPICh. This type of synchronization is required for test model 4 without CPICH.

Parameters:

<Type>   CPICh | SCHannel

                  *RST: CPICh

Example: SENS:CDP:STYP SCH

Mode: WCDMA

Manual operation: See "Synchronization Type" on page 56

[SENSe:]CDPower:UCPich:CODE <CodeNumber>

This command sets the code number of the user defined CPICH used for signal analysis.

Parameters:

<CodeNumber>   Range: 0 to 225
                  *RST: 0

Example: SENS:CDP:UCP:CODE 10

Mode: WCDMA

Manual operation: See "S-CPICH Code Nr" on page 63

[SENSe:]CDPower:UCPich:PATTern <Pattern>

This command defines which pattern is used for signal analysis for the user-defined CPICH. OFF leads to a pattern selection according to the antenna selection, 1 leads to the fixed usage of "Pattern 1" and 2 leads to the fixed usage of "Pattern 2" according to standard.

Parameters:

<Pattern>   OFF | 1 | 2

                             *RST: OFF

Example: SENS:CDP:UCP:PATT 1

Mode: WCDMA

Manual operation: See "S-CPICH Antenna Pattern" on page 63

[SENSe:]CDPower:UCPich[:STATe] <State>

This command defines if the user defined CPICH settings are valid and shall be used for signal analysis.

Parameters:

<State>   ON | OFF

                             *RST: OFF

Example: SENS:CDP:UCP ON

Mode: WCDMA

Manual operation: See "CPICH Mode" on page 63

8.6.2 SENSe:ADJust Subsystem

[SENSe:]ADJust:ALL

This command activates all automatic settings:

- Level
- Scrambling code

Example: ADJ:ALL

Mode: WCDMA

Manual operation: See "Auto All" on page 79

[SENSe:]ADJust:CONFiguration:HYSTeresis:LOWer <Threshold>

This command defines a lower threshold the signal must drop below before the reference level is automatically adjusted when the "Auto Level" function is performed.

For more information see [SENSe:]ADJust:LEVel).

Parameters:

<Threshold>	Range:	0 to 200
	*RST:	+1 dB
	Default unit: dB	

Example: SENS:ADJ:CONF:HYST:LOW 2

Example: For an input signal level of currently 20 dBm, the reference level will only be adjusted when the signal level falls below 18 dBm.

Manual operation: See "Lower Level Hysteresis" on page 80

[SENSe:]ADJust:CONFiguration:HYSTeresis:UPPer <Threshold>

This command defines an upper threshold the signal must exceed before the reference level is automatically adjusted when the "Auto Level" function is performed.

For more information see [SENSe:]ADJust:LEVel).

Parameters:

<Threshold>	Range:	0 to 200
	*RST:	+1 dB
	Default unit: dB	

Example: SENS:ADJ:CONF:HYST:UPP 2
For an input signal level of currently 20 dBm, the reference level will only be adjusted when the signal level rises above 22 dBm.

Manual operation: See "Upper Level Hysteresis" on page 79

[SENSe:]ADJust:CONFigure:LEVel:DURation <Duration>

This command defines the duration of the level measurement used to determine the optimal reference level automatically (for SENS:ADJ:LEV ON).

Parameters:

<Duration>	<numeric value> in seconds	
	Range:	0.001 to 16000.0
	*RST:	0.001
	Default unit: s	

Example: ADJ:CONF:LEV:DUR:5

Manual operation: See "Meas Time Manual" on page 79

[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE <Mode>

This command selects the way the R&S FSV determines the length of the measurement that is performed while determining the ideal reference level.

Parameters:

<Mode>   **AUTO**
                 Automatically determines the measurement length.

                 MANual
                 Manual definition of the measurement length.

                 *RST: AUTO

Example: `ADJ:CONF:LEV:DUR:MODE MAN`
                 Specifies manual definition of the measurement duration.
                 `ADJ:CONF:LEV:DUR:5`
                 Specifies the duration manually.

[SENSe:]ADJust:FREQuency

This command defines the center frequency automatically by determining the highest level in the frequency span.

Example: `ADJ:FREQ`

[SENSe:]ADJust:LEVel

This command automatically sets the optimal reference level for the current measurement.

You can define a threshold that the signal must exceed before the reference level is adjusted, see `[SENSe:]ADJust:CONFIGuration:HYSTeresis:UPPer` and `[SENSe:]ADJust:CONFIGuration:HYSTeresis:LOWer`.

Example: `ADJ:LEV`

Manual operation: See "Adjust Ref Lvl" on page 53
                        See "Auto Level" on page 79

8.6.3   Other SENSe Commands Referenced in this Manual

8.6.3.1   SENSe:BANDwidth subsystem

[SENSe:]BANDwidth|BWIDth[:RESolution] <Bandwidth>

This command defines the resolution bandwidth.

The available resolution bandwidths are specified in the data sheet. For details on the correlation between resolution bandwidth and filter type refer to chapter 5.2.5, "Selecting the Appropriate Filter Type", on page 23.

Parameters:

<Bandwidth>	refer to data sheet
	*RST: (AUTO is set to ON)

Example:	BAND 1 MHz
	Sets the resolution bandwidth to 1 MHz

Manual operation: See "Res BW Manual" on page 103

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO <State>

This command couples and decouples the resolution bandwidth to the span.

The automatic coupling adapts the resolution bandwidth to the current frequency span according to the relationship between frequency span and resolution bandwidth.

The 6 dB bandwidths 200 Hz, 9 kHz and 120 kHz and the channel filters available are not set by the automatic coupling.

Use [SENSe:]BANDwidth|BWIDth[:RESolution]:RATio to define the ratio RBW/span.

Parameters:

<State>	ON	OFF
	*RST: ON

Example:	BAND:AUTO OFF
	Switches off the coupling of the resolution bandwidth to the span.

Manual operation:	See "Res BW Manual" on page 103
	See "Res BW Auto" on page 103
	See "Default Coupling" on page 108

[SENSe:]BANDwidth|BWIDth[:RESolution]:FFT <FilterMode>

This command defines the filter mode of FFT filters by defining the partial span size. The partial span is the span which is covered by one FFT analysis.

This command is only available for sweep type "FFT".

Parameters:

\<FilterMode\>	**AUTO** The firmware determines whether to use wide or narrow filters to obtain the best measurement results. **NARRow** The FFT filters with the smaller partial span are used. This allows you to perform measurements near a carrier with a reduced reference level due to a narrower analog prefilter. *RST: AUTO

Example:	BAND:TYPE FFT Select FFT filter.
Example:	BAND:FFT NARR Select narrow partial span for FFT filter.
Manual operation:	See "Auto" on page 106 See "Narrow" on page 106

[SENSe:]BANDwidth|BWIDth[:RESolution]:RATio \<Ratio\>

This command defines the ratio between the resolution bandwidth (Hz) and the span (Hz).

Note that the ratio defined with the remote command (RBW/span) is reciprocal to that of the manual operation (span/RBW).

Parameters:

\<Ratio\>	Range:	0.0001 to 1
	*RST:	0.01

Example:	BAND:RAT 0.01
Manual operation:	See "Span/RBW Manual" on page 107

[SENSe:]BANDwidth|BWIDth[:RESolution]:TYPE \<FilterType\>

This command selects the type of resolution filter.

For detailed information on filters see chapter 5.2.5, "Selecting the Appropriate Filter Type", on page 23 and chapter 5.2.6, "List of Available RRC and Channel Filters", on page 23.

When changing the filter type, the next larger filter bandwidth is selected if the same filter bandwidth is not available for the new filter type.

5 Pole filters are not available when using the sweep type "FFT".

Parameters:

<FilterType>   **NORMal**
                      Gaussian filters

                      CFILter
                      channel filters

                      RRC
                      RRC filters

                      P5
                      5 Pole filters

                      *RST: NORMal

Example: BAND:TYPE NORM

Manual operation: See "Filter Type" on page 108

[SENSe:]BANDwidth|BWIDth:VIDeo <Bandwidth>

This command defines the video bandwidth. The available video bandwidths are specified in the data sheet.

Parameters:

<Bandwidth>   refer to data sheet

                      *RST: (AUTO is set to ON)

Example: BAND:VID 10 kHz

Manual operation: See "Video BW Manual" on page 103

[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO <State>

This command couples and decouples the VBW to the RBW.

Use [SENSe:]BANDwidth|BWIDth:VIDeo:RATio to define the ratio VBW/RBW.

Parameters:

<State>   ON | OFF

                      *RST: ON

Example: BAND:VID:AUTO OFF

Manual operation: See "Video BW Manual" on page 103
                      See "Video BW Auto" on page 104
                      See "Default Coupling" on page 108

[SENSe:]BANDwidth|BWIDth:VIDeo:RATio <Ratio>

This command defines the ratio between video bandwidth (Hz) and resolution bandwidth (Hz).

Note that the ratio defined with the remote command (VBW/RBW) is reciprocal to that of the manual operation (RBW/VBW).

Parameters:

<Ratio>	Range:	0.01 to 1000
	*RST:	3

Example: `BAND:VID:RAT 3`

Sets the coupling of video bandwidth to video bandwidth = 3*resolution bandwidth

Manual operation: See "RBW/VBW Sine [1/1]" on page 106

See "RBW/VBW Pulse [.1]" on page 106

See "RBW/VBW Noise [10]" on page 107

See "RBW/VBW Manual" on page 107

See "Span/RBW Auto [100]" on page 107

[SENSe:]BANDwidth|BWIDth:VIDeo:TYPE <Mode>

This command selects the position of the video filter in the signal path.

Changing the video filter position is possible only if the resolution bandwidth is ≤100 kHz.

Parameters:

<Mode>   **LINear**

The video filter is applied in front of the logarithmic amplifier. In linear mode, measurements with a logarithmic level scale result in flatter falling edges compared to logarithmic mode. The reason is the conversion of linear power values into logarithmic level values: if you halve the linear power, the logarithmic level decreases by 3 dB.

LOGarithmic

The video filter is applied after the logarithmic amplifier.

*RST: LINear

Example: `BAND:VID:TYPE LIN`

Video filter ahead of the logarithmic amplifier

8.6.3.2 SENSe:FREQuency subsystem

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency (frequency domain) or measuring frequency (time domain).

Parameters:

<Frequency>   Range: 0 to fmax
                  *RST: fmax/2
                  Default unit: Hz
                  f_{max} is specified in the data sheet. min span is 10 Hz

Example: FREQ:CENT 100 MHz

Manual operation: See "Center" on page 52

[SENSe:]FREQuency:CENTer:STEP <StepSize>

This command defines the center frequency step size.

Parameters:

<StepSize>   Range: 1 to fmax
                  *RST: 0.1 x <span value>
                  Default unit: Hz

Example: FREQ:CENT:STEP 120 MHz

Manual operation: See "CF Stepsize" on page 67
                        See "Manual" on page 94

[SENSe:]FREQuency:CENTer:STEP:AUTO <State>

This command couples the step size of the center frequency to the span (ON) or sets the value of the center frequency entered via [SENSe:]FREQuency:CENTer (OFF).

Parameters:

<State>   ON | OFF

                  *RST: ON

Example: FREQ:CENT:STEP:AUTO ON
                  Activates the coupling of the step size to the span.

[SENSe:]FREQuency:CENTer:STEP:LINK <CouplingType>

This command couples and decouples the center frequency step size to the span or the resolution bandwidth.

Parameters:

<CouplingType>   **SPAN**
                        Couples the step size to the span. Available for measurements
                        in the frequency domain.

                        RBW
                        Couples the step size to the resolution bandwidth. Available for
                        measurements in the time domain.

                        OFF
                        Decouples the step size (manual input).

                        *RST: SPAN

Example: FREQ:CENT:STEP:LINK SPAN

Manual operation: See "0.1*Span (span > 0)" on page 92
                        See "0.1*RBW (span > 0)" on page 93
                        See "0.5*Span (span > 0)" on page 93
                        See "0.5*RBW (span > 0)" on page 93
                        See "x*Span (span > 0)" on page 93
                        See "x*RBW (span > 0)" on page 93

[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <Factor>

This command defines a step size factor if the center frequency step size is coupled to
the span or the resolution bandwidth.

Parameters:

<Factor>   Range: 1 to 100
                        *RST: 10
                        Default unit: PCT

Example: FREQ:CENT:STEP:LINK:FACT 20PCT

Manual operation: See "0.1*Span (span > 0)" on page 92
                        See "0.1*RBW (span > 0)" on page 93
                        See "0.5*Span (span > 0)" on page 93
                        See "0.5*RBW (span > 0)" on page 93

[SENSe:]FREQuency:OFFSet <Offset>

This command defines the frequency offset.

Parameters:

<Offset>   Range: -100 GHz to 100 GHz
                        *RST: 0 Hz
                        Default unit: Hz

Example: FREQ:OFFS 1GHZ

Manual operation: See "Frequency Offset" on page 52

[SENSe:]FREQuency:SPAN <Span>

This command defines the frequency span.

Parameters:

<Span>   min span to fmax

                          *RST: fmax
                          f_{max} is specified in the data sheet. min span is 10 Hz

Example: FREQ:SPAN 10MHz

Manual operation: See "Span Manual" on page 95

[SENSe:]FREQuency:SPAN:FULL

This command sets the frequency span to its maximum.

Example: FREQ:SPAN:FULL

Manual operation: See "Full Span" on page 95

[SENSe:]FREQuency:STARt <Frequency>

This command defines the start frequency for measurements in the frequency domain.

Parameters:

<Frequency>   0 to (fmax - min span)

                          *RST: 0
                          f_{max} is specified in the data sheet. min span is 10 Hz

Example: FREQ:STAR 20MHz

Manual operation: See "Start" on page 94

[SENSe:]FREQuency:STOP <Frequency>

This command defines the stop frequency for measurements in the frequency domain.

Parameters:

<Frequency>   min span to fmax

                          *RST: fmax
                          f_{max} is specified in the data sheet. min span is 10 Hz

Example: FREQ:STOP 2000 MHz

Manual operation: See "Stop" on page 94

8.6.3.3 SENSe:POWer subsystem

[SENSe:]POWer:ACHannel:ACPairs <ChannelPairs>

This command sets the number of adjacent channels (upper and lower channel in pairs).The figure 0 stands for pure channel power measurement.

Parameters:

<ChannelPairs>   0 to 12

                   *RST: 1

Example: POW:ACH:ACP 3
                   Sets the number of adjacent channels to 3, i.e. the adjacent channel and alternate adjacent channels 1 and 2 are switched on.

[SENSe:]POWer:ACHannel:MODE <Mode>

This command switches between absolute and relative adjacent channel measurement. The command is only available with span > 0 and if the number of adjacent channels is greater than 0.

For the relative measurement the reference value is set to the currently measured channel power using the command [SENSe:]POWer:ACHannel:REFerence: AUTO ONCE.

Parameters:

<Mode>   ABSolute | RELative

                   ABSolute
                   absolute adjacent channel measurement
                   RELative
                   relative adjacent channel measurement

                   *RST: RELative

Example: POW:ACH:MODE REL
                   Sets the adjacent channel measurement mode to relative.

[SENSe:]POWer:ACHannel:PRESet:RLEVel

This command adapts the reference level to the measured channel power and – if required – switches on previously the adjacent channel power measurement. This ensures that the signal path of the instrument is not overloaded. Since the measurement bandwidth is significantly smaller than the signal bandwidth in channel power measurements, the signal path can be overloaded although the trace is still significantly below the reference level. If the measured channel power equals the reference level, the signal path is not overloaded.

Subsequent commands have to be synchronized with *WAI, *OPC or *OPC? to the end of the auto range process which would otherwise be aborted.

Example: POW:ACH:PRES:RLEV;*WAI

Adapts the reference level to the measured channel power.

[SENSe:]POWer:ACHannel:REFerence:AUTO ONCE

This command sets the reference value to the currently measured channel power for the relative measurement.

Example: POW:ACH:REF:AUTO ONCE

[SENSe:]POWer:ACHannel:SPACing:ALTernate<channel> <Spacing>

This command defines the spacing between the alternate adjacent channels and the TX channel (ALT1, ALT2, ...). A modification of a higher adjacent-channel spacing causes a change by the same factor (new spacing value/old spacing value) in all higher adjacent-channel spacings, while the lower adjacent-channel spacings remain unchanged.

Suffix:

<channel>	1...11
	the alternate adjacent channel

Parameters:

<Spacing>	100 Hz to 20 GHz
	*RST: 40 kHz (ALT1), 60 kHz (ALT2), 80 kHz (ALT3), ...

Example: POW:ACH:SPAC:ALT1 100 kHz

Sets the spacing between TX channel and alternate adjacent channel 1 (ALT1) from 40 kHz to 100 kHz. In consequence, the spacing between the TX channel and all higher alternate adjacent channels is increased by the factor 100/40 = 2.5: ALT2 = 150 kHz, ALT3 = 200 kHz, ALT4 = 250 kHz.

[SENSe:]POWer:ACHannel:TXCHannel:COUNt <Number>

This command selects the number of carrier signals.

The command is available only for multicarrier channel and adjacent-channel power measurements with span > 0 (see CALCulate<n>:MARKer<m>:FUNCtion:POWer: SELect on page 133).

Parameters:

<Number>	1 to 18
	*RST: 1

Example: POW:ACH:TXCH:COUN 3

[SENSe:]POWer:NCORrection <Mode>

This command turns noise cancellation on and off.

If noise cancellation is on, the R&S FSV performs a reference measurement to determine its inherent noise and subtracts the result from the channel power measurement result (first active trace only).

The inherent noise of the instrument depends on the selected center frequency, resolution bandwidth and level setting. Therefore, the correction function is disabled whenever one of these parameters is changed. A corresponding message is displayed on the screen. Noise correction must be turned on again manually after the change.

Parameters:

<Mode>   **ON**
                         Performs noise correction.

                         OFF
                         Performs no noise correction.

                         AUTO
                         Performs noise correction.
                         After a parameter change, noise correction is restarted automatically and a new correction measurement is performed.

                         *RST: OFF

Example: POW:NCOR ON

Manual operation: See "Noise Correction" on page 101

[SENSe:]POWer:TRACe <TraceNumber>

This command assigns the channel/adjacent channel power measurement to the indicated trace. The corresponding trace must be active, i.e. its state must be different from blank.

Note: The measurement of the occupied bandwidth (OBW) is performed on the trace on which marker 1 is positioned. To evaluate another trace, marker 1 must be positioned to another trace with CALCulate<n>:MARKer<m>:TRACe.

Parameters:

<TraceNumber>   1 to 6

Example: POW:TRAC 2
                        Assigns the measurement to trace 2.

8.6.3.4 SENSe:SWEep subsystem

[SENSe:]SWEep:COUNt <NumberSweeps>

This command defines the number of sweeps started with single sweep, which are used for calculating the average or maximum value. If the values 0 or 1 are set, one sweep is performed.

Parameters:

<NumberSweeps>   0 to 32767

*RST: 0 (GSM: 200, PHN:1)

Example: `SWE:COUN 64`

Sets the number of sweeps to 64.

`INIT:CONT OFF`

Switches to single sweep mode.

`INIT;*WAI`

Starts a sweep and waits for its end.

Manual operation: See "Sweep Count" on page 71

[SENSe:]SWEep:EGATe:POLarity <Polarity>

This command determines the polarity of the external gate signal. The setting applies both to the edge of an edge-triggered signal and the level of a level-triggered signal.

Parameters:

<Polarity>   POSitive | NEGative

*RST: POSitive

Example: `SWE:EGAT:POL POS`

Manual operation: See "Trigger Polarity" on page 72

[SENSe:]SWEep:POINts <NumberPoints>

This command defines the number of measurement points to be collected during one sweep.

Note: For Spurious Emissions measurements the maximum number of sweep points in all ranges is limited to 100001.

Parameters:

<NumberPoints>   Range: 101 to 32001

*RST: 691

Example: `SWE:POIN 251`

Manual operation: See "Sweep Points" on page 112

[SENSe:]SWEep:TIME <Time>

This command defines the sweep time.

The range depends on the frequency span.

Parameters:

<Time>   refer to data sheet

                               *RST: (automatic)

Example: SWE:TIME 10s

Manual operation: See "Sweeptime Manual" on page 95

[SENSe:]SWEep:TIME:AUTO <State>

In realtime mode, this command automatically sets the sweep time to 32 ms.

In analyzer mode, this command controls the automatic coupling of the sweep time to the frequency span and bandwidth settings. If [SENSe:]SWEep:TIME is used, automatic coupling is switched off.

Parameters:

<State>   ON | OFF

                               *RST: ON

Example: SWE:TIME:AUTO ON
                               Activates automatic sweep time.

Manual operation: See "Sweeptime Manual" on page 95
                               See "Sweeptime Auto" on page 105
                               See "Default Coupling" on page 108

[SENSe:]SWEep:TYPE <Type>

This command selects the sweep type.

Parameters:

<Type>   **SWE**
                               Selects analog frequency sweeps.

                               AUTO
                               Automatically selects the sweep type (FFT or analog frequency sweep).

                               FFT
                               Selects FFT sweeps.

                               *RST: AUTO

Example: SWE:TYPE FFT
                               Selects FFT sweeps.

Manual operation: See "Sweep" on page 105
                               See "FFT" on page 105
                               See "Auto" on page 106

8.6.3.5 Other Commands in the SENSe Subsystem

[SENSe:]AVERage<n>:COUNt <NoMeasurements>

This command defines the number of measurements which contribute to the average value.

Note that continuous averaging is performed after the indicated number has been reached in continuous sweep mode.

In single sweep mode, the sweep is stopped as soon as the indicated number of measurements (sweeps) is reached. Synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

This command has the same effect as the `[SENSe<source>:]SWEep:COUNt` command. In both cases, the number of measurements is defined whether the average calculation is active or not.

The number of measurements applies to all traces in the window.

Suffix:

<n>	Selects the measurement window.

Parameters:

<NoMeasurements>	0 to 32767
	*RST: 0

Example:	`SWE:CONT OFF`
	Switching to single sweep mode.
	`AVER:COUN 16`
	Sets the number of measurements to 16.
	`AVER:STAT ON`
	Switches on the calculation of average.
	`INIT;*WAI`
	Starts the measurement and waits for the end of the 16 sweeps.

[SENSe:]AVERage<n>[:STATe<Trace>] <State>

This command turns averaging for a particular trace in a particular window on and off.

Suffix:

<n>	Selects the measurement window.
<Trace>	1...6
	Selects the trace.

Parameters:

<State>	ON	OFF
	*RST: OFF

Example:	`AVER OFF`
	Switches off the average calculation for trace 1.
	`AVER:STAT3 ON`
	Switches on the average calculation for trace 3.

8.7 STATus:QUEStionable subsystem (R&S FSV-K72)

The STATus subsystem contains the commands for the status reporting system (for details refer to the description of remote control basics in the base unit). *RST does not influence the status registers.

The STATus:QUEStionable subsystem contains information about the observance of limits during adjacent power measurements, the reference and local oscillator, the observance of limit lines and limit margins and possible overloads of the unit.

8.7.1 STATus:QUEStionable:SYNC subsystem (R&S FSV-K72)

This register contains information on the error situation in the code domain power analysis of the R&S FSV-K72 option. It can be queried with the following commands:

STATus:QUEStionable:SYNC:CONDition?

This command reads the information on the error situation in the code domain power analysis.

Return values:

<Result>   If the result is ON, an error occurred. Details can be obtained
                             using STAT:QUES:SYNC:EVEN.

                             *RST: OFF

Example: STAT:QUES:SYNC:COND?

Usage: Query only

Mode: WCDMA, CDMA, EVDO

STATus:QUEStionable:SYNC[:EVENt]?

This command reads the information on the error situation in the code domain power analysis. The value can only be read once. The possible events are described in the table below.

Example: STAT:QUES:SYNC[:EVEN]?

Usage: Query only

Mode: WCDMA, CDMA, EVDO

Bit	Definition
0	Not used.
1	Frame Sync failed
	This bit is set when synchronization is not possible within the application.
	Possible reasons:
	• Incorrectly set frequency
	• Incorrectly set level
	• Incorrectly set scrambling code
	• Incorrectly set values for Q-INVERT or SIDE BAND INVERT
	• Invalid signal at input
	• Antenna 1 synchronization is not possible (Time Alignment Error measurements, R&S FSV-K72 only)
2	For Time Alignment Error measurements (R&S FSV-K72 only): bit is set if antenna 2 synchronization is not possible;
	Otherwise: not used.
3 to 4	Not used.
5	Incorrect Pilot Symbol
	This bit is set when one or more of the received pilot symbols are not equal to the specified pilot symbols of the 3GPP standard.
	Possible reasons:
	• Incorrectly sent pilot symbols in the received frame.
	• Low signal to noise ratio (SNR) of the WCDMA signal.
	• One or more code channels has a significantly lower power level compared to the total power. The incorrect pilots are detected in these channels because of low channel SNR.
	• One or more channels are sent with high power ramping. In slots with low relative power to total power, the pilot symbols might be detected incorrectly (check the signal quality by using the symbol constellation display).
6 to 14	Not used.
15	This bit is always 0.

8.8   TRACe subsystem (R&S FSV-K72)

The TRACe subsystem controls access to the instruments internal trace memory.

8.8.1   Description of Channel Types

The following table describes the channel types and their abbreviations.

Channel type	Description
0 - DPCH	**D**edicated **P**hysical **Ch**annel of a standard frame
1 - PICH	**P**aging **I**ndication **Ch**annel

Channel type	Description
2 - CPICH	**C**ommon **Pi**lot **Ch**annel
3 - PSCH	**P**rimary **S**ynchronization **Ch**annel
4 - SSCH	**S**econdary **S**ynchronization **Ch**annel
5 - PCCPCH	**P**rimary **C**ommon **C**ontrol **P**hysical **Ch**annel
6 - SCCPCH	**S**econdary **C**ommon **C**ontrol **P**hysical **Ch**annel
7 - HS_SCCH	HSDPA: **H**igh **S**peed **S**hared **C**ontrol **Ch**annel
8 - HS_PDSCH	HSDPA: **H**igh **S**peed **P**hysical **D**ownlink **S**hared **Ch**annel
9 - CHAN	Channel without any pilot symbols (QPSK modulated)
10 - CPRSD	Dedicated Physical Channel in **compres**s**ed** mode
11 - CPR-TPC	Dedicated Physical Channel in **compr**essed mode **TPC** symbols are sent in the first slot of the gap.
12 - CPR-SF/2	Dedicated Physical Channel in **compr**essed mode using half spreading factor (**SF/2**).
13 - CPR-SF/2-TPC	Dedicated Physical Channel in **compr**essed mode using half spreading factor (**SF/2**). **TPC** symbols are sent in the first slot of the gap.
14 - EHICH-ERGCH	HSUPA: **E**nhanced **HA**RQ Hybrid Acknowledgement **I**ndicator **Ch**annel HSUPA: **E**nhanced **R**elative **G**rant **Ch**annel
15 - EAGCH	E-AGCH: **E**nhanced **A**bsolute **G**rant **Ch**annel
16 - SCPICH	**S**econdary **C**ommon **Pi**lot **Ch**annel

8.8.2 TRACe:DATA subsystem (R&S FSV-K72)

The `TRACe:DATA` subsystem provides commands to query the trace results depending on the selected measurement mode.

TRACe<n>[:DATA]? <MeasMode>

This command reads trace data out of the instrument. Depending on the selected measurement mode, the results vary. For a detailed description of the results, see the individual commands:

- TRACe<n>[:DATA]? ABITstream<1...4>
- TRACe<n>[:DATA]? ATRACE<1...4>
- TRACe<n>[:DATA]? CTABLe
- TRACe<n>[:DATA]? CWCDp
- TRACe<n>[:DATA]? FINAL1
- TRACe<n>[DATA]? LIST
- TRACe<n>[:DATA]? PWCDp
- TRACe<n>[:DATA]? TPVSlot
- TRACe<n>[:DATA]? TRACE<t>

Suffix:

<n>	1...4
	irrelevant

Query parameters:

<MeasMode>	ATRACE1 | AWCDMATRACE2 | ATRACE3 | ATRACE4 | FINAL1 | TRACE1 | TRACE2 | TRACE3 | TRACE4 | ABITstream1 | ABITstream2 | ABITstream3 | ABITstream4 | PWCDp | CWCDp | CTABLe | TPVSlot | LIST
	The data type defines which type of trace data is read.

Example:	TRAC:DATA ATRACE3
Usage:	Query only
Mode:	WCDMA

TRACe<n>[:DATA]? <ABitstreamNo>

This command returns the bit streams of all 15 slots one after the other. The output format may be REAL, UINT or ASCII. The number of bits of a 16QAM-modulated channel is twice that of a QPSK-modulated channel, the number of bits of a 64QAM-modulated channel is three times that of a QPSK-modulated channel.

This query is only available if the result diagram for the corresponding screen is set to "Bitstream", e.g. using the CALC:FEED "XTIM:CDP:BSTReam" command (see CALCulate<n>:FEED on page 129).

The output format is identical to that of the `TRAC1:DATA? TRAC2` command for an activated Bitstream display (see `TRACe<n>[:DATA]?` on page 218). The only difference is the number of symbols which are evaluated. The ABITstream parameter evaluates all symbols of one frame. Each symbol contains two (QPSK) or four (16QAM) consecutive bits. One value is transferred per bit (range 0,1,). The number of symbols is not constant and may vary depending on the selected channel and its symbol modulation type. Individual symbols in the bit stream may be invalid depending on the channel type and the bit rate (symbols without power).

If "HS-DPA/UPA" is disabled (see "Channel Detection Settings" on page 57 or `[SENSe:]CDPower:HSDPamode` on page 185), the values and number of the bits are as follows:

Unit	[]
Value range	{0, 1, 6, 9} 0 - Low state of a transmitted bit 1 - High state of a transmitted bit 6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD) 9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)
Bits per slot	$N_{BitPerSymb} = 2$
Number of symbols	$N_{Symb} = 150*2^{(8-Code\ Class)}$
Number of bits	$N_{Bit} = N_{Symb} * N_{BitPerSymb}$
Format	Bit_{00}, Bit_{01}, Bit_{10}, Bit_{11}, Bit_{20}, Bit_{21},.... , $Bit_{NSymb\ 0}$, $Bit_{NSymb\ 1}$

If "HS-DPA/UPA" is enabled (see "Channel Detection Settings" on page 57 or `[SENSe:]CDPower:HSDPamode` on page 185), the values and number of the bits are as follows:

Unit	[]
Value range	{0, 1, 6, 7, 8, 9} 0 - Low state of a transmitted bit 1 - High state of a transmitted bit 6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD) 7 - Bit of a switched-off symbol of an HS-PDSCH channel 8 - Fill value for unused bits of a lower order modulation symbol in a frame containing higher order modulation 9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)
Bits per symbol	$N_{BitPerSymb} = \{2, 4, 6\}$
Symbols per slot	$N_{Symb\_Slot} = 10*2^{(8-Code\ Class)}$
Symbols per frame	$N_{Symb\_Frame} = 15*N_{Symb\_Slot} = 150*2^{(8-Code\ Class)}$
Number of bits	$N_{Bit} = N_{Symb\_Frame} * N_{BitPerSymb\_MAX}$

Format (16QAM)	$Bit_{00}, Bit_{01}, Bit_{02}, Bit_{03}, Bit_{10}, Bit_{11}, Bit_{12}, Bit_{13}, \ldots \ldots$, $Bit_{NSymb\_Frame\ 0}, Bit_{NSymb\_Frame\ 1}, Bit_{NSymb\_Frame\ 2}, Bit_{NSymb\_Frame\ 3}$
Format (64QAM)	$Bit_{00}, Bit_{01}, Bit_{02}, Bit_{03}, Bit_{04}, Bit_{05}, Bit_{10}, Bit_{11}, Bit_{12}, Bit_{13}, Bit_{14}, Bit_{15}, \ldots$, $Bit_{NSymb\_Frame\ 0}, Bit_{NSymb\_Frame\ 1}, Bit_{NSymb\_Frame\ 2}, Bit_{NSymb\_Frame\ 3}, Bit_{NSymb\_Frame\ 4}, Bit_{NSymb\_Frame\ 5}$

The values 7 and 8 are only used in case of a varying modulation type of an HS-PDSCH channel. In this case the number of bits per symbol (NBitPerSymb) varies, as well. However, the length of the transmitted bit vector (NBit) depends only on the maximum number of bits per symbol in that frame. Thus, if the modulation type changes throughout the frame this will not influence the number of bits being transmitted.

Example 1:

Some slots of the frame are 64QAM modulated, other are 16QAM and QPSK modulated and some are switched OFF (NONE). If one or more slots of the frame are 64QAM modulated, six bits per symbol are transmitted and if the highest modulation order is 16QAM, four bits per symbol are transmitted. In any slot of the frame with lower order modulation, the first two or four of the four or six bits are marked by the number 8 and the last bits represent the transmitted Remote Control Commands symbol. If no power is transmitted in a slot, four or six entries per symbol of value 7 are transmitted.

Example 2:

Some slots of the frame are QPSK modulated and some are switched OFF. If one or more slots of the frame are QPSK modulated and no slot is 16QAM modulated, 2 bits per symbol are transmitted. If no power is transmitted in a slot, 2 entries per symbol of value 7 are transmitted.

Example 3:

Some slots of a DPCH are suppressed because of compressed mode transmittion. The bits of the suppressed slots are marked by the digit '6'. In this case, always 2 bits per symbol are transmitted.

Suffix:

<n>   1...4
                            irrelevant

Query parameters:

<ABitstreamNo>   **ABITstream1 | ABITstream2 | ABITstream3 | ABITstream4**
                            Number of the active bit stream.

Example: `CALC2:FEED "XTIM:CDP:BSTReam"`
                            Sets the result display for screen B to bit stream.
                            `TRAC2:DATA? ABITstream2`
                            Returns the bit streams of all 15 slots in trace 2 (screen B), one after the other.

Usage: Query only

Mode: WCDMA

TRACe<n>[:DATA]? <ATRACE>

This command returns a list of absolute frequency errors vs slot for all slots. In contrast to the scope presentation and the TRACE<t> parameter return value, absolute values are returned.

Suffix:

<n>   1...4
                                irrelevant

Query parameters:

<ATRACE>   **ATRACE1 | ATRACE2 | ATRACE3 | ATRACE4 | ATRACE5 |
                                ATRACE6**
                                Trace number for which absolute values are returned.

Return values:

<Result>   SlotNumber 0, FreqError 0, …., SlotNumber 14, FreqError 14

                                Comma-separated list with 15 entries, one for each slot

                                Default unit: Hz

Example: `TRAC2:DATA? ATRACE2`
                                Returns a list of absolute frequency errors for all slots in trace 2 (screen B).

Usage: Query only

Mode: WCDMA

TRACe<n>[:DATA]? CTABLe

This command returns the pilot length and the channel state (active, inactive) in addition to the values returned for "TRACE<t>".

Suffix:

<n>   1...4
                                irrelevant

Return values:

<Result>   < class>,<channel number>,<absolute level>,<relative level>,<timing offset> or <I/Q-mapping>, <pilot length>, <active | inactive>

                                Comma-separated list with 7 values for each channel; the pilot length is specified in symbols.
                                For details on the other result information, see `TRACe<n>[:DATA]?` on page 218.

Example: `TRAC:DATA? CTABLe`
                                Returns a list of channel information, including the pilot length and channel state.

Usage: Query only

Mode: WCDMA

TRACe<n>[:DATA]? CWCDp

This command returns pilot length, channel state, channel type, modulation type and a reserved value in addition to the values returned for "TRACE<t>" (see TRACe<n>[: DATA]? on page 218).

Suffix:

<n>	1...4
	irrelevant

Return values:

<Result>   <code class>,<channel number>,<absolute level>,<relative level>, <timing offset>, <pilot length>, <active flag>, <channel type>, <modulation type>, <reserved>

Comma-separated list with 10 values for each channel; the channels are output in ascending order sorted by code number, i.e. in the same sequence they are displayed on screen.

<pilot length>
Pilot length of the code channel. According to the 3GPP standard, the pilot length range depends on the code class.
{0,2,4,8,16} [symbols]

<active flag>
Flag to indicate whether a channel is active
0 – channel not active
1 – channel active

<channel type>
Channel type indication {0 … 16}
For a description of the channel types, see chapter 8.8.1, "Description of Channel Types", on page 209.

<modulation type>
Modulation type of the code channel at the selected channel slot. (The channel slot can be marked by adjusting SELECT CPICH slot.) {2,4,15}
2 – QPSK: Modulation type QPSK.
4 – 16QAM: Modulation type 16QAM.
15 – NONE: There is no power in the selected channel slot [slot is switched OFF]. (According to 3GPP, the power of an HSDPA channel can be switched every 2 ms, i.e. 3 slots.)

reserved
for future use

Example: TRAC:DATA? CWCDp
Returns a list of channel information for each channel in ascending order.

Usage: Query only

Mode: WCDMA

TRACe<n>[:DATA]? FINAL1

This command returns the peak list. For each peak the following results are given:

Suffix:

<n>   1...4
                       irrelevant

Return values:

<Result>   <freq1>, <level1>, <delta level 1>, <freq2>, <level2>, <delta
                       level 2>, … <freq n>, <level n>, <delta level n>

Example: `TRAC2:DATA? FINAL1`
                       Returns a list of peak values.

Usage: Query only

Mode: WCDMA

TRACe<n>[:DATA]? LIST

This command returns the peak list of the spectrum emission mask measurement list
evaluation (see also `CALCulate<n>:PEAKsearch|PSEarch:AUTO` on page 164).

Suffix:

<n>   1...4
                       irrelevant

Return values:

<Result>   <No>, <Start>, <Stop>, <Rbw>, <Freq>, <Levelabs>, <Level-
                            rel>, <Delta>, <Limitcheck>, <unused1>, <unused2>

                            An array of values is returned for each range of the limit line
                            (<value array of range 1>, <value array of range 2>, ..., <value
                            array of range n>).

                            No []
                            number of the limit line range

                            Start [Hz]
                            start frequency of the limit line range

                            Stop [Hz]
                            stop frequency of the limit line range

                            Rbw [Hz]
                            resolution band width of the limit line range

                            Freq [Hz]
                            frequency of the power peak with in the range

                            Levelabs [dBm]
                            absolute power of the peak with in the range

                            Levelrel [dB]
                            relative power of the peak with in the range related to channel
                            power.

                            Delta [dB]
                            power difference to margin power

                            Limitcheck [0 | 1]
                            indicates whether the power is below [0] or above [1] the limit
                            line

                            Unused1/2 []
                            for future use

                            Default unit: Hz

Example: TRAC2DATA? ATRACE2
                            Returns a list of absolute frequency errors for all slots in trace 2
                            (screen B).

Usage: Query only

Mode: WCDMA

TRACe<n>[:DATA]? PWCDp

This command returns the pilot length in addition to the values returned for
"TRACE<t>".

Suffix:
<n>   1...4
                            irrelevant

Return values:

<Result>   < class>,<channel number>,<absolute level>,<relative
                            level>,<timing offset> or <I/Q-mapping>, <pilot length>

                            Comma-separated list with six values for each channel; the pilot
                            length is specified in symbols.
                            For details on the other result information, see `TRACe<n>[:`
                            `DATA]?` on page 218.

Example: `TRAC:DATA? PWCDp`
                            Returns a list of channel information, including the pilot length.

Usage: Query only

Mode: WCDMA

TRACe<n>[:DATA]? TPVSlot

This command returns a list of absolute frequency errors vs slot for all slots. In contrast
to the scope presentation and the TRACE<t> parameter return value, absolute values
are returned.

Suffix:

<n>   1...4
                            irrelevant

Return values:

<Result>   <slot number>, <level value in dBm>

                            Comma-separated list with 16 pairs of slots (slot number of
                            CPICH) and level values (for 16 slots)

                            Default unit: Hz

Example: `CALC2:FEED 'XTIM:CDP:PVSLot:ABSolute'`
                            Sets the result display for screen B to POWER VS SLOT.
                            `TRAC2:DATA? TPVSlot`
                            Returns a list of absolute frequency errors for all slots in trace 2
                            (screen B).

Usage: Query only

Mode: WCDMA

TRACe<n>[:DATA]? TRACE<t>

This command returns the trace data. Depending on the display mode, the trace data
format varies. For details see chapter 6.1.2, "Measurement Modes in Code Domain
Analyzer", on page 32.

Suffix:

<n>   1...4
                            irrelevant

<t>   1...4
                            trace 1, 2, 3, 4

Return values:

<Result>
    <code class>,<channel number>,<absolute level>,<relative level>, <timing offset>

Comma-separated list with 5 values for each channel; the channels are output in ascending order sorted by code number, i.e. in the same sequence they are displayed on screen.

<code class>
Code class of the channel {2 … 9}

<channel number>
Code number of the channel {0 … 511}

<absolute level>
Absolute level of the code channel at the selected channel slot. (The channel slot can be marked by the SELECTED CPICH slot.)

<relative level >
Relative level of the code channel at the selected channel slot referenced to CPICH or total power. (The channel slot can be marked by the SELECTED CPICH slot.)

<timing offset>
Timing offset of the code channel to the frame start. The value is measured in chips. The step width is 256 chips in the case of code class 2 to 8, and 512 chips in the case of code class 9. {0 … 38400} [chips]

Example:
    `TRAC2:DATA? TRACE2`
Returns the trace data from trace 2 (screen B).

Usage:
    Query only

Mode:
    WCDMA

8.9 Other Commands Referenced in this Manual

The following commands are identical to those in the base unit and are included in this manual only because they are specifically referenced to here.

See also chapter 8.6.3, "Other SENSe Commands Referenced in this Manual", on page 194 and chapter 8.2.4, "Other CALCulate Commands Referenced in this Manual", on page 138

FORMat:DEXPort:DSEParator <Separator>

This command defines which decimal separator (decimal point or comma) is to be used for outputting measurement data to the file in ASCII format. Different languages of evaluation programs (e.g. MS-Excel) can thus be supported.

Parameters:

<Separator>   POINt | COMMA

                     *RST: (factory setting is POINt; *RST does not affect set-
                               ting)

Example: FORM:DEXP:DSEP POIN
                    Sets the decimal point as separator.

DIAGnostic<n>:SERVice:NSOurce <State>

This command switches the 28 V supply of the noise source on the front panel on or off.

Suffix:

<n>   irrelevant

Parameters:

<State>	ON | OFF
	*RST: OFF

Example: `DIAG:SERV:NSO ON`

Manual operation: See "Noise Source" on page 80

INITiate<n>:CONMeas

This command restarts a measurement that has been stopped in single sweep mode.

The measurement is restarted at the first sweep point.

As opposed to `INITiate<n>[:IMMediate]`, this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using max hold or averaging functions.

In single sweep mode, you can synchronize to the end of the measurement with *OPC, *OPC? or *WAI. In continuous sweep mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous sweep mode in remote control, as results like trace data or markers are only valid after a single sweep end synchronization.

Suffix:

<n>	irrelevant

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`DISP:WIND:TRAC:MODE AVER`
Switches on trace averaging.
`SWE:COUN 20`
Setting the sweep counter to 20 sweeps.
`INIT;*WAI`
Starts the measurement and waits for the end of the 20 sweeps.
`INIT:CONM;*WAI`
Continues the measurement (next 20 sequences) and waits for the end.

Manual operation: See "Continue Single Sweep" on page 71

INITiate<n>:CONTinuous <State>

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

The sweep is started immediately.

Suffix:

<n>	irrelevant

Parameters:

<State>	ON | OFF
	*RST: ON

Example: `INIT:CONT OFF`
Switches the sequence to single sweep.
`INIT:CONT ON`
Switches the sequence to continuous sweep.

Mode: all

Manual operation: See "Continuous Sweep" on page 71
See "Single Sweep" on page 71

INITiate<n>:ESPectrum

This command starts a Spectrum Emission Mask measurement.

Suffix:
<n>   irrelevant

Example: `INIT:ESP`
Starts a Spectrum Emission Mask measurement.

INITiate<n>[:IMMediate]

The command initiates a new measurement sequence.

With sweep count > 0 or average count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

In single sweep mode, you can synchronize to the end of the measurement with *OPC, *OPC? or *WAI. In continuous sweep mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous sweep mode in remote control, as results like trace data or markers are only valid after a single sweep end synchronization.

Suffix:
<n>   irrelevant

Example: `INIT:CONT OFF`
Switches to single sweep mode.
`DISP:WIND:TRAC:MODE AVER`
Switches on trace averaging.
`SWE:COUN 20`
Setting the sweep counter to 20 sweeps.
`INIT;*WAI`
Starts the measurement and waits for the end of the 20 sweeps.

Mode: all

INPut:ATTenuation <Value>

This command programs the input attenuator. To protect the input mixer against damage from overloads, the setting 0 dB can be obtained by entering numerals, not by using the DOWN command.

The attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). If the defined reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

In the default state with "Spectrum" mode, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

This function is not available if the R&S Digital I/Q Interface (R&S FSV-B17) is active.

Parameters:

<Value>	*RST:	10 dB (AUTO is set to ON)

Example: `INP:ATT 30dB`
Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

Mode: all

Manual operation: See "RF Atten Manual/Mech Att Manual" on page 69

INPut:ATTenuation:AUTO <State>

This command automatically couples the input attenuation to the reference level (state ON) or switches the input attenuation to manual entry (state OFF).

This function is not available if the R&S Digital I/Q Interface (R&S FSV-B17) is active.

Parameters:

<State>	ON | OFF
	*RST: ON

Example: `INP:ATT:AUTO ON`
Couples the attenuation set on the attenuator to the reference level.

Manual operation: See "RF Atten Auto/Mech Att Auto" on page 69

INPut:COUPling <CouplingType>

Toggles the RF input of the R&S FSV between AC and DC coupling.

This function is not available if the R&S Digital I/Q Interface (R&S FSV-B17) is active.

Parameters:

<CouplingType>	AC | DC
	*RST: AC

Example: `INP:COUP DC`

Manual operation: See "Input (AC/DC)" on page 70

INPut:DIQ:CDEVice

This command queries the current configuration and the status of the digital baseband input from the optional R&S Digital I/Q Interface (option R&S FSV-B17).

For details see the section "Interface Status Information" for the R&S Digital I/Q Interface (R&S FSV-B17) in the description of the base unit.

Return values:

<ConnState>	Defines whether a device is connected or not.
	0
	No device is connected.
	1
	A device is connected.
<DeviceName>	Device ID of the connected device
<SerialNumber>	Serial number of the connected device
<PortName>	Port name used by the connected device
<SampleRate>	Maximum or currently used sampling rate of the connected device in Hz (depends on the used connection protocol version; indicated by <SampleRateType> parameter)
<MaxTransferRate>	Maximum data transfer rate of the connected device in Hz
<ConnProtState>	State of the connection protocol which is used to identify the connected device.
	Not Started
	Has to be Started
	Started
	Passed
	Failed
	Done
<PRBSTestState>	State of the PRBS test.
	Not Started
	Has to be Started
	Started
	Passed
	Failed
	Done
<SampleRateType>	**0**
	Maximum sampling rate is displayed
	1
	Current sampling rate is displayed
<Placeholder>	for future use; currently "0"

Example:	`INP:DIQ:CDEV?`
	Result:
	`1,SMU200A,103634,Out`
	`A,70000000,100000000,Passed,Not Started,0,0`

Mode:	IQ, VSA, EVDO, CDMA, WCDMA, GSM, ADEMOD, TDS
Manual operation:	See "Connected Device" on page 81 See "Digital IQ Info" on page 81

INPut:DIQ:RANGe:AUTO <State>

If enabled, the digital input fullscale level is automatically set to the value provided by the connected device (if available).

This command is only available if the optional Digital Baseband interface (option R&S FSV-B17) is installed.

For details see the Digital Baseband Interface (R&S FSV-B17) description of the base unit.

Parameters:

<State>	ON | OFF
	*RST: OFF

Example:	`INP:DIQ:RANG:AUTO ON`
Mode:	IQ, VSA, EVDO, CDMA, WCDMA, GSM, ADEMOD, TDS

INPut:DIQ:RANGe:COUPling <State>

If enabled, the reference level for digital input is adjusted to the full scale level automatically if the fullscale level changes.

This command is only available if the optional R&S Digital I/Q Interface (option R&S FSV-B17) is installed.

For details see the R&S Digital I/Q Interface (R&S FSV-B17) description of the base unit.

Parameters:

<State>	ON | OFF
	*RST: OFF

Example:	`INP:DIQ:RANG:COUP OFF`
Mode:	IQ, VSA, EVDO, CDMA, WCDMA, GSM, ADEMOD, TDS
Manual operation:	See "Adjust Reference Level to Full Scale Level" on page 81

INPut:DIQ:RANGe[:UPPer] <Level>

Defines or queries the "Full Scale Level", i.e. the level that should correspond to an I/Q sample with the magnitude "1".

It can be defined either in dBm or Volt (see "Full Scale Level" on page 81).

This command is only available if the optional R&S Digital I/Q Interface (option R&S FSV-B17) is installed.

For details see the R&S Digital I/Q Interface (R&S FSV-B17) description of the base unit.

Parameters:

<Level>	<numeric value>
	Range: 70.711 nV to 7.071 V
	*RST: 1 V

Example: `INP:DIQ:RANG 1V`

Mode: A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

Manual operation: See "Full Scale Level" on page 81

INPut:DIQ:RANGe[:UPPer]:UNIT <Unit>

Defines the unit of the full scale level (see "Level Unit" on page 81). The availability of units depends on the measurement application you are using.

This command is only available if the optional R&S Digital I/Q Interface (option R&S FSV-B17) is installed.

For details see the R&S Digital I/Q Interface (R&S FSV-B17) description of the base unit.

Parameters:

<Level>	V	dBm	dBpW	W	dBmV	dBuV	dBuA	A
	*RST: Volt

Example: `INP:DIQ:RANG:UNIT A`

Mode: IQ, VSA, EVDO, CDMA, WCDMA, GSM, ADEMOD, TDS

Manual operation: See "Level Unit" on page 81

INPut:DIQ:SRATe <SampleRate>

This command specifies or queries the sample rate of the input signal from the R&S Digital I/Q Interface (see "Input Sample Rate" on page 81).

This command is only available if the optional R&S Digital I/Q Interface (option R&S FSV-B17) is installed.

For details see the R&S Digital I/Q Interface (R&S FSV-B17) description of the base unit.

Parameters:

<SampleRate>	Range:	1 Hz to 10 GHz
	*RST:	32 MHz

Example: INP:DIQ:SRAT 200 MHz

Mode: A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD,
                      GSM, OFDM, OFDMA/WiBro, WLAN

Manual operation: See "Input Sample Rate" on page 81

INPut:DIQ:SRATe:AUTO <State>

If enabled, the sample rate of the digital baseband IQ input signal is set automatically by the connected device, if the currently used sample rate is provided (indicated by the <SampleRateType> parameter in the result of the INPut:DIQ:CDEVice command.

This command is only available if the optional R&S Digital I/Q Interface (option R&S FSV-B17) is installed.

For details see the R&S Digital I/Q Interface (B17) description of the base unit.

Parameters:
<State>   ON | OFF

                      *RST: OFF

Example: INP:DIQ:SRAT:AUTO ON

Mode: IQ, VSA, EVDO, CDMA, WCDMA, GSM, ADEMOD, TDS

INPut:EATT <Attenuation>

This command defines the electronic attenuation.

If necessary, the command also turns the electronic attenuator on.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

The attenuation can be varied in 1 dB steps from 0 to 25 dB. Other entries are rounded to the next lower integer value.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

Parameters:
<Attenuation>   0...25

                      *RST: 0 dB (OFF)

Example: INP1:EATT 10 dB

Mode: all

Manual operation: See "El Atten Mode (Auto/Man)" on page 70

INPut:EATT:AUTO <State>

This command switches the automatic behaviour of the electronic attenuator on or off. If activated, electronic attenuation is used to reduce the operation of the mechanical attenuation whenever possible.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

Parameters:

<State>	ON | OFF
	*RST: ON

Example:	INP1:EATT:AUTO OFF
Mode:	all
Manual operation:	See "El Atten On/Off" on page 69
	See "El Atten Mode (Auto/Man)" on page 70

INPut:EATT:STATe <State>

This command turns the electronic attenuator on or off.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

Parameters:

<State>	ON | OFF
	*RST: OFF

Example:	INP:EATT:STAT ON
	Switches the electronic attenuator into the signal path.

INPut:GAIN:STATe <State>

This command turns the 20 dB preamplifier on and off.

With option R&S FSV-B22, the preamplifier only has an effect below 7 GHz.

With option R&S FSV-B24, the amplifier applies to the entire frequency range.

This command is not available when using R&S Digital I/Q Interface (R&S FSV-B17).

Parameters:

<State>	ON | OFF
	*RST: OFF

Example:	INP:GAIN:STAT ON
	Turns the preamplifier on.
Manual operation:	See "Preamp On/Off" on page 53

INPut:IMPedance <Impedance>

This command selects the nominal input impedance.

75 Ω should be selected if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type (= 25 Ω in series to the input impedance of the instrument). The correction value in this case is 1.76 dB = 10 log (75Ω/50Ω).

This function is not available if the R&S Digital I/Q Interface (R&S FSV-B17) is active.

Parameters:

<Impedance>	50 | 75
	*RST: 50 Ω

Example:	INP:IMP 75

Manual operation:	See "Input 50 Ω/75 Ω " on page 102

INPut:SELect <Source>

This command selects the signal source for measurements.

Parameters:

<Source>	RF | DIQ
	RF
	Radio Frequency ("RF INPUT" connector)
	DIQ
	Digital IQ (only available with R&S Digital I/Q Interface, option R&S FSV-B17)
	*RST: RF

Example:	INP:SEL RF

Mode:	A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

Manual operation:	See "Input Path" on page 81

MMEMory:STORe<n>:LIST <FileName>

This command stores the current list evaluation results in a <file name>.dat file. The file consists of a data section containing the list evaluation results.

Suffix:

<n>	irrelevant

Parameters:

<FileName>	<file name>

Example:	MMEM:STOR:LIST 'test'
	Stores the current list evaluation results in the test.dat file.

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

This command stores the selected trace in the specified window in a file with ASCII for-
mat. The file format is described in chapter 5.2.7, "ASCII File Export Format",
on page 25

The decimal separator (decimal point or comma) for floating-point numerals contained
in the file is defined with the FORMat:DEXPort:DSEParator command (see
FORMat:DEXPort:DSEParator on page 220).

Suffix:

<n>   window; For applications that do not have more than 1 measure-
                           ment window, the suffix <n> is irrelevant.

Parameters:

<Trace>   1 to 6

                           selected measurement trace

<FileName>   DOS file name
                           The file name includes indication of the path and the drive name.
                           Indication of the path complies with DOS conventions.

Example: MMEM:STOR:TRAC 3,'TEST.ASC'
                           Stores trace 3 in the file TEST.ASC.

SYSTem:DISPlay:UPDate <State>

In remote control mode, this command switches on or off the instrument display. If
switched on, only the diagrams, traces and display fields are displayed and updated.

The best performance is obtained if the display output is switched off during remote
control.

Parameters:

<State>   ON | OFF
                           *RST: OFF

Example: SYST:DISP:UPD ON

TRIGger<n>[:SEQuence]:LEVel:BBPower <Level>

This command sets the level of the baseband power trigger source (for digital input via
the R&S Digital I/Q Interface, R&S FSV-B17).

Suffix:

<n>   irrelevant

Parameters:

<Level>   Range: -50 dBm to +20 dBm
                           *RST: -20 DBM

Example: TRIG:LEV:BB -30DBM

Mode: All

TRIGger<n>[:SEQuence]:BBPower:HOLDoff <Value>

This command sets the holding time before the next BB power trigger event (for digital input via the R&S Digital I/Q Interface, R&S FSV-B17).

Suffix:

<n>   irrelevant

Parameters:

<Value>   *RST: 150 ns

Example: `TRIG:SOUR BBP`
                       Sets the baseband power trigger source.
                       `TRIG:BBP:HOLD 200 ns`
                       Sets the holding time to 200 ns.

Mode: all

TRIGger<n>[:SEQuence]:IFPower:HOLDoff <Value>

This command sets the holding time before the next IF power trigger event.

Suffix:

<n>   irrelevant

Parameters:

<Value>   *RST: 150 ns

Example: `TRIG:SOUR IFP`
                       Sets the IF power trigger source.
                       `TRIG:IFP:HOLD 200 ns`
                       Sets the holding time to 200 ns.

TRIGger<n>[:SEQuence]:IFPower:HYSTeresis <Value>

This command sets the limit that the hysteresis value for the IF power trigger has to fall below in order to trigger the next measurement.

Suffix:

<n>   irrelevant

Parameters:

<Value>   *RST: 3 dB

Example: `TRIG:SOUR IFP`
                       Sets the IF power trigger source.
                       `TRIG:IFP:HYST 10DB`
                       Sets the hysteresis limit value.

TRIGger<n>[:SEQuence]:HOLDoff[:TIME] <Delay>

This command defines the length of the trigger delay.

A negative delay time (pretrigger) can be set in zero span only.

Suffix:

<n>	irrelevant

Parameters:

<Delay>	Range:	zero span: -sweeptime (see data sheet) to 30 s; span: 0 to 30 s
	*RST:	0 s

Example: `TRIG:HOLD 500us`

Manual operation: See "Trigger Offset" on page 55

TRIGger<n>[:SEQuence]:LEVel[:EXTernal] <TriggerLevel>

This command sets the level of the external trigger source in Volt.

Suffix:

<n>	irrelevant

Parameters:

<TriggerLevel>	Range:	0.5 V to 3.5 V
	*RST:	1.4 V

Example: `TRIG:LEV 2V`

TRIGger<n>[:SEQuence]:SLOPe <Type>

This command selects the slope of the trigger signal. The selected trigger slope applies to all trigger signal sources.

Suffix:

<n>	irrelevant

Parameters:

<Type>	POSitive | NEGative	
	*RST:	POSitive

Example: `TRIG:SLOP NEG`

Manual operation: See "Trg/Gate Polarity" on page 54
See "Trigger Polarity" on page 72

TRIGger<n>[:SEQuence]:SOURce <Source>

This command selects the trigger source.

For details on trigger modes refer to the "Trg/Gate Source" softkey in the base unit description.

Suffix:

<n>	irrelevant

Parameters:

<Source>	**IMMediate**
	Free Run
	EXTern
	External trigger
	IFPower
	Power trigger at the second intermediate frequency
	RFPower
	Power trigger at the first intermediate frequency
	TIME
	Time interval
	PSEN
	External power sensor (requires R&S FSV-K9 option)
	*RST: IMMediate

Example:	TRIG:SOUR EXT
	Selects the external trigger input as source of the trigger signal
Manual operation:	See "Trigger Source External" on page 54
	See "Trigger Source Free Run" on page 54

OUTPut:IF[:SOURce] <Source>

This command selects the source of the IF output.

Parameters:

<Source>	**IF**
	intermediate frequency output
	VIDeo
	video output, 200 mV
	*RST: IF

Example:	OUTP:IF VID
	Selects the video signal for the IF output connector.
Manual operation:	See "Video Output" on page 112

OUTPut:TRIGger <PortLevel>

This command selects level of the Trigger Out port. Thus, you can trigger an additional device via the external trigger port, for example.

Parameters:

<PortLevel>	LOW | HIGH
	*RST: LOW

Example:	OUTP:TRIG HIGH
Manual operation:	See "Trigger Out" on page 113

9 Error Messages

Error messages are entered in the error/event queue of the status reporting system in the remote control mode and can be queried with the command `SYSTem:ERRor?`.

A short explanation of the device-specific error messages for R&S FSV-K72 is given below.

Status bar message	Description
Sync not found	This message is displayed if synchronization is not possible. Possible causes are that frequency, level, scrambling code, Invert Q values are set incorrectly, or the input signal is invalid.
Sync OK	This message is displayed if synchronization is possible.
Incorrect pilot symbols	This message is displayed if one or more of the received pilot symbols are not equal to the specified pilot symbols of the 3GPP standard. Possible causes are: • Incorrectly sent pilot symbols in the received frame. • Low signal to noise ratio (SNR) of the WCDMA signal. • One or more code channels have a significantly lower power level compared to the total power. The incorrect pilots are detected in these channels because of low channel SNR. • One or more channels are sent with high power ramping. In slots with low relative power to total power, the pilot symbols might be detected incorrectly (check the signal quality by using the symbol constellation display

10 Glossary

CPICH	Common pilot channel (spreading code number 0 at spreading factor 128). The channel constantly contains the symbol (1,1) through out the total length of the 3GPP FDD BTS frame. For the measurements, the CPICH (Primary CPICH) is used for synchronization. For this reason, the CPICH must be contained in the signal to be measured.
Composite EVM	In accordance with the 3GPP specifications, the squared error between the real and imaginary components of the test signal and an ideal reference signal is determined (EVM referenced to the total signal) in a composite EVM measurement.
DPCH	Dedicated physical channel, data channel. The data channels, which can be sent at different transmission rates, are automatically recognized during the measurement.
Inactive channel threshold	Minimum power that a single channel must have as compared to the total signal in order to be recognized as an active channel.
PCCPCH	Primary common control physical channel (spreading code number 1 at spreading factor 128). The channel is used for synchronizing the measurements. For this reason, it must be contained in the signal to be measured.
Peak code domain error	In accordance with the 3GPP specifications, the error between the test signal and the ideal reference signal is projected onto the classes of the different spreading factors in the case of a peak code domain measurement.
PICH	Paging indication channel. This special channel is defined in the test models to 3GPP for measurements on base station signals. Since it does not contain any pilot symbols, it cannot automatically be recognized during measurement. Therefore, this channel must be deactivated for CDP measurements.
SCH	Synchronization channel, divided into P-SCH (primary synchronization channel) and S-SCH (secondary synchronization channel). The two channels are required for synchronizing the measurement. Therefore, they must always be contained in the signal to be measured.
Timing offset	Offset between the start of the first slot of a channel and the start of the analyzed 3GPP FDD BTS frame (in multiples of 256 chips).

List of Commands

Index