

# R&S®FSW-K72/K73

## 3GPP FDD Measurements Options

### User Manual



1173.9305.02 – 17

This manual applies to the following R&S®FSW models with firmware version 2.40 and higher:

- R&S®FSW8 (1312.8000K08)
- R&S®FSW13 (1312.8000K13)
- R&S®FSW26 (1312.8000K26)
- R&S®FSW43 (1312.8000K43)
- R&S®FSW50 (1312.8000K50)
- R&S®FSW67 (1312.8000K67)
- R&S®FSW85 (1312.8000K85)

The following firmware options are described:

- R&S FSW-K72 (1313.1422.02)
- R&S FSW-K73 (1313.1439.02)

The software contained in this product makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgment" 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.

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The following abbreviations are used throughout this manual: R&S®FSW is abbreviated as R&S FSW. "R&S FSW-K72 and R&S FSW-K73" are abbreviated as R&S FSW-K72/K73.

# Contents

<b>1</b>	<b>Preface</b> .....	<b>7</b>
1.1	About this Manual.....	7
1.2	Documentation Overview.....	8
1.3	Conventions Used in the Documentation.....	9
<b>2</b>	<b>Welcome to the 3GPP FDD Applications</b> .....	<b>11</b>
2.1	Starting the 3GPP FDD Application.....	11
2.2	Understanding the Display Information.....	12
<b>3</b>	<b>Measurements and Result Display</b> .....	<b>15</b>
3.1	Code Domain Analysis.....	15
3.2	Time Alignment Error Measurements.....	33
3.3	RF Measurements.....	35
<b>4</b>	<b>Measurement Basics</b> .....	<b>42</b>
4.1	Channel Detection.....	45
4.2	BTS Channel Types.....	45
4.3	UE Channel Types.....	49
4.4	3GPP FDD BTS Test Models.....	50
4.5	Setup for Base Station Tests.....	51
4.6	3GPP FDD UE Test Models.....	52
4.7	Setup for User Equipment Tests.....	53
4.8	Time Alignment Error Measurements.....	54
4.9	CDA Measurements in MSRA Operating Mode.....	57
<b>5</b>	<b>Configuration</b> .....	<b>59</b>
5.1	Result Display.....	59
5.2	Code Domain Analysis.....	60
5.3	Time Alignment Error Measurements.....	111
5.4	RF Measurements.....	117
<b>6</b>	<b>Analysis</b> .....	<b>122</b>
6.1	Evaluation Range.....	122
6.2	Code Domain Analysis Settings (BTS Measurements).....	125
6.3	Code Domain Analysis Settings (UE Measurements).....	127

6.4	Traces.....	128
6.5	Markers.....	130
7	I/Q Data Import and Export.....	137
7.1	Import/Export Functions.....	137
8	Optimizing and Troubleshooting the Measurement.....	139
8.1	Error Messages.....	139
9	How to Perform Measurements in 3GPP FDD Applications.....	140
10	Measurement Examples.....	145
10.1	Measurement 1: Measuring the Signal Channel Power.....	145
10.2	Measurement 2: Determining the Spectrum Emission Mask.....	146
10.3	Measurement 3: Measuring the Relative Code Domain Power.....	148
10.4	Measurement 4: Triggered Measurement of Relative Code Domain Power.....	152
10.5	Measurement 5: Measuring the Composite EVM.....	154
10.6	Measurement 6: Determining the Peak Code Domain Error.....	155
11	Remote Commands for 3GPP FDD Measurements.....	158
11.1	Introduction.....	158
11.2	Common Suffixes.....	163
11.3	Activating 3GPP FDD Measurements.....	164
11.4	Selecting a Measurement.....	168
11.5	Configuring Code Domain Analysis and Time Alignment Error Measurements .....	170
11.6	Configuring RF Measurements.....	239
11.7	Configuring the Result Display.....	240
11.8	Starting a Measurement.....	248
11.9	Retrieving Results.....	253
11.10	Analysis.....	279
11.11	Importing and Exporting I/Q Data and Results.....	291
11.12	Configuring the Slave Application Data Range (MSRA mode only).....	292
11.13	Querying the Status Registers.....	295
11.14	Deprecated Commands.....	298
11.15	Programming Examples (R&S FSW-k72).....	301
12	I/Q Data File Format (iq-tar).....	309

12.1	I/Q Parameter XML File Specification.....	309
12.2	I/Q Data Binary File.....	313
	List of Remote Commands (3GPP FDD).....	315
	Index.....	321



# 1 Preface

## 1.1 About this Manual

This 3GPP FDD User Manual provides all the information **specific to the 3GPP FDD applications**. All general instrument functions and settings common to all applications and operating modes are described in the main R&S FSW User Manual.

The main focus in this manual is on the measurement results and the tasks required to obtain them. The following topics are included:

- **Welcome to the 3GPP FDD Measurements Application**  
Introduction to and getting familiar with the application
- **Measurements and Result Displays**  
Details on supported measurements and their result types
- **Measurement Basics**  
Background information on basic terms and principles in the context of the measurement
- **Configuration + Analysis**  
A concise description of all functions and settings available to configure measurements and analyze results with their corresponding remote control command
- **I/Q Data Import and Export**  
Description of general functions to import and export raw I/Q (measurement) data
- **Optimizing and Troubleshooting the Measurement**  
Hints and tips on how to handle errors and optimize the test setup
- **How to Perform Measurements in 3GPP FDD Applications**  
The basic procedure to perform each measurement and step-by-step instructions for more complex tasks or alternative methods
- **Measurement Examples**  
Detailed measurement examples to guide you through typical measurement scenarios and allow you to try out the application immediately
- **Remote Commands for 3GPP FDD Measurements**  
Remote commands required to configure and perform 3GPP FDD measurements in a remote environment, sorted by tasks  
(Commands required to set up the environment or to perform common tasks on the instrument are provided in the main R&S FSW User Manual)  
Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes
- **List of remote commands**  
Alphabetical list of all remote commands described in the manual
- **Index**

## 1.2 Documentation Overview

The user documentation for the R&S FSW consists of the following parts:

- "Getting Started" printed manual
- Online Help system on the instrument
- User manuals and online manual for base unit and options provided on the product page
- Service manual provided on the internet for registered users
- Instrument security procedures provided on the product page
- Release notes provided on the product page
- Data sheet and brochures provided on the product page
- Application notes provided on the Rohde & Schwarz website



You find the user documentation on the R&S FSW product page mainly at:

<http://www.rohde-schwarz.com/product/FSW> > "Downloads" > "Manuals"

Additional download paths are stated directly in the following abstracts of the documentation types.

### Getting Started

Introduces the R&S FSW and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc.

### Online Help

Offers quick, context-sensitive access to the information needed for operation and programming. It contains the description for the base unit and the software options. The Online Help is embedded in the instrument's firmware; it is available using the ? icon on the toolbar of the R&S FSW.

### User Manuals and Online Manual

Separate manuals are provided for the base unit and the software options:

- **Base unit manual**  
Contains the description of the graphical user interface, an introduction to remote control, the description of all SCPI remote control commands, programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the **Getting Started** manual.
- **Software option manuals**  
Describe the specific functions of the option. Basic information on operating the R&S FSW is not included.

The **online manual** provides the contents of the user manuals for the base unit and all software options for immediate display on the internet.



**Service Manual**

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS).

**Instrument Security Procedures**

Deals with security issues when working with the R&S FSW in secure areas.

**Data Sheet and Brochures**

The data sheet contains the technical specifications of the R&S FSW. Brochures provide an overview of the instrument and deal with the specific characteristics, see:

<http://www.rohde-schwarz.com/product/FSW> > "Downloads" > "Brochures and Data Sheets"

**Release Notes**

Describes the firmware installation, new and modified features and fixed issues according to the current firmware version. You find the latest version at:

<http://www.rohde-schwarz.com/product/FSW> > "Firmware"

**Application Notes, Application Cards, White Papers, etc.**

These documents deal with special applications or background information on particular topics, see:

<http://www.rohde-schwarz.com/> > "Downloads" > "Applications".

## 1.3 Conventions Used in the Documentation

### 1.3.1 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.
<i>Input</i>	Input to be entered by the user is displayed in italics.

Convention	Description
<a href="#">Links</a>	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

### 1.3.2 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.

### 1.3.3 Notes on Screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as much as possible of the provided functions and possible interdependencies between parameters.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

## 2 Welcome to the 3GPP FDD Applications

The 3GPP FDD applications add functionality to the R&S FSW to perform code domain analysis or power measurements according to the 3GPP standard (FDD mode). The application firmware is in line with the 3GPP standard (Third Generation Partnership Project) with Release 5. Signals that meet the conditions for channel configuration of test models 1 to 4 according to the 3GPP standard, e.g. W-CDMA signals using FDD, can be measured with the 3GPP FDD BTS application. In addition to the code domain measurements specified by the 3GPP standard, the application firmware offers measurements with predefined settings in the frequency domain, e.g. power and ACLR measurements.

R&S FSW-K72 performs **Base Transceiver Station (BTS)** measurements (for downlink signals).

R&S FSW-K73 performs **User Equipment (UE)** measurements (for uplink signals).

In particular, the 3GPP FDD applications feature:

- Code domain analysis, providing results like code domain power, EVM, peak code domain error etc.
- Time alignment error determination
- Various power measurements
- Spectrum Emission Mask measurements
- Statistical (CCDF) evaluation

This user manual contains a description of the functionality that the application provides, including remote control operation.

Functions that are not discussed in this manual are the same as in the Spectrum application and are described in the R&S FSW User Manual. The latest version is available for download at the product homepage

<http://www2.rohde-schwarz.com/product/FSW.html>.

### Installation

You can find detailed installation instructions in the R&S FSW Getting Started manual or in the Release Notes.

## 2.1 Starting the 3GPP FDD Application

The 3GPP FDD measurements require a special application on the R&S FSW.

### To activate the 3GPP FDD applications

1. Select the MODE key.

A dialog box opens that contains all operating modes and applications currently available on your R&S FSW.

2. Select the "3GPP FDD BTS" or "3GPP FDD UE" item.




The R&S FSW opens a new measurement channel for the 3GPP FDD application.

A Code Domain Analysis measurement is started immediately with the default settings. It can be configured in the 3GPP FDD "Overview" dialog box, which is displayed when you select the "Overview" softkey from any menu (see [Chapter 5.2.1, "Configuration Overview"](#), on page 61).

### Multiple Measurement Channels and Sequencer Function

When you activate an application, a new measurement channel is created which determines the measurement settings for that application. The same application can be activated with different measurement settings by creating several channels for the same application.

Only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided.

If activated, the measurements configured in the currently active channels are performed one after the other in the order of the tabs. The currently active measurement is indicated by a  symbol in the tab label. The result displays of the individual channels are updated in the tabs (including the "MultiView") as the measurements are performed. Sequential operation itself is independent of the currently *displayed* tab.

For details on the Sequencer function see the R&S FSW User Manual.

## 2.2 Understanding the Display Information

The following figure shows a measurement diagram during a 3GPP FDD BTS measurement. All different information areas are labeled. They are explained in more detail in the following sections.

(The basic screen elements are identical for 3GPP FDD UE measurements)



- 1 = Channel bar for firmware and measurement settings
- 2+3 = Window title bar with diagram-specific (trace) information
- 4 = Diagram area
- 5 = Diagram footer with diagram-specific information
- 6 = Instrument status bar with error messages, progress bar and date/time display



**MSRA operating mode**

In MSRA operating mode, additional tabs and elements are available. A colored background of the screen behind the measurement channel tabs indicates that you are in MSRA operating mode.

For details on the MSRA operating mode see the R&S FSW MSRA User Manual.

**Channel bar information**

In 3GPP FDD applications, when performing Code Domain Analysis, the R&S FSW screen display deviates from the Spectrum application. For RF measurements, the familiar settings are displayed (see the R&S FSW Getting Started manual).

*Table 2-1: Hardware settings displayed in the channel bar in 3GPP FDD applications for Code Domain Analysis*

Ref Level	Reference level
Att	Mechanical and electronic RF attenuation
Freq	Center frequency for the RF signal
Channel	Channel number (code number and spreading factor)
CPICH Slot / Slot (UE)	Slot of the (CPICH) channel

<b>Power</b>	Power result mode: <ul style="list-style-type: none"> <li>• Absolute</li> <li>• Relative to CPICH (BTS application (K72) only)</li> <li>• Relative to total power</li> </ul>
<b>SymbRate</b>	Symbol rate of the current channel
<b>Capture</b>	<b>(UE application (K73) only):</b> basis for analysis (slot or frame)

### Window title bar information

For each diagram, the header provides the following information:



**Figure 2-1: Window title bar information in 3GPP applications**

- 1 = Window number
- 2 = Window type
- 3 = Trace color
- 4 = Trace number
- 5 = Detector

### Diagram footer information

For most graphical evaluations the diagram footer (beneath the diagram) contains scaling information for the x-axis, where applicable:

- Start channel/chip/frame/slot
- Channel/chip/frame/slot per division
- Stop channel/chip/frame/slot

For the **Bitstream** evaluation, the diagram footer indicates:

- Channel format (type and modulation type (HS-PDSCH only))
- Number of data bits
- Number of TPC bits
- Number of TFCI bits
- Number of pilot bits

(The bit numbers are indicated in the order they occur.)

### Status bar information

Global instrument settings, the instrument status and any irregularities are indicated in the status bar beneath the diagram. Furthermore, the progress of the current operation is displayed in the status bar.

## 3 Measurements and Result Display

The 3GPP FDD applications provide several different measurements for signals according to the 3GPP FDD standard. The main and default measurement is Code Domain Analysis. Furthermore, a Time Alignment Error measurement is provided.

In addition to the code domain power measurements specified by the 3GPP standard, the 3GPP FDD options offer measurements with predefined settings in the frequency domain, e.g. RF power measurements.

### Evaluation methods

The captured and processed data for each measurement can be evaluated with various different methods. All evaluation methods available for the selected 3GPP FDD measurement are displayed in the evaluation bar in SmartGrid mode.

### Evaluation range

You can restrict evaluation to a specific channel, frame or slot, depending on the evaluation method. See [Chapter 6.1, "Evaluation Range"](#), on page 122.

- [Code Domain Analysis](#)..... 15
- [Time Alignment Error Measurements](#)..... 33
- [RF Measurements](#).....35

### 3.1 Code Domain Analysis

**Access:** MEAS > "Code Domain Analyzer"

The Code Domain Analysis measurement provides various evaluation methods and result diagrams.

The code domain power measurements are performed as specified by the 3GPP standards. A signal section of approximately 20 ms is recorded for analysis and then searched through to find the start of a 3GPP FDD 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 evaluations are calculated from the captured I/Q data set. Therefore it is not necessary to start a new measurement in order to change the evaluation.

The 3GPP FDD applications provide the peak code domain error measurement and composite EVM specified by the 3GPP standard, as well as the code domain power measurement of assigned and unassigned codes. The power can be displayed either for all channels in one slot, or for one channel in all slots. The composite constellation diagram of the entire signal can also be displayed. In addition, the symbols demodulated in a slot, their power, and the determined bits or the symbol EVM can be displayed for an active channel.

The power of a code channel is always measured in relation to its symbol rate within the code domain. It can be displayed either as absolute values or relative to the total signal or the CPICH channel. By default, the power relative to the CPICH channel is

displayed. The total power may vary depending on the slot, since the power can be controlled on a per-slot-basis. The power in the CPICH channel, on the other hand, is constant in all slots.

For all measurements performed in a slot of a selected channel (bits, symbols, symbol power, EVM), the actual slot spacing of the channel is taken as a basis, rather than the CPICH slots. The time reference for the start of a slot is the CPICH slot. If code channels contain a timing offset, the start of a specific slot of the channel differs from the start of the reference channel (CPICH). Thus, the power-per-channel display may not be correct. If channels with a timing offset contain a power control circuit, the channel-power-versus-time display may provide better results.

The composite EVM, peak code domain error and composite constellation measurements are always referenced to the total signal.

#### Remote command:

CONF:WCDP:MEAS WCDP, see [CONFIGure:WCDPower\[:BTS\]:MEASurement](#) on page 168

### 3.1.1 Code Domain Parameters

Two different types of measurement results are determined and displayed in the Result Summary: global results and channel results (for the selected channel).



The number of the CPICH slot at which the measurement is performed is indicated globally for the measurement in the channel bar.

The spreading code of the selected channel is indicated with the channel number in the channel bar and above the channel-specific results in the Result Summary.

In the Channel Table, the analysis results for all active channels are displayed.

**Table 3-1: General code domain power results for a specific frame and slot**

Parameter	Description
Total Power:	The total signal power (average power of total evaluated slot).
Carrier Freq Error:	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 for one (CPICH) slot. See also the note on " <a href="#">Carrier Frequency Error</a> " on page 17.
Chip Rate Error:	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.
Trigger to Frame:	The time difference between the beginning of the recorded signal section to the start of the analyzed frame. In 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 input signal fails, the value of "Trigger to Frame" is not significant.
IQ Offset:	DC offset of the signal in the selected slot in %



Parameter	Description
IQ Imbalance:	I/Q imbalance of signals in the selected slot in %
Avg Power Inact Chan	Average power of the inactive channels
Composite EVM:	The composite EVM is the difference between the test signal and the ideal reference signal in the selected slot in %. See also " <a href="#">Composite EVM</a> " on page 23
Pk CDE (15 ksps):	The Peak Code Domain Error projects the difference between the test signal and the ideal reference signal onto the selected spreading factor in the selected slot (see " <a href="#">Peak Code Domain Error</a> " on page 27). The spreading factor onto which projection is performed can be derived from the symbol rate indicated in brackets.
RHO	Quality parameter RHO for each slot.
No of Active Chan:	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.
Avg. RCDE	Average Relative Code Domain Error over all channels detected with 64 QAM (UE: 4PAM) modulation in the selected frame.



### Carrier Frequency Error

The maximum frequency error that can be compensated is specified in [Table 3-2](#) as a function of the synchronization mode. Transmitter and receiver should be synchronized as far as possible.

**Table 3-2: Maximum frequency error that can be compensated**

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

**Table 3-3: Channel-specific code domain power results**

Symbol Rate:	Symbol rate at which the channel is transmitted
Channel Slot No:	<b>(BTS measurements only):</b> Channel slot number; determined by combining the value of the selected CPICH and the channel's timing offset
Channel Mapping	<b>(UE measurements only):</b> Branch onto which the channel is mapped (I or Q, specified by the standard)
Chan Power Abs:	Channel power, absolute
Chan Power Rel:	Channel power, relative (referenced to CPICH or total signal power)
Timing Offset:	Offset between the start of the first slot in the channel and the start of the analyzed 3GPP FDD BTS frame
RCDE	Relative Code Domain Error for the complete frame of the selected channel

Symbol EVM:	Peak and average of the results of the error vector magnitude evaluation
No of Pilot Bits:	Number of pilot bits of the selected channel
Modulation Type:	BTS measurements: Modulation type of an HSDPA channel. High speed physical data channels can be modulated with QPSK, 16 QAM or 64 QAM modulation. UE measurements: the modulation type of the selected channel. Valid entries are: <ul style="list-style-type: none"> <li>• BPSK I for channels on I-branch</li> <li>• BPSK Q for channels on Q-branch</li> <li>• NONE for inactive channels</li> </ul>

### 3.1.2 Evaluation Methods for Code Domain Analysis



**Access:** "Overview" > "Display Config"

The captured I/Q data can be evaluated using various different methods without having to start a new measurement.

The selected evaluation also affects the results of the trace data query (see [Chapter 11.9.2, "Measurement Results for TRACe<n>\[:DATA\]? TRACE<n>"](#), on page 258).

Bitstream.....	18
Channel Table.....	19
└ Table Configuration.....	20
Code Domain Power.....	21
Code Domain Error Power.....	22
Composite Constellation.....	22
Composite EVM.....	23
EVM vs Chip.....	24
Frequency Error vs Slot.....	25
Mag Error vs Chip.....	25
Marker Table.....	26
Peak Code Domain Error.....	27
Phase Discontinuity vs Slot.....	27
Phase Error vs Chip.....	28
Power vs Slot.....	29
Power vs Symbol.....	30
Result Summary.....	30
Symbol Constellation.....	31
Symbol EVM.....	31
Symbol Magnitude Error.....	32
Symbol Phase Error.....	32

#### Bitstream

The Bitstream evaluation 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).

4 Bitstream Table											
	0	2	4	6	8	10	12	14	16	18	20
0	00	00	00	00	00	00	00	00	00	00	
22											
44											
66											
88											
110											
132											
154											
176											
198											
220											
	CPICH	20xD1		0xTPC	0xTFCI		0xD2		0xPil		

Figure 3-1: Bitstream display for 3GPP FDD BTS measurements

**TIP:** Select a specific symbol using the **MKR key** while the display is focused. If you enter a number, the marker jumps to the selected symbol, which is highlighted by a blue circle.

The diagram footer indicates:

- Channel format (type and modulation type (HS-PDSCH only))
- Number of data bits (D1 / D2)
- Number of TPC bits (TPC)
- Number of TFCI bits (TFCI)
- Number of pilot bits (Pil)

Remote command:

LAY:ADD? '1',RIGH, BITS, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? ABITstream

### Channel Table

The Channel Table evaluation displays the detected channels and the results of the code domain power measurement. The channel table can contain a maximum of 512 entries.

In BTS measurements, this corresponds to the 512 codes that can be assigned within the class of spreading factor 512.

In UE measurements, this corresponds to the 256 codes that can be assigned within the class of spreading factor 256, with both I and Q branches.

The first entries of the table indicate the channels that must be available in the signal to be analyzed and any other control channels (see [Chapter 4.2, "BTS Channel Types"](#), on page 45 and [Chapter 4.3, "UE Channel Types"](#), on page 49).

The lower part of the table indicates the data channels that are contained in the signal.

If the type of a channel can be fully recognized, based on pilot sequences or modulation type, the type is indicated in the table. In BTS measurements, all other channels 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. Therefore, the unassigned codes are always displayed at the end of the table.

Chan Type	Ch.SF	SymRate [ksps]	State	TFCI	PilotL [Bits]	PwrAbs [dBm]	PwrRel [dB]	Toffs [Chips]
CPICH	0.256	15	ON	OFF	0	-34.47	0.00	0.00
PSCH		0	ON	OFF	0	-37.74	-3.27	0.00
SSCH		0	ON	OFF	0	-37.06	-2.59	0.00
PCCPCH	1.256	15	ON	OFF	0	-34.38	0.09	0.00
SCCPCH	3.256	15	ON	OFF	0	-42.32	-7.85	0.00
PICH	16.256	15	ON	OFF	0	-42.26	-7.79	30720.0
HSPDSCH-16QAM	4.16	240	ON	OFF	0	-28.30	6.17	0.00
HSPDSCH-16QAM	12.16	240	ON	OFF	0	-28.56	5.91	0.00
HSSSCH	9.128	30	ON	OFF	0	-38.40	-3.93	0.00
DPCH	15.128	30	ON	OFF	8	-40.38	-5.91	22016.0
DPCH	23.128	30	ON	OFF	8	-38.32	-3.85	34304.0
HSSSCH	29.128	30	ON	OFF	0	-44.38	-9.91	0.00
DPCH	68.128	30	ON	OFF	8	-38.46	-3.99	13312.0
DPCH	76.128	30	ON	OFF	8	-41.38	-6.91	11520.0

Figure 3-2: Channel Table display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, CTABLE, see LAYout:ADD[:WINDOW]? on page 242

TRACe<n>[:DATA]? CTABLE

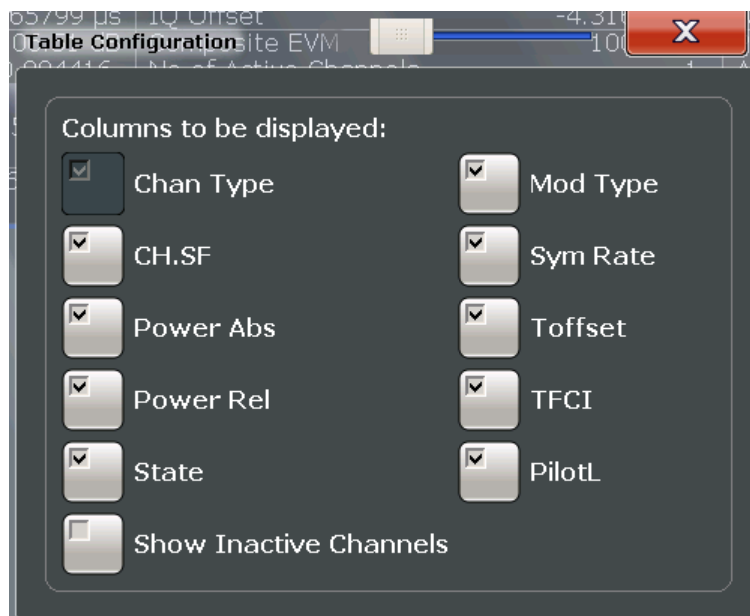
TRACe<n>[:DATA]? PWCDp

TRACe<n>[:DATA]? CWCDp

### Table Configuration ← Channel Table

You can configure which parameters are displayed in the Channel Table by double-clicking the table header.

A "Table Configuration" dialog box is displayed in which you can select the columns to be displayed.



By default, only active channels are displayed. In order to display all channels, including the inactive ones, enable the "Show Inactive Channels" option.

The following parameters of the detected channels are determined by the CDP measurement and can be displayed in the Channel Table evaluation. (For details see [Chapter 3.1.1, "Code Domain Parameters"](#), on page 16.)

Table 3-4: Code domain power results in the channel table

Label	Description
Chan Type	Type of channel (active channels only)
Ch. SF	Number of channel spreading code (0 to [spreading factor-1])
Symbol Rate [ksps]	Symbol rate at which the channel is transmitted In BTS measurements: always
State	Active: channel is active and all pilot symbols are correct Inactive: channel is not active Pilotf: channel is active, but pilot symbols incomplete or missing
TFCI	<b>(BTS measurements only):</b> Data channel uses TFCI symbols
Mapping	<b>(UE measurements only):</b> Branch the channel is mapped to (I or Q)
PilotL [Bits]	Number of pilot bits in the channel (UE measurements: only for control channel DPCCH)
Pwr Abs [dBm]/Pwr Rel [dBm]	Absolute and relative channel power (referred to the CPICH or the total power of the signal)
T Offs [Chips]	<b>(BTS measurements only):</b> Timing offset

### Code Domain Power

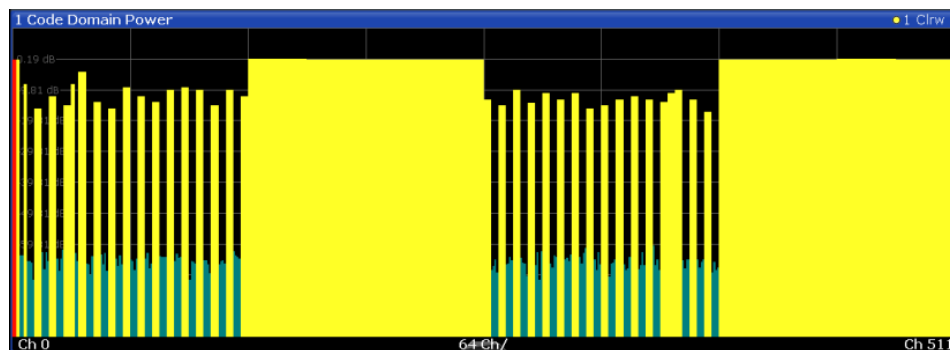


Figure 3-3: Code Domain Power Display for 3GPP FDD BTS measurements

The Code Domain Power evaluation shows the power of all possible code channels in the selected channel slot. The x-axis shows the possible code channels from 0 to the highest spreading factor. 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 selected code channel is highlighted red. The codes where no channel could be detected are displayed green.

**Note:** Effects of missing or incomplete pilot symbols. In "Autosearch" channel detection mode, the application expects specific pilot symbols for DPCH channels. If these symbols are missing or incomplete, the channel power in the Code Domain Power evaluation is displayed green at the points of the diagram the channel should appear due to its spreading code, and a message ("INCORRECT PILOT") is displayed in the

status bar. In this case, check the pilot symbols for those channels using the Power vs Slot or the Bitstream evaluations.

Optionally, all QPSK-modulated channels can also be recognized without pilot symbols (see "HSDPA/UPA" on page 63).

Remote command:

LAY:ADD? '1',RIGH, CDPower, see LAYout:ADD[:WINDow]? on page 242

CALC:MARK:FUNC:WCDP:RES? CDP, see CALCulate<n>:MARKer<m>:FUNctIon:WCDPower[:BTS]:RESult? on page 254

CALC:MARK:FUNC:WCDP:MS:RES? CDP, see CALCulate<n>:MARKer<m>:FUNctIon:WCDPower:MS:RESult? on page 256

TRACe<n>[:DATA]? CTABLE

TRACe<n>[:DATA]? PWCDp

TRACe<n>[:DATA]? CWCDp

### Code Domain Error Power

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

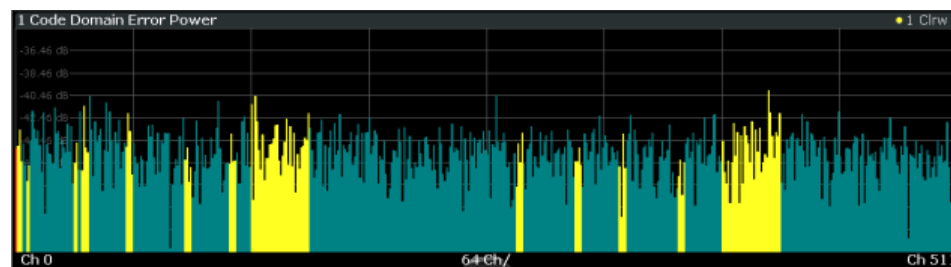


Figure 3-4: Code Domain Error Power Display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, CDEPower, see LAYout:ADD[:WINDow]? on page 242

TRACe<n>[:DATA]? TRACE<1...4>

### Composite Constellation

The Composite Constellation evaluation analyzes the entire signal for one single slot. If a large number of channels is to be analyzed, the results are superimposed. In that case the benefit of this evaluation is limited (senseless).

In Composite Constellation evaluation 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. Thus, it is not possible to assign constellation points to channels. The constellation points are displayed normalized with respect to the total power.

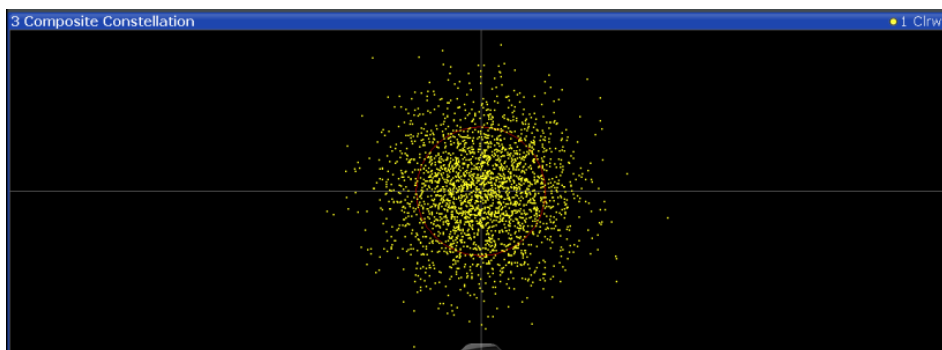


Figure 3-5: Composite Constellation display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, CCONst, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### Composite EVM

The Composite EVM evaluation displays the root mean square composite EVM (modulation accuracy) according to the 3GPP specification. The square root is determined of the mean squared errors between the real and imaginary components of the received signal and an ideal reference signal (EVM referenced to the total signal). The error is averaged over all channels for individual slots. The Composite EVM evaluation covers the entire signal during the entire observation time.

$$EVM_{RMS} = \sqrt{\frac{\sum_{n=0}^N |s_n - x_n|^2}{\sum_{n=0}^{N-1} |x_n|^2}} * 100\% \quad | \quad N = 2560$$

where:

$EVM_{RMS}$	root mean square of the vector error of the composite signal
$s_n$	complex chip value of received signal
$x_n$	complex chip value of reference signal
$n$	index number for mean power calculation of received and reference signal.
$N$	number of chips at each CPICH slot

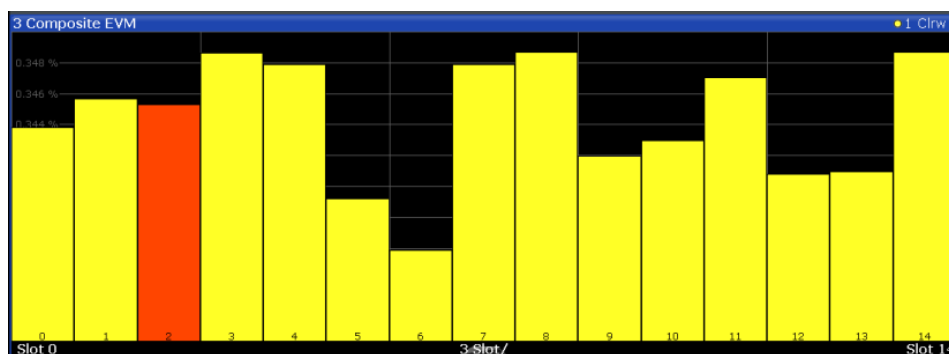


Figure 3-6: Composite EVM display for 3GPP FDD BTS measurements

The measurement result consists of one composite EVM measurement value per slot. In this case, the measurement interval is the slot spacing of the CPICH (timing offset of 0 chips referenced to the beginning of the frame). Only the channels recognized as active are used to generate the ideal reference signal. If an assigned channel is not recognized as active since pilot symbols are missing or incomplete, the difference between the measurement and reference signal and the composite EVM is very high.

Remote command:

LAY:ADD? '1',RIGH, CEVM, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### EVM vs Chip

EVM vs Chip activates the Error Vector Magnitude (EVM) versus chip display. The EVM is displayed for all chips of the selected slot.

**Note:** In UE measurements, if the measurement interval "Halfslot" is selected for evaluation, 30 slots are displayed instead of the usual 15 (see "Measurement Interval" on page 127).

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.

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

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

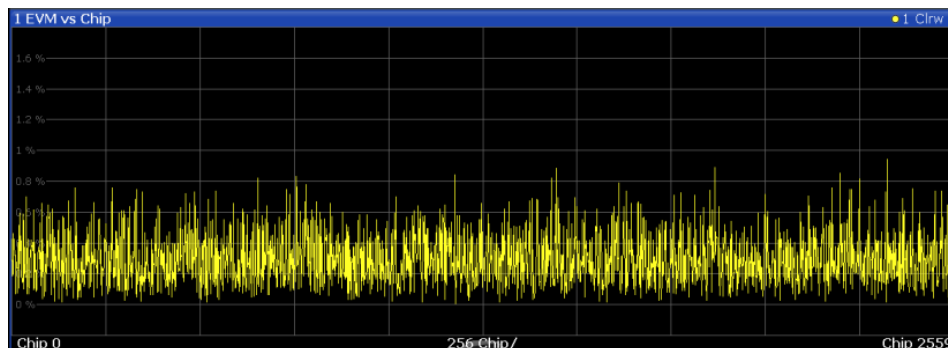


Figure 3-7: EVM vs Chip display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, EVMChip, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### Frequency Error 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 (based on CPICH slots). This helps eliminate a static frequency offset of the whole signal to achieve a better display of the actual time-dependant frequency diagram.

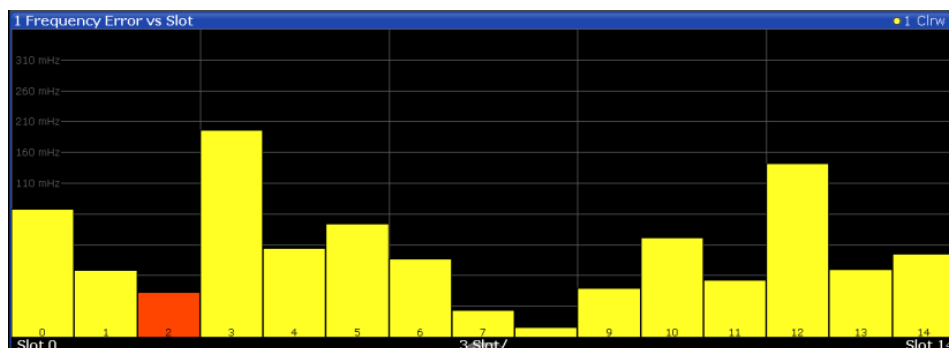


Figure 3-8: Frequency Error vs Slot display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, FESLot, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? ATRACE

### Mag Error vs Chip

The Magnitude Error versus chip display shows the magnitude error for all chips of the selected slot.

**Note:** In UE measurements, if the measurement interval "Halfslot" is selected for evaluation, 30 slots are displayed instead of the usual 15 (see "Measurement Interval" on page 127).

The magnitude error is calculated as the difference of the magnitude of the received signal to the magnitude of the 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.

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

Where:

MAG <sub>k</sub>	Magnitude error of chip number k
s <sub>k</sub>	Complex chip value of received signal
x <sub>k</sub>	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

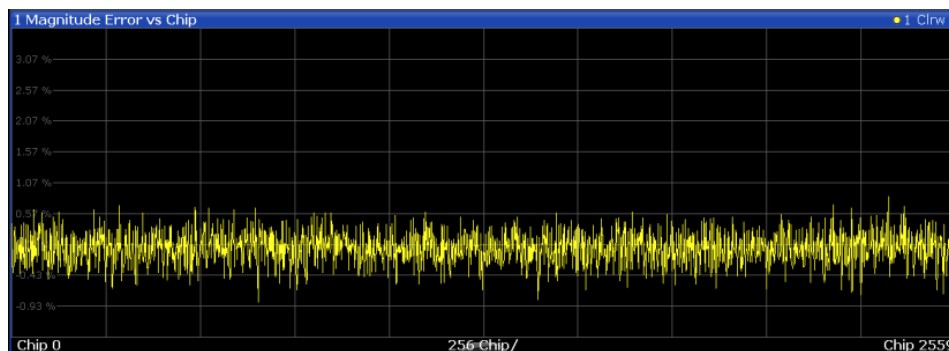


Figure 3-9: Magnitude Error vs Chip display for 3GPP FDD BTS measurements

Remote command:

```
LAY:ADD? '1',RIGH, MEChip, see LAYout:ADD[:WINDow]? on page 242
TRACe<n>[:DATA]? TRACE<1...4>
```

**Marker Table**

Displays a table with the current marker values for the active markers.

This table may be displayed automatically if configured accordingly (see "Marker Table Display" on page 133).

Wnd	Type	Ref	Trc	X-value	Y-value
1	M1		1	<b>13.25 GHz</b>	<b>-200.0 dBm</b>
1	D2	M1	1	<b>-600.0 kHz</b>	<b>0.0 dB</b>
1	D3	M1	1	<b>600.0 kHz</b>	<b>0.0 dB</b>
1	D4	M1	1	<b>-2.0 MHz</b>	<b>0.0 dB</b>

**Tip:** To navigate within long marker tables, simply scroll through the entries with your finger on the touchscreen.

Remote command:

LAY:ADD? '1',RIGH, MTAB, see LAYout:ADD[:WINDow]? on page 242

Results:

CALCulate<n>:MARKer<m>:X on page 282

CALCulate<n>:MARKer<m>:Y? on page 278

### Peak Code Domain Error

In line with the 3GPP specifications, the error between the measurement signal and the ideal reference signal for a given slot and for all codes is projected onto the various spreading factors. The result consists of the peak code domain error value per slot. The measurement interval is the slot spacing of the CPICH (timing offset of 0 chips referenced to the beginning of the frame). Only the channels recognized as active are used to generate the ideal reference signal for the peak code domain error. If an assigned channel is not recognized as active since pilot symbols are missing or incomplete, the difference between the measurement and reference signal is very high. This display is a bar diagram over slots. The unit is dB. The Peak Code Domain Error evaluation covers the entire signal and the entire observation time.

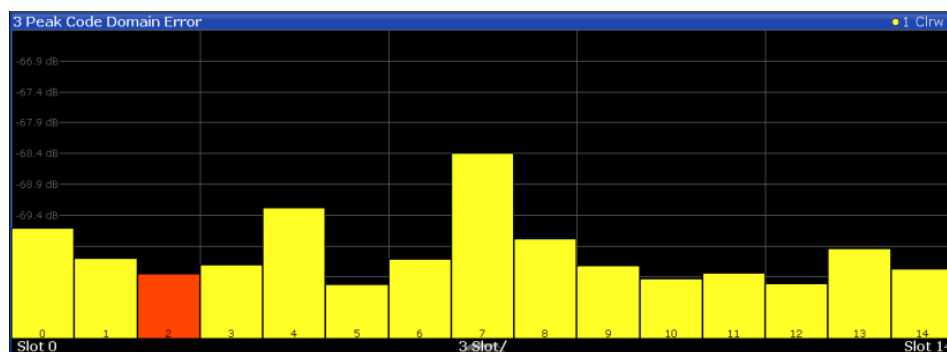


Figure 3-10: Peak Code Domain Error display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, PCDError, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### 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.

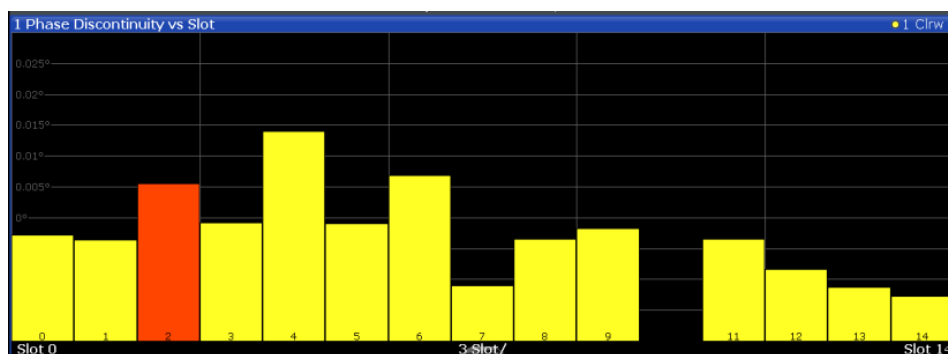


Figure 3-11: Phase Discontinuity vs Slot display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, PDSLot, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### 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 selected slot.

**Note:** In UE measurements, if the measurement interval "Halfslot" is selected for evaluation, 30 slots are displayed instead of the usual 15 (see "Measurement Interval" on page 127).

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°.

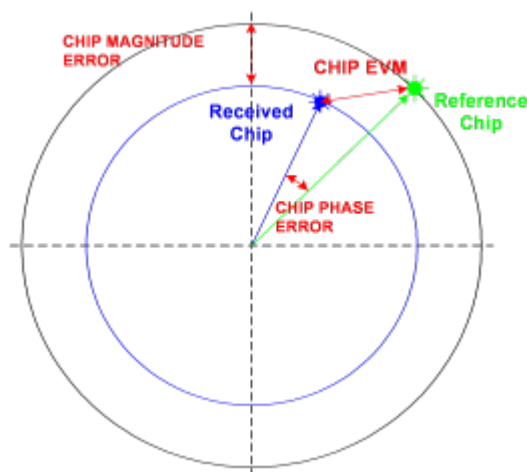
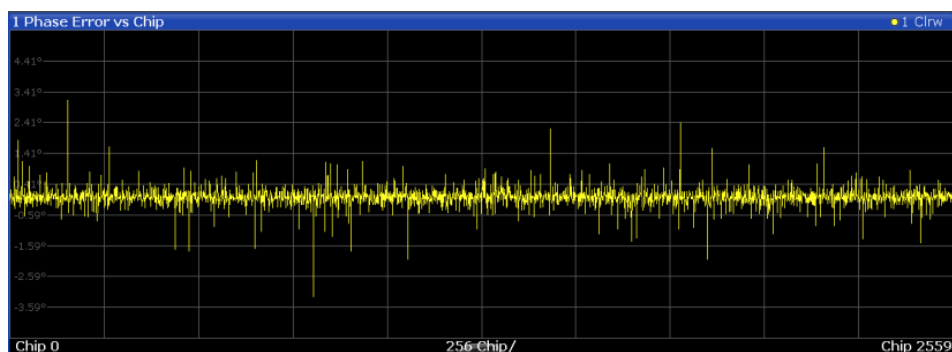


Figure 3-12: Calculating the magnitude, phase and vector error per chip

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

Where:

$\text{PHI}_k$	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



Remote command:

LAY:ADD? '1',RIGH, PEChip, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1..4>

### Power vs Slot

The Power vs Slot evaluation displays the power of the selected channel for each slot. The power is displayed either absolute or relative to the total power of the signal or to the CPICH channel.

**Note:** In UE measurements, this evaluation is only available if the analysis mode "Frame" is selected (see "Capture Mode" on page 96).

If the measurement interval "Halfslot" is selected for evaluation, 30 slots are displayed instead of the usual 15 (see "Measurement Interval" on page 127).

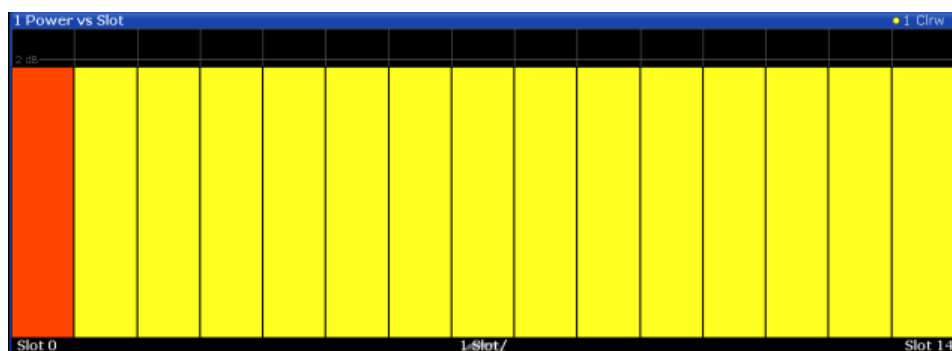


Figure 3-13: Power vs Slot Display for 3GPP FDD BTS measurements

If a timing offset of the selected channel in relation to the CPICH channel occurs, the power is calculated and displayed per channel slot (as opposed to the Code Domain Power evaluation). However, for reference purposes, the grid in the Power vs Slot diagram indicates the CPICH slots. The first CPICH slot is always slot 0, the grid and labels of the grid lines do not change. Thus, the channel slots may be shifted in the diagram grid. The channel slot numbers are indicated within the power bars. The selected slot is highlighted in the diagram.

Remote command:

LAY:ADD? '1',RIGH, PSLot, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TPVSlot

### Power vs Symbol

The Power vs. Symbol evaluation shows the power over the symbol number for the selected channel and the selected slot. The power is 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.

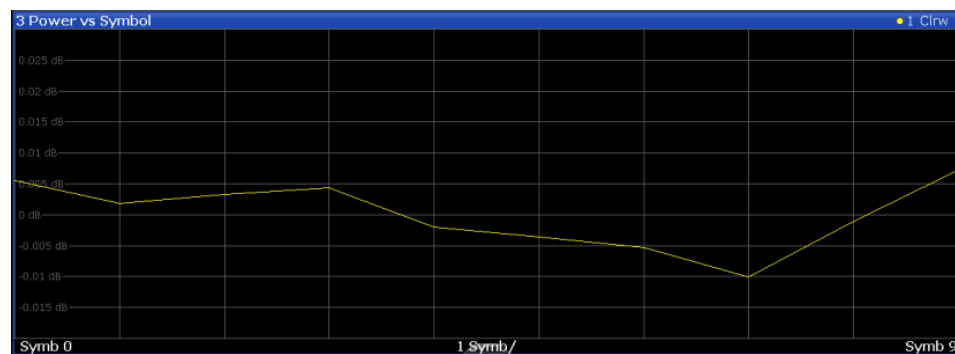


Figure 3-14: Power vs Symbol display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, PSYMBOL, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### Result Summary

The Result Summary evaluation displays a list of measurement results on the screen. For details see Chapter 3.1.1, "Code Domain Parameters", on page 16.

2 Result Summary					
General Results (Frame 0, CPICH Slot 2)					
Total Power	-10.79 dBm	Carrier Freq Error	-1.46 kHz	Chip Rate Error	1.46 ppm
Trigger To Frame	4.176281 ms	IQ Offset	0.08	IQ Imbalance	0.05 %
Avg Power Inact Chan	-100.19 dB	Composite EVM	0.34 %	Pk CDE(15 Ksps)	-70.17 dB
Rho	0.999988	No of Active Channels	44	Avg.RCDE(64QAM)	---
Channel Results (Ch 19.128)					
Symbol Rate	30 ksymb/s	Timing Offset	6400 Chips	No of Pilot Bits	8
Channel Slot No	0	RCDE	-45.43 dB	Modulation Type	QPSK
Channel Power Abs	-35.82 dBm	Symbol EVM	1.23 % PK		
Channel Power Rel	-13.99 dB	Symbol EVM	0.66 % rms		

Figure 3-15: Result Summary display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, RSUMmary, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>  
 CALCulate<n>:MARKer<m>:FUNCTION:WCDPower[:BTS]:RESult? on page 254

### Symbol Constellation

The Symbol Constellation evaluation shows all 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.



Figure 3-16: Symbol Constellation display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, SCONst, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### Symbol EVM

The Symbol EVM evaluation 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.

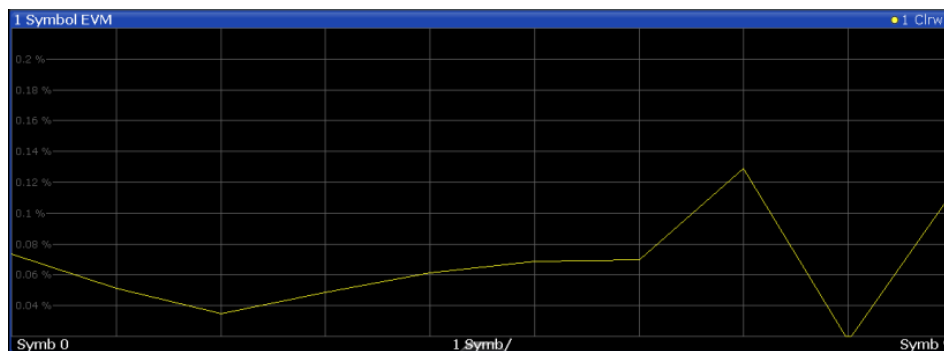


Figure 3-17: Symbol EVM display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, SEVM, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### Symbol Magnitude Error

The Symbol Magnitude Error is calculated analogous to symbol EVM. The result 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 expected ideal value. The symbol magnitude error is the difference between the magnitude of the received symbol and that of the reference symbol, related to the magnitude of the reference symbol.

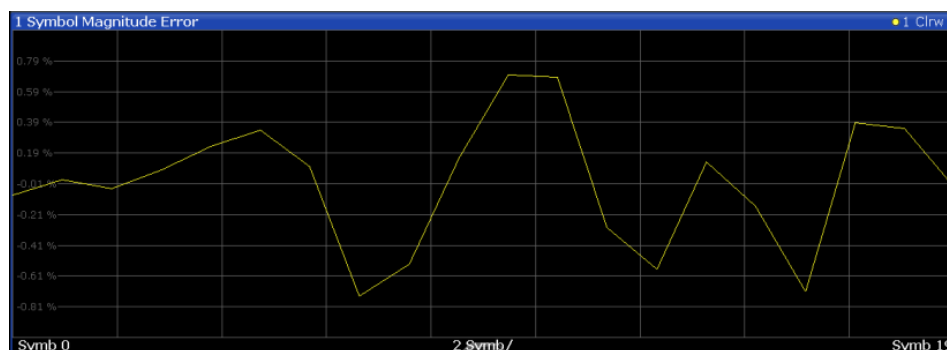


Figure 3-18: Symbol Magnitude Error display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, SMERror, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>

### Symbol Phase Error

The Symbol Phase Error is calculated analogous to symbol EVM. The result 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 expected ideal value.

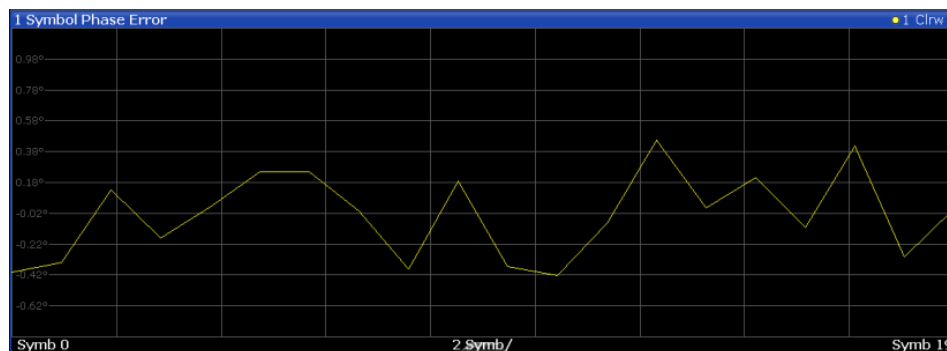


Figure 3-19: Symbol Phase Error display for 3GPP FDD BTS measurements

Remote command:

LAY:ADD? '1',RIGH, SPERror, see LAYout:ADD[:WINDow]? on page 242  
 TRACe<n>[:DATA]? TRACE<1...4>



### 3.1.3 CDA Measurements in MSRA Operating Mode

The 3GPP FDD BTS application can also be used to analyze data in MSRA operating mode.

In MSRA operating mode, only the MSRA Master actually captures data; the MSRA applications receive an extract of the captured data for analysis, referred to as the **application data**. The application data range is indicated in the MSRA Master by vertical blue lines.

However, the individual result displays of the application need not analyze the complete data range. The data range that is actually analyzed by the individual result display is referred to as the **analysis interval**.

In the 3GPP FDD BTS application, the analysis interval is automatically determined. It depends on the selected channel/ slot/ frame to analyze, which is defined for the evaluation range, and on the result display. The currently used analysis interval (in seconds, related to capture buffer start) is indicated in the window header for each result display.

For details on the MSRA operating mode, see the R&S FSW MSRA User Manual.

## 3.2 Time Alignment Error Measurements

**Access:** MEAS > "Time Alignment Error"

Time Alignment Error Measurements are a special type of Code Domain Analysis used to determine the time offset between signals on different antennas in a base station and different base stations. This measurement is required by the standard for Tx diversity and MIMO signals. It can be performed for the two transmitter branches of a BTS as well as for the transmit signals of multiple base stations on different transmit frequencies.

They are only available in 3GPP FDD BTS measurements.

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



#### Synchronization errors

A synchronization check is performed for both antennas which must have the result "Sync OK" to ensure a proper TAE result. Synchronization problems are indicated by the messages "No antenna 1 sync", "No antenna 2 sync" and "No sync".

---

For more information see [Chapter 4.8, "Time Alignment Error Measurements"](#), on page 54.

#### Evaluation Methods

For Time Alignment Error measurements, the following evaluation methods are available:

#### Result List

**For one base station only:**

Indicates the time delay (in chips) of the signal at antenna 2 relative to the signal at antenna 1.

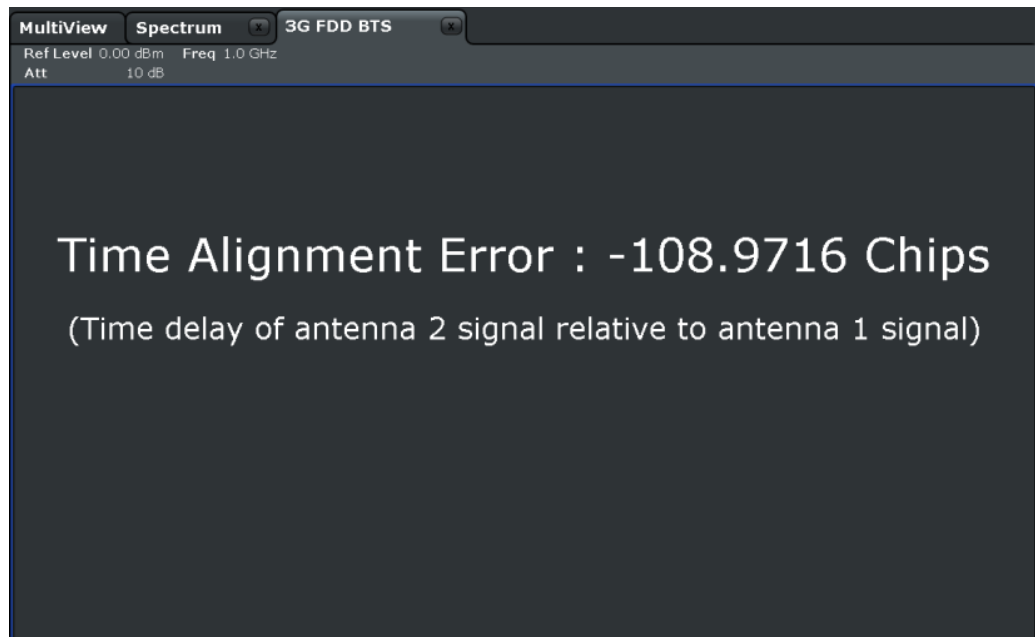


Figure 3-20: Time Alignment Error display for 1 base station

#### For multiple base stations and carriers:

Indicates the frequency offset for each carrier and the time delay (in chips) for each antenna, relative to the specified reference carrier. Furthermore, the synchronization state for each antenna is indicated. The overall status indicated above the table is "SYNC OK" only if the signals for all of the antennas for all of the base stations defined in the table are "SYNC OK".

1 Time Alignment Error					
Time Alignment for Frame : 0				No Sync	
Carrier	Offset	Ant1[chips]	State	Ant2[chips]	State
0	0.000 Hz	0.0000	No Sync	-548.5176	No Sync
1	5.000 MHz	-29887.2363	No Sync	-31293.2598	No Sync
2	10.000 MHz	-30052.6680	No Sync	-30639.9727	No Sync
3	15.000 MHz	7190.6895	No Sync	5802.2793	No Sync
4	20.000 MHz	-29919.2559	No Sync	-30982.2891	No Sync
5	25.000 MHz	8340.7012	No Sync	7775.9473	No Sync

Figure 3-21: Time Alignment Error display for multiple base stations and carriers

Remote command:

CONF:WCDP:MEAS TAER, see [CONFigure:WCDPower\[:BTS\]:MEASurement](#) on page 168

[CALCulate<n>:MARKer<m>:FUNCTION:TAERror:RESult?](#) on page 254

### 3.3 RF Measurements

In addition to the Code Domain Analysis measurements, the 3GPP FDD applications also provide some RF measurements as defined in the 3GPP FDD standard. RF measurements are identical to the corresponding measurements in the base unit, but configured according to the requirements of the 3GPP FDD standard.

For details on these measurements see the R&S FSW User Manual.



#### MSRA operating mode

RF measurements are not available in MSRA operating mode.

For details on the MSRA operating mode see the R&S FSW MSRA User Manual.

#### 3.3.1 RF Measurement Types and Results

**Access:** MEAS > Select Meas

The 3GPP FDD applications provide the following RF measurements:

Channel Power ACLR.....	35
Occupied Bandwidth.....	35
Power.....	36
RF Combi.....	36
Spectrum Emission Mask.....	37
CCDF.....	38

#### Channel Power ACLR

**Access:** MEAS > "Channel Power ACLR"

Channel Power ACLR performs an adjacent channel power measurement in the default setting according to 3GPP specifications (adjacent channel leakage ratio).

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

Remote command:

CONF:WCDP:MEAS ACLR, see [CONFIGure:WCDPower\[:BTS\]:MEASurement](#) on page 168

Querying results:

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>:RESult?](#) on page 276

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNCTION:POWer<sb>:RESult?](#) on page 276

#### Occupied Bandwidth

**Access:** MEAS > "OBW"

The Occupied Bandwidth measurement determines 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 table.

Remote command:

CONF:WCDP:MEAS OBAN, see [CONFigure:WCDPower\[:BTS\]:MEASurement](#) on page 168

Querying results:

CALC:MARK:FUNC:POW:RES? OBW, see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?](#) on page 276

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?](#) on page 276

### Power

**Access:** MEAS > "Power"

The Output Power measurement determines the 3GPP FDD signal channel power. The R&S FSW measures the unweighted RF signal power in a bandwidth of:

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

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.

Remote command:

CONF:WCDP:MEAS POW, see [CONFigure:WCDPower\[:BTS\]:MEASurement](#) on page 168

Querying results: CALC:MARK:FUNC:POW:RES? CPOW, see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?](#) on page 276

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult?](#) on page 276

### RF Combi

**Access:** MEAS > "RF Combi"

This measurement combines the following measurements:

- "Channel Power ACLR" on page 35
- "Occupied Bandwidth" on page 35
- "Spectrum Emission Mask" on page 37

The ACLR and OBW are measured on trace 1, from which the SEM trace 2 is derived via integration.

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 individual measurements.

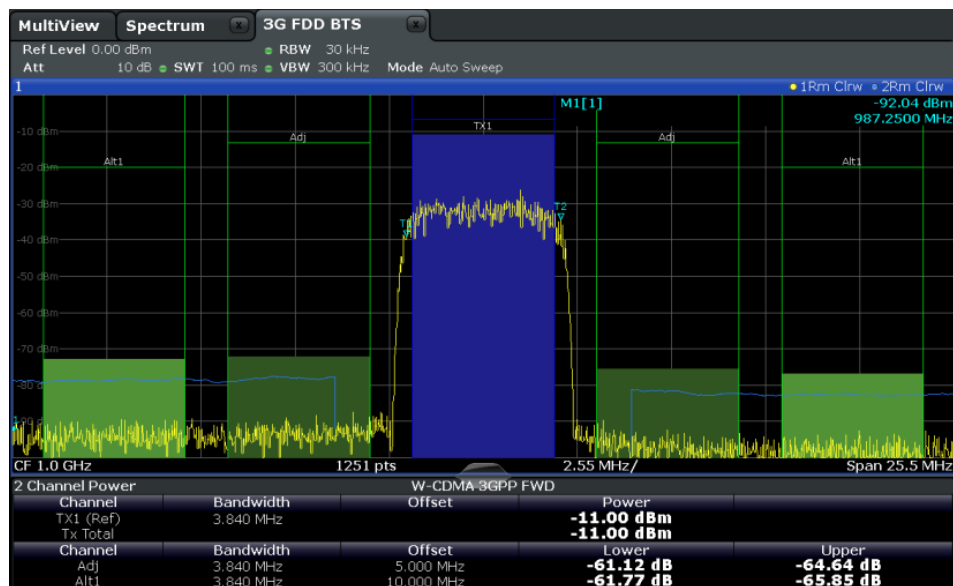


Figure 3-22: RF Combi measurement results

Remote command:

CONF:WCDP:BTS:MEAS RFC, see [CONFigure:WCDPower\[:BTS\]:MEASurement](#) on page 168

Querying results:

CALC:MARK:FUNC:POW:RES? ACP**CALC**ulate<n>:MARKer<m>:FUNCtion:  
**POWER**<sb>:RESult? on page 276

CALC:MARK:FUNC:POW:RES? OBW

CALC:MARK:FUNC:POW:RES? CPOW

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNCtion:  
\*\*POWER\*\*](#)<sb>:RESult? on page 276

CALC:MARK:FUNC:POW:RES? OBW

CALC:MARK:FUNC:POW:RES? CPOW

[CALCulate<n>:LIMit<k>:FAIL?](#) on page 275

### Spectrum Emission Mask

**Access:** MEAS > "Spectrum Emission Mask"

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

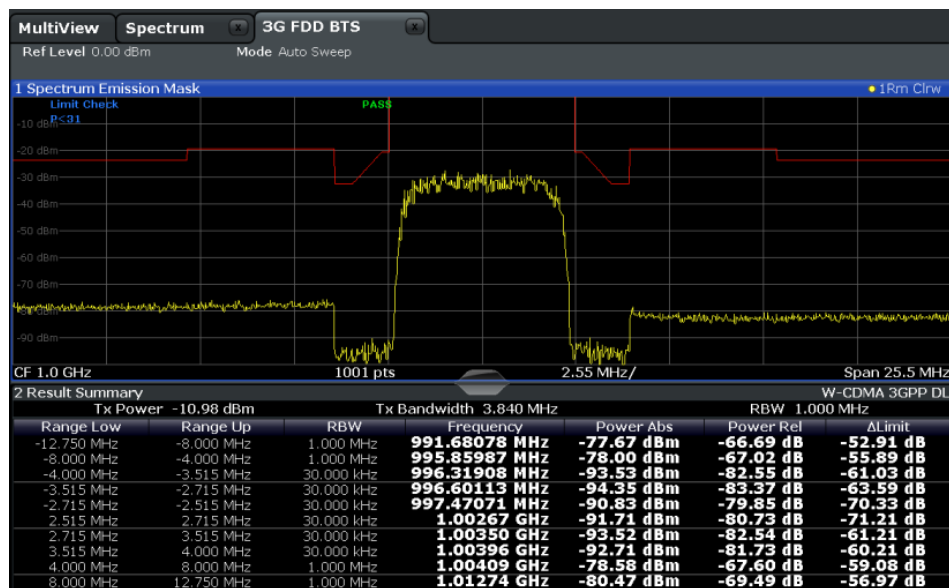


Figure 3-23: SEM measurement results for 3GPP FDD BTS measurements

Remote command:

CONF:WCDP:MEAS ESP, see [CONFigure:WCDPower\[:BTS\]:MEASurement](#) on page 168

Querying results:

CALC:MARK:FUNC:POW:RES? CPOW, see [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESULT?](#) on page 276

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESULT?](#) on page 276

[CALCulate<n>:LIMIT<k>:FAIL?](#) on page 275

## CCDF

**Access:** MEAS > "CCDF"

The CCDF measurement determines the distribution 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.

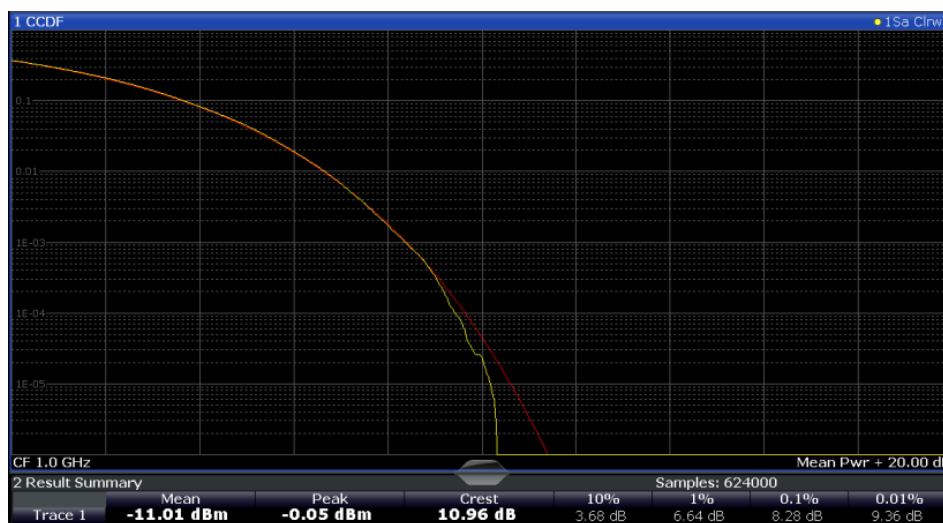


Figure 3-24: CCDF measurement results for 3GPP FDD BTS measurements

Remote command:

CONF:WCDP:MEAS CCDF, see [CONFIGure:WCDPower\[:BTS\]:MEASurement](#) on page 168

Querying results:

[CALCulate<n>:MARKer<m>:Y?](#) on page 278

[CALC:MARK:FUNC:POW:RES? ACP](#), see [CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?](#) on page 276

[CALC:MARK:FUNC:POW:RES? ACP](#), see [CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?](#) on page 276

[CALCulate<n>:STATistics:RESult<t>?](#) on page 278

### 3.3.2 Evaluation Methods for RF Measurements



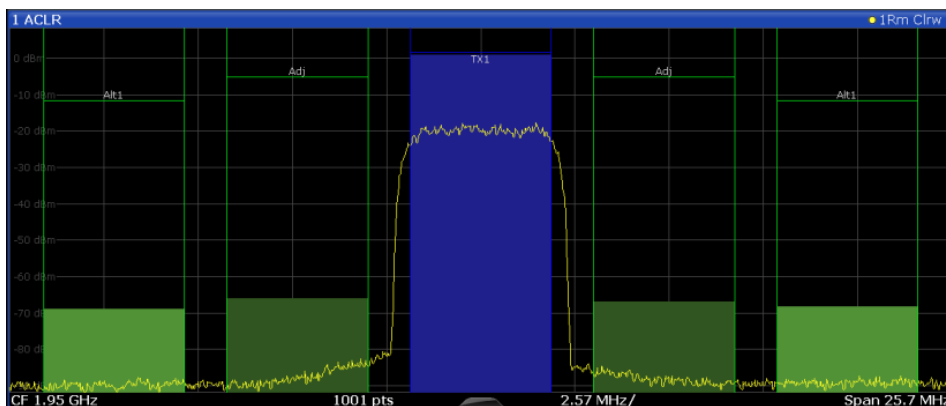
Access: "Overview" > "Display Config"

The evaluation methods for RF measurements are identical to those in the Spectrum application.

<a href="#">Diagram</a> .....	39
<a href="#">Result Summary</a> .....	40
<a href="#">Marker Table</a> .....	40
<a href="#">Marker Peak List</a> .....	41

#### Diagram

Displays a basic level vs. frequency or level vs. time diagram of the measured data to evaluate the results graphically. This is the default evaluation method. Which data is displayed in the diagram depends on the "Trace" settings. Scaling for the y-axis can be configured.



Remote command:

LAY:ADD? '1',RIGH, DIAG, see LAYout:ADD[:WINDow]? on page 242

### Result Summary

Result summaries provide the results of specific measurement functions in a table for numerical evaluation. The contents of the result summary vary depending on the selected measurement function. See the description of the individual measurement functions for details.

2 Result Summary				
Channel	Bandwidth	Offset	Power	
TX1 (Ref)	1.229 MHz		<b>-0.86 dBm</b>	
Tx Total			<b>-0.86 dBm</b>	
Channel	Bandwidth	Offset	Lower	Upper
Adj	30.000 kHz	750.000 kHz	<b>-79.59 dB</b>	<b>-80.34 dB</b>
Alt1	30.000 kHz	1.960 MHz	<b>-85.04 dB</b>	<b>-83.85 dB</b>

**Tip:** To navigate within long result summary tables, simply scroll through the entries with your finger on the touchscreen.

Remote command:

LAY:ADD? '1',RIGH, RSUM, see LAYout:ADD[:WINDow]? on page 242

### Marker Table

Displays a table with the current marker values for the active markers.

This table may be displayed automatically if configured accordingly (see "Marker Table Display" on page 133).

4 Marker Table						
Wnd	Type	Ref	Trc	X-value	Y-value	
1	M1		1	<b>13.25 GHz</b>	<b>-200.0 dBm</b>	
1	D2	M1	1	<b>-600.0 kHz</b>	<b>0.0 dB</b>	
1	D3	M1	1	<b>600.0 kHz</b>	<b>0.0 dB</b>	
1	D4	M1	1	<b>-2.0 MHz</b>	<b>0.0 dB</b>	

**Tip:** To navigate within long marker tables, simply scroll through the entries with your finger on the touchscreen.

Remote command:

LAY:ADD? '1',RIGH, MTAB, see LAYout:ADD[:WINDow]? on page 242

Results:

CALCulate<n>:MARKer<m>:X on page 282

CALCulate<n>:MARKer<m>:Y? on page 278



### Marker Peak List

The marker peak list determines the frequencies and levels of peaks in the spectrum or time domain. How many peaks are displayed can be defined, as well as the sort order. In addition, the detected peaks can be indicated in the diagram. The peak list can also be exported to a file for analysis in an external application.

2 Marker Peak List		
No	Stimulus	Response
1	64.400000 MHz	-30.352 dBm
2	128.400000 MHz	-51.896 dBm
3	192.300000 MHz	-40.227 dBm
4	257.200000 MHz	-60.699 dBm
5	320.200000 MHz	-44.273 dBm
6	384.100000 MHz	-53.494 dBm
7	448.100000 MHz	-47.460 dBm
8	513.000000 MHz	-55.603 dBm

**Tip:** To navigate within long marker peak lists, simply scroll through the entries with your finger on the touchscreen.

Remote command:

LAY:ADD? '1',RIGH, PEAK, see [LAYout:ADD\[:WINDow\]?](#) on page 242

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 282

[CALCulate<n>:MARKer<m>:Y?](#) on page 278

## 4 Measurement Basics

Some background knowledge on basic terms and principles used in 3GPP FDD tests and measurements is provided here for a better understanding of the required configuration settings.

### Basic principle

The basic principle of 3GPP FDD (frequency division duplex) is that the communication between a base station and several mobile stations is performed in the same frequency band and in the same time slots. The separation of the data for the different mobile stations is achieved by using CDMA (Code Division Multiple Access). In this technique, channels are distinguished by using different orthogonal codes.

### Scrambling codes

Each base station uses a unique scrambling code. The mobile station can only demodulate the base station signal if it knows which scrambling code was used by the base station.

Thus, in order to demodulate the data in the 3GPP FDD applications, you must either specify the scrambling code explicitly, or the application can perform an automatic search to detect the scrambling code itself.

### Channels, codes and symbol rate

In signals according to the 3GPP FDD standard, the data is transmitted in channels. These channels are based on orthogonal codes and can have different data rates. The data rate depends on the used modulation type and the spreading factor of the channel.

### Spreading factors

**Spreading factors** determine whether the transmitted data is sent in short or long sequences. The spreading factor is re-assigned dynamically in certain time intervals according to the current demand of users and data to be transmitted. The higher the spreading factor, the lower the data rate; the lower the spreading factor, the higher the data rate.

The smallest available spreading factor is 4, the largest is 512. So we can say that the code domain consists of 512 basic codes. A channel with a lower spreading factor consists of several combined codes. That means a channel can be described by its number and its spreading factor.

The following table shows the relationship between the code class, the spreading factor, the number of codes per channel, and the symbol rate.

**Table 4-1: Relationship between code class, spreading factor, codes per channel and symbol rate for 3GPP FDD signals**

Code class	Spreading factor	No. codes / channel	Symbol rate
2	4	128	960 ksps
3	8	64	480 ksps
4	16	32	240 ksps
5	32	16	120 ksps
6	64	8	60 ksps
7	128	4	30 ksps
8	256	2	15 ksps
9	512	1	7.5 ksps



In the measurement settings and results, the spreading factor is often represented by the corresponding symbol rate (in kilo symbols per second, ksps). The power of a channel is always measured in relation to its symbol rate (or spreading factor).

In the 3GPP FDD applications, the channel number consists of the used spreading factor and the channel's sequential number in the code domain, assuming the code domain is divided into equal divisions:

<sequence number>.<spreading factor>

#### Example:

For a channel number of 5.32, for example, imagine a code domain of 512 codes with a scale of 16 codes per division. Each division represents a possible channel with spreading factor 32. Since channel numbering starts at 0, channel number 5 is the sixth division on the scale.

#### Selected codes and channels

In the result displays that refer to channels, the currently selected channel is highlighted in the diagram. You select a channel by entering a channel number and spreading factor in the "Evaluation Range" settings. In the example above, if you select the channel number 5.32, the sixth division on the scale with 16 codes per division is highlighted.

For the display in the 3GPP FDD applications, the scale for code-based diagrams contains 512 divisions, one for each code. The selected channel in the example (5.32) would thus correspond to codes 80-96. (The division starts at  $5 \cdot 16 = 80$  and is 16 codes wide.)

If no spreading factor is given for the channel number, the default factor 512 is assumed. Channel number 5 would thus refer to the sixth division on the scale, which is the sixth code in the code domain. If the code belongs to a detected channel, the entire channel is highlighted.

If the selected channel is not active, only the first code belonging to the corresponding division is highlighted. In the example, for the inactive channel number 5.32, the first code in the sixth division on the scale with 16 codes per division is highlighted. That corresponds to code number 80 with the scale based on 512 divisions.

### Special channels - PCCPCH, SCH, CPICH, DPCH

In order to control the data transmission between the sender and the receiver, specific symbol must be included in the transmitted data, for example the scrambling code of the sender or the used spreading factor, as well as synchronization data for different channels. This data is included in special data channels defined by the 3GPP standard which use fixed codes in the code domain. Thus, they can be detected easily by the receiver.

The **Primary Common Control Physical Channel** (PCCPCH) must always be contained in the signal. As the name implies, it is responsible for common control of the channels during transmission.

The **Synchronization Channel** (SCH) is a time reference and responsible for synchronizing the individual channels.

Another important channel is the **Common Pilot Channel** (CPICH), which continuously transmits the sender's scrambling code. This channel is used to identify the sender, but also as a reference in 3GPP FDD signal measurements.

The user data is contained in the **Dedicated Physical Channel** (DPCH).

More details on channel types are provided in [Chapter 4.2, "BTS Channel Types"](#), on page 45.

### Chips, frames and slots

The user data is spread across the available bandwidth using the spreading factor before transmission. The spread bits are referred to as "chips".

A time span of 10 ms is also known as a "frame". A frame is a basic time unit in the transmission process. Each frame is divided into 15 time "slots". Various channel parameters are put in relation to frames or the individual slots in the 3GPP standard, as well as some measurement results for 3GPP FDD signals. A slot contains 2560 chips.

### Channel slots versus CPICH slots

The time slots of the individual channels may not be absolutely synchronous. A time offset may occur, so that the slots in a data channel are slightly shifted in relation to the CPICH slots, for example. In the 3GPP FDD BTS application, the CPICH slot number is provided as a reference with the measurement settings in the channel bar. In the Result Summary, the actual slot number of the evaluated channel is indicated as the "Channel Slot No".

### Pilot symbols

Some slots contain a fixed sequence of symbols, referred to as "pilot symbols". These pilot symbols allow the receiver to identify a particular channel, if the unique pilot symbols can be detected in the input signal.

### Power control

While the spreading factors are adjusted for each frame, i.e. every 10 ms, the power levels for transmission must be adapted to the current requirements (such as interference) much more dynamically. Thus, power control bits are transmitted in each slot, allowing for much higher change rates. As the CPICH channel continuously transmits the same data, the power level need not be adapted. Thus, the power control bits can lead to a timing offset between the CPICH slots and other channel slots.

## 4.1 Channel Detection

The 3GPP FDD applications provide two basic methods of detecting active channels:

- **Automatic search using pilot sequences**

The application performs an automatic search for active (DPCH) channels throughout the entire code domain. The search is based on the presence of known symbol sequences (pilot symbols) in the despread symbols of a channel. A data channel is considered to be active if the pilot symbols as specified by the 3GPP FDD standard are found at the end of each slot. In this mode, channels without or with incomplete pilot symbols are therefore not recognized as being active.

An exception to this rule is seen in the special channels PICH and SCCPCH, which can be recognized as active in the automatic search mode although they do not contain pilot symbols. Optionally, all QPSK-modulated channels can also be recognized without pilot symbols (see "[HSDPA/UPA](#)" on page 63).

In addition, the channel must exceed a minimum power in order to be considered active (see "[Inactive Channel Threshold \(BTS measurements only\)](#)" on page 99).

**In UE measurements**, a channel is considered to be active if a minimum signal/noise ratio is maintained within the channel.

- **Comparison with predefined channel tables**

The input signal is compared to a predefined channel table. All channels that are included in the predefined channel table are considered to be active.

## 4.2 BTS Channel Types

The 3GPP FDD standard defines various BTS channel types. Some channels are mandatory and must be contained in the signal, as they have control or synchronization functions. Thus, these channels always occupy a specific channel number and use a specific symbol rate by which they can be identified.

### Control and synchronization channels

The 3GPP FDD BTS application expects the following control and synchronization channels for the Code Domain Power measurements:

Table 4-2: Common 3GPP FDD BTS control channels and their usage

Channel type	Description
<b>PSCH</b>	<p><b>Primary Synchronization Channel</b></p> <p>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.</p>
<b>SSCH</b>	<p><b>Secondary Synchronization Channel</b></p> <p>The Secondary Synchronization Channel is a non-orthogonal channel. Only the power of this channel is determined.</p>
<b>PCCPCH</b>	<p><b>Primary Common Control Physical Channel</b></p> <p>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.</p>
<b>SCCPCH</b>	<p><b>Secondary Common Control Physical Channel</b></p> <p>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 be fixed and can vary. For this reason, the following rules are used to indicate the SCCPCH.</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• If the application is configured to recognize all QPSK-modulated channels without pilot symbols (see "<a href="#">HSDPA/UPA</a>" on page 63), and one of these channels is received at code class 8 and code number 3, it is displayed as the SCCPCH.</li> </ul>
<b>CPICH</b>	<p><b>Common Pilot Channel</b></p> <p>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.</p> <p>If it is not contained in the signal configuration, the firmware application must be configured to synchronize to the SCH channel (see "<a href="#">Synchronization Type</a>" on page 97).</p>

Other channels are optional and contain the user data to be transmitted. A data channel is any channel that does not have a predefined channel number and symbol rate. The following channel types can be detected by the 3GPP FDD BTS application.

Table 4-3: Common 3GPP FDD BTS data channels and their usage

Channel type	Description
<b>PICH</b>	<p><b>Paging Indication Channel</b></p> <p>The Paging Indication Channel is expected at code class 8 and code number 16.</p> <p>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 are indicated in the column "Chan Type".</p>
<b>DPCH</b>	<p><b>Dedicated Physical Channel</b> of a standard frame</p> <p>The Dedicated Physical Channel is a data channel that contains pilot symbols. The displayed channel type is DPCH.</p>
<b>CPRSD</b>	<p>Dedicated Physical Channel (DPCH) in <b>compressed</b> mode</p> <p>Compressed mode channels usually do not transmit valid symbols in all slots. There are different lengths of the transmitting gap. One to fourteen slots can be switched off in each frame. In some cases outside the gap the symbol rate is increased by 2 to ensure a constant average symbol rate of this channel. In any case all of the transmitted slots contain a pilot sequence defined in the 3GPP specification. There are different types of compressed mode channels.</p> <p>To evaluate compressed mode channels, the associated measurement mode needs to be activated (see "<a href="#">Compressed Mode</a>" on page 64).</p>
<b>CPR-TPC</b>	DPCH in <b>compressed</b> mode where <b>TPC</b> symbols are sent in the first slot of the transmitting gap
<b>CPR-SF/2</b>	DPCH in <b>compressed</b> mode using half spreading factor ( <b>SF/2</b> ) to increase the symbol rate of the active slots by two
<b>CPR-SF/2-TPC</b>	DPCH in <b>compressed</b> mode using half spreading factor ( <b>SF/2</b> ) to increase the symbol rate of the active slots by two, where <b>TPC</b> symbols are sent in the first slot of the transmitting gap
<b>HS-PDSCH</b>	<p>HSDPA: <b>High Speed Physical Downlink Shared Channel</b></p> <p>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 vary depending on the selected slot.</p> <p><b>HSPDSCH-QPSK_</b>: QPSK-modulated slot of an HS PDSCH channel  <b>HSPDSCH-16QAM_</b>: 16QAM-modulated slot of an HS PDSCH channel  <b>HSPDSCH-NONE_</b>: slot without power of an HS PDSCH channel</p>
<b>HS-SCCH</b>	<p>HSDPA: <b>High Speed Shared Control Channel</b></p> <p>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.</p> <p>If the application is configured to recognize all QPSK-modulated channels without pilot symbols (see "<a href="#">HSDPA/UPA</a>" on page 63), 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 is 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. Therefore, the unassigned codes are always to be found at the end of the table.</p> <p>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.</p>

Channel type	Description
EHICH-ERGCH	HSUPA: Enhanced HARQ Hybrid Acknowledgement Indicator Channel Enhanced Relative Grant Channel
EAGCH	Enhanced Absolute Grant Channel
SCPICH	Secondary Common Pilot Channel
CHAN	If the application is configured to recognize all QPSK-modulated channels without pilot symbols (see "HSDPA/UPA" on page 63), all QPSK-modulated channels without pilot symbols and a code class higher than or equal to 7 are marked with the channel type CHAN.

### MIMO channel types

Optionally, single antenna MIMO measurement channels can also be detected. In this case, 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".

The MIMO constellations resulting on a single antenna consist of three amplitudes per dimension (-1, 0, 1) in the case of QPSK x QPSK, and seven amplitudes per dimension (-3, -2, -1, 0, 1, 2, 3) 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 4-4: 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 4-5: 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



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

### 4.3 UE Channel Types

The following channel types can be detected in 3GPP FDD uplink signals by the 3GPP FDD UE application.

#### Control channels

The 3GPP FDD UE application expects the following control channels for the Code Domain Power measurements:

*Table 4-6: Common 3GPP FDD UE control channels and their usage*

Channel type	Description
DPCCH	The <b>D</b> edicated <b>P</b> hysical <b>C</b> ontrol <b>C</b> hannel is used to synchronize the signal. It carries pilot symbols and is expected in the Q branch at code class 8 with code number 0. This channel must be contained in every channel table.
HSDPCCH	The <b>H</b> igh <b>S</b> peed <b>D</b> edicated <b>P</b> hysical <b>C</b> ontrol <b>C</b> hannel (for HS-DCH) is used to carry control information (CQI/ACK/NACK) for downlink high speed data channels (HS-DCH). It is used in HSDPA signal setup. The symbol rate is fixed to 15ksps. The code allocation depends on the number of active DPCH. The HS-DPCCH can be switched on or off after the duration of 1/5 frame or 3 slots or 2ms. Power control is applicable too.
EDPCCH	The <b>E</b> nhanced <b>D</b> edicated <b>P</b> hysical <b>C</b> ontrol <b>C</b> hannel is used to carry control information for uplink high speed data channels (EDPDCH). It is used in HSUPA signal setup. The symbol rate is fixed to 15ksps.

Other channels are optional and contain the user data to be transmitted. A data channel is any channel that does not have a predefined channel number and symbol rate.

The following channel types can be detected by the 3GPP FDD UE application:

*Table 4-7: Common 3GPP FDD UE data channels and their usage*

Channel type	Description
DPDCH	The <b>D</b> edicated <b>P</b> hysical <b>D</b> ata <b>C</b> hannel is used to carry UPLINK data from the UE to the BS. The code allocation depends on the total required symbol rate.
EDPDCH	The <b>E</b> nhanced <b>D</b> edicated <b>P</b> hysical <b>D</b> ata <b>C</b> hannel is used to carry UPLINK data for high speed channels (EDPDCH). It is used in HSUPA signal setup. The symbol rate and code allocation depends on the number of DPDCH and HS-DPCCH.



As specified in 3GPP, the channel table can contain up to 6 DPDCHs or up to 4 E-DPDCHs.

## 4.4 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 here.

**Table 4-8: Test model 1**

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	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 4-9: 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 x 10, 1 x 50	2 x -10, 1 x -3	24, 72, 120	1, 7, 2

**Table 4-10: Test model 3**

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (x256Tchip)
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 4-11: Test model 4

Channel type	Number of channels	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 4-12: 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

## 4.5 Setup for Base Station Tests

This section describes how to set up the analyzer for 3GPP FDD BTS tests. As a prerequisite for starting the test, the R&S FSW must be correctly set up and connected to the AC power supply as described in the instrument's Getting Started manual. Furthermore, the 3GPP FDD BTS application must be available.

### Standard Test Setup

- Connect the antenna output (or Tx output) of the BTS to the 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

Max. power	Recommended ext. attenuation
≥30 to 35 dBm	10 to 15 dB
≥25 to 30 dBm	5 to 10 dB
≥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 trigger input of the analyzer.

### Presetting

Configure the R&S FSW as follows:

- Set the external attenuation (Reference level offset).
- Set the reference level.
- Set the center frequency.
- Set the trigger.
- Select the BTS standard and measurement.

## 4.6 3GPP FDD UE Test Models

The possible channel configurations for the mobile station signal are limited by 3GPP. Only two different configurations for data channels DPDCH are permissible according to the specification. In addition to these two channel configurations, the HS-DPCCH channel can be transmitted to operate the mobile station in HSDPA mode. Thus, the 3GPP FDD UE application checks for these channel configurations only during the automatic channel search. Therefore, channels whose parameters do not correspond to one of these configurations are not automatically detected as active channels.

The two possible channel configurations are summarized below:

**Table 4-13: Channel configuration 1: DPCCH and 1 DPDCH**

Channel type	Number of channels	Symbol rate	Spreading code(s)	Mapping
DPCCH	1	15 ksps	0	Q
DPDCH	1	15 ksps – 960 ksps	[spreading-factor/4]	I

**Table 4-14: Channel configuration 2: DPCCH and up to 6 DPDCH**

Channel type	Number of channels	Symbol rate	Spreading code(s)	Mapping
DPCCH	1	15 ksps	0	Q
DPDCH	1	960 ksps	1	I
DPDCH	1	960 ksps	1	Q
DPDCH	1	960 ksps	3	I
DPDCH	1	960 ksps	3	Q
DPDCH	1	960 ksps	2	I
DPDCH	1	960 ksps	2	Q

**Table 4-15: Channel configuration 3: DPCCH, up to 6 DPDCH and 1 HS-DPCCH** The channel configuration is as above in table 4-2. On HS-DPCCH is added to each channel table.

Number of DPDCH	Symbol rate all DPDCH	Symbol rate HS-DPCCH	Spreading code HS-DPCCH	Mapping (HS-DPCCH)
1	15 – 960 ksps	15 ksps	64	Q
2	1920 ksps	15 ksps	1	I
3	2880 ksps	15 ksps	32	Q
4	3840 ksps	15 ksps	1	I
5	4800 ksps	15 ksps	32	Q
6	5760 ksps	15 ksps	1	I

**Table 4-16: Channelization code of HS-DPCCH**

Nmax-dpdch (as defined in subclause 4.2.1)	Channelization code $C_{ch}$
1	$C_{ch,256,64}$
2,4,6	$C_{ch,256,1}$
3,5	$C_{ch,256,32}$

## 4.7 Setup for User Equipment Tests

This section describes how to set up the R&S FSW for 3GPP FDD UE user equipment tests. As a prerequisite for starting the test, the R&S FSW must be correctly set up and connected to the AC power supply as described in the analyzer's Getting Started manual. Furthermore, the 3GPP FDD UE application must be installed.

### Standard Test Setup

- Connect antenna output (or Tx output) of UE 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
<sup>3</sup> 55 to 60 dBm	35 to 40 dB
<sup>3</sup> 50 to 55 dBm	30 to 35 dB
<sup>3</sup> 45 to 50 dBm	25 to 30 dB
<sup>3</sup> 40 to 45 dBm	20 to 25 dB
<sup>3</sup> 35 to 40 dBm	15 to 20 dB
<sup>3</sup> 30 to 35 dBm	10 to 15 dB
<sup>3</sup> 25 to 30 dBm	5 to 10 dB
<sup>3</sup> 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 external reference input connector of the analyzer (REF INPUT).
- 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 user equipment. For instance, a rubidium frequency standard may be used as a reference source.
- If the user equipment is provided with a trigger output, connect this output to one of the TRIGGER INPUT connectors of the analyzer.

### Presetting

Configure the R&S FSW as follows:

- Set the external attenuation (Reference level offset).
- Set the reference level.
- Set the center frequency.
- Set the trigger.
- Select the UE standard and measurement.

## 4.8 Time Alignment Error Measurements

Time Alignment Error Measurements are a special type of Code Domain Analysis used to determine the time offset between signals on different antennas in a base station and different base stations. They can be performed for the two transmitter branches of a BTS as well as for the transmit signals of multiple base stations on different transmit

frequencies. The time alignment error is relevant, for instance, for WCDMA base stations using TX diversity or MIMO configurations.

- [Measurement Setup for Two Antennas in a Base Station](#)..... 55
- [Measurement Setup for Transmit Signals From Multiple Base Stations](#).....55

#### 4.8.1 Measurement Setup for Two Antennas in 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 [Time Alignment Error Measurement setup for one base station using an R&S FSW](#) shows the measurement setup.

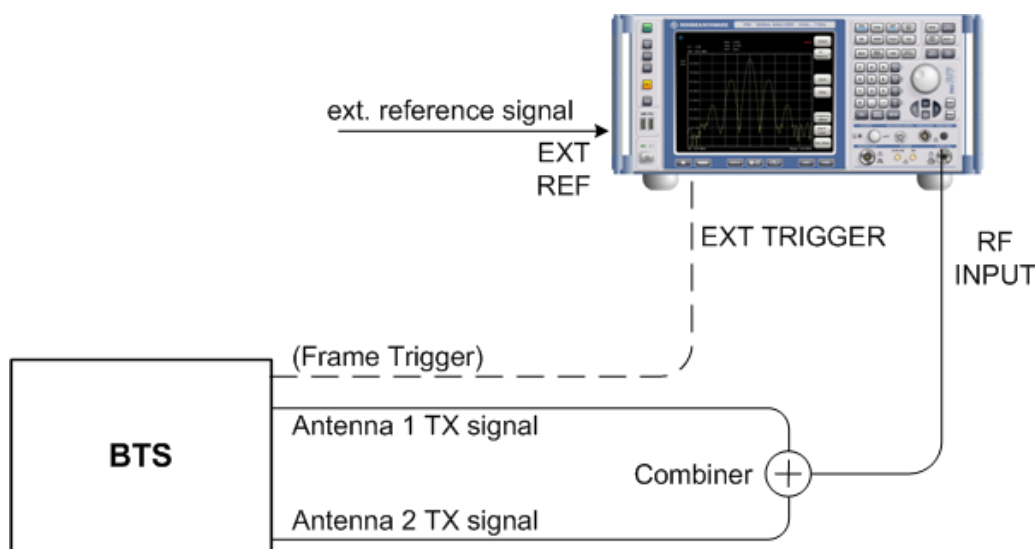


Figure 4-1: Time Alignment Error Measurement setup for one base station using an R&S FSW

##### Synchronization check

A synchronization check is performed for both antennas which must have the result "Sync OK" to ensure a proper TAE result. Synchronization problems are indicated by the messages "No antenna 1 sync", "No antenna 2 sync" and "No sync". Errors can also be read remotely via bits 1 and 2 of the `Sync` status register (see [Chapter 11.13, "Querying the Status Registers"](#), on page 295).

#### 4.8.2 Measurement Setup for Transmit Signals From Multiple Base Stations

All of the signals must be superimposed in a similar way to the measurement with a single base station, prior to feeding them into the spectrum analyzer's RF input. The signals from the different base stations can each include one or both of the transmit antennas. Here too, all of the signals on all of the antennas to be tested must provide a

common pilot channel: P-CPICH for all signals on antenna 1, P-CPICH or S-CPICH for signals on antenna 2.

### Carrier tables

The number of base stations and the transmit frequency of the base stations can be defined using a table. You can define a table interactively in the R&S FSW 3GPP FDD Measurements application, using remote commands, or offline by defining an xml file with a specified structure. A template for such a file is provided with the R&S FSW 3GPP FDD Measurements application.

A default table ("RECENT") is always available and cannot be deleted.

### Carriers and reference carrier

The measurement can be performed for base station signals on different transmit frequencies for up to 4 signals. One carrier must be defined as the reference carrier for the time alignment error results. Based on the maximum spacing for the base stations set in the table, the R&S FSW 3GPP FDD Measurements application determines the necessary bandwidth and sampling rate. The smallest possible bandwidth and sampling rate are always used.

### Carrier frequencies

Carriers are defined by their frequencies, or more precisely: as frequency offsets to the reference carrier. The reference carrier itself is set to the current center frequency, thus the offset is always 0.

The **minimum spacing** between two carriers is 2.5 MHz. If this minimum spacing is not maintained, a conflict is indicated.

The **maximum positive and negative frequency offset** which a carrier can have from the reference depends on the available analysis bandwidth.

- R&S FSW with no bandwidth extension options: 1 carrier only (multi-carrier not available)
- R&S FSW with bandwidth extension option B28:  $\pm 5.5$  MHz
- R&S FSW with bandwidth extension option B40:  $\pm 17.5$  MHz
- R&S FSW with bandwidth extension option B80:  $\pm 37.5$  MHz
- R&S FSW with bandwidth extension option B160 or higher:  $\pm 61.5$  MHz

If the maximum offsets from the reference are exceeded, a conflict is indicated.

### Carrier details

For each base station to be tested, the scrambling code, CPICH number and patterns used on both antennas must be known in order to enable synchronization to the signal for this antenna.



## 4.9 CDA Measurements in MSRA Operating Mode

The 3GPP FDD BTS application can also be used to analyze data in MSRA operating mode.

In MSRA operating mode, only the MSRA Master actually captures data; the MSRA applications receive an extract of the captured data for analysis, referred to as the **application data**. For the 3GPP FDD BTS application in MSRA operating mode, the application data range is defined by the same settings used to define the signal capture in Signal and Spectrum Analyzer mode. In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the analysis interval for the 3GPP FDD BTS measurement.

### Data coverage for each active application

Generally, if a signal contains multiple data channels for multiple standards, separate applications are used to analyze each data channel. Thus, it is of interest to know which application is analyzing which data channel. The MSRA Master display indicates the data covered by each application, restricted to the channel bandwidth used by the corresponding standard (for 3GPP FDD: 5 MHz), by vertical blue lines labeled with the application name.

### Analysis interval

However, the individual result displays of the application need not analyze the complete data range. The data range that is actually analyzed by the individual result display is referred to as the **analysis interval**.

In the 3GPP FDD BTS application the analysis interval is automatically determined according to the selected channel, slot or frame to analyze which is defined for the evaluation range, depending on the result display. The analysis interval can not be edited directly in the 3GPP FDD BTS application, but is changed automatically when you change the evaluation range.

### Analysis line

A frequent question when analyzing multi-standard signals is how each data channel is correlated (in time) to others. Thus, an analysis line has been introduced. The analysis line is a common time marker for all MSRA slave applications. It can be positioned in any MSRA slave application or the MSRA Master and is then adjusted in all other slave applications. Thus, you can easily analyze the results at a specific time in the measurement in all slave applications and determine correlations.

If the marked point in time is contained in the analysis interval of the slave application, the line is indicated in all time-based result displays, such as time, symbol, slot or bit diagrams. By default, the analysis line is displayed, however, it can be hidden from view manually. In all result displays, the "AL" label in the window title bar indicates whether the analysis line lies within the analysis interval or not:

- **orange "AL"**: the line lies within the interval
- **white "AL"**: the line lies within the interval, but is not displayed (hidden)
- **no "AL"**: the line lies outside the interval

For details on the MSRA operating mode see the R&S FSW MSRA User Manual.

## 5 Configuration

The 3GPP FDD applications provide several different measurements for signals according to the 3GPP FDD application. The main and default measurement is Code Domain Analysis. Furthermore, a Time Alignment Error measurement is provided. In addition to the code domain power measurements specified by the 3GPP standard, the 3GPP FDD options offer measurements with predefined settings in the frequency domain, e.g. RF power measurements.

Only one measurement type can be configured per channel; however, several channels with 3GPP FDD applications can be configured in parallel on the R&S FSW. Thus, you can configure one channel for a Code Domain Analysis, for example, and another for a Time Alignment Error or Power measurement for the same input signal. Then you can use the Sequencer to perform all measurements consecutively and either switch through the results easily or monitor all results at the same time in the "MultiView" tab.

For details on the Sequencer function see the R&S FSW User Manual.

### Selecting the measurement type


When you activate an 3GPP FDD application, Code Domain Analysis of the input signal is started automatically. However, the 3GPP FDD applications also provide other measurement types.

- ▶ To select a different measurement type, do one of the following:
  - In the "Overview", select the "Select Measurement" button. Select the required measurement.
  - Press the MEAS key. In the "Select Measurement" dialog box, select the required measurement.


• <a href="#">Result Display</a> .....	59
• <a href="#">Code Domain Analysis</a> .....	60
• <a href="#">Time Alignment Error Measurements</a> .....	111
• <a href="#">RF Measurements</a> .....	117

### 5.1 Result Display

The captured signal can be displayed using various evaluation methods. All evaluation methods available for 3GPP FDD applications are displayed in the evaluation bar in SmartGrid mode when you do one of the following:

- Select the  "SmartGrid" icon from the toolbar.
- Select the "Display" button in the "Overview".
- Press the MEAS key.
- Select the "Display Config" softkey in any 3GPP FDD menu.

Up to 16 evaluation methods can be displayed simultaneously in separate windows. The 3GPP FDD evaluation methods are described in [Chapter 3.1.2, "Evaluation Methods for Code Domain Analysis"](#), on page 18.

To close the SmartGrid mode and restore the previous softkey menu select the  "Close" icon in the righthand corner of the toolbar, or press any key.



For details on working with the SmartGrid see the R&S FSW Getting Started manual.

## 5.2 Code Domain Analysis

**Access:** MODE > "3G FDD BTS"/ "3G FDD UE"

3GPP FDD measurements require special applications on the R&S FSW.



When you activate a 3GPP FDD application the first time, a set of parameters is passed on from the currently active application:

- center frequency and frequency offset
- reference level and reference level offset
- attenuation

After initial setup, the parameters for the measurement channel are stored upon exiting and restored upon re-entering the channel. Thus, you can switch between applications quickly and easily.

When you activate a 3GPP FDD application, Code Domain Analysis of the input signal is started automatically with the default configuration. The "Code Domain Analyzer" menu is displayed and provides access to the most important configuration functions.



The "Span", "Bandwidth", "Lines", and "Marker Functions" menus are not available in 3GPP FDD applications.

Code Domain Analysis can be configured easily in the "Overview" dialog box, which is displayed when you select the "Overview" softkey from any menu.



### Importing and Exporting I/Q Data

**Access:**   "Save/Recall" menu > "Import I/Q"/ "Export I/Q"

The 3GPP FDD applications can not only measure the 3GPP FDD I/Q data to be evaluated. They can also import I/Q data, provided it has the correct format. Furthermore, the evaluated I/Q data from the 3GPP FDD applications can be exported for further analysis in external applications.

For details on importing and exporting I/Q data, see the R&S FSW User Manual.

- [Configuration Overview](#).....61
- [Signal Description](#)..... 62
- [Data Input and Output Settings](#).....67
- [Frontend Settings](#).....80
- [Trigger Settings](#).....88
- [Signal Capture \(Data Acquisition\)](#)..... 94
- [Application Data \(MSRA\)](#) ..... 97
- [Synchronization \(BTS Measurements Only\)](#).....97
- [Channel Detection](#).....98
- [Sweep Settings](#)..... 106
- [Automatic Settings](#)..... 108

### 5.2.1 Configuration Overview



**Access:** MEAS CONFIG > "Overview"

Throughout the measurement configuration, an overview of the most important currently defined settings is provided in the "Overview".

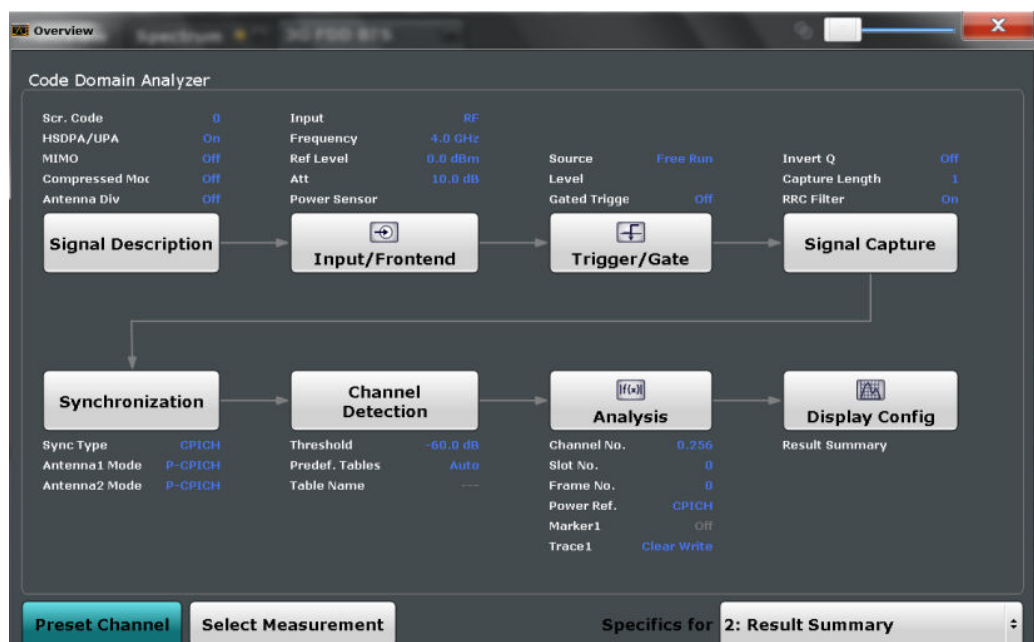


Figure 5-1: Configuration "Overview" for CDA measurements

In addition to the main measurement settings, the "Overview" provides quick access to the main settings dialog boxes. Thus, you can easily configure an entire measurement channel from input over processing to evaluation by stepping through the dialog boxes as indicated in the "Overview".



The available settings and functions in the "Overview" vary depending on the currently selected measurement.

For Time Alignment Error Measurements see [Chapter 5.3.1, "Configuration Overview"](#), on page 111.

For RF measurements see [Chapter 5.4, "RF Measurements"](#), on page 117.

### To configure settings

- ▶ Select any button in the "Overview" to open the corresponding dialog box. Select a setting in the channel bar (at the top of the measurement channel tab) to change a specific setting.

<a href="#">Preset Channel</a> .....	62
<a href="#">Select Measurement</a> .....	62
<a href="#">Specifics for</a> .....	62

#### Preset Channel

Select the "Preset Channel" button in the lower lefthand corner of the "Overview" to restore all measurement settings **in the current channel** to their default values.

Note that the PRESET key restores the entire instrument to its default values and thus closes **all measurement channels** on the R&S FSW (except for the default Spectrum application channel)!

Remote command:

`SYSTem:PRESet:CHANnel[:EXECute]` on page 167

#### Select Measurement

Selects a different measurement to be performed.

See [Chapter 3, "Measurements and Result Display"](#), on page 15.

#### Specifics for

The measurement channel may contain several windows for different results. Thus, the settings indicated in the "Overview" and configured in the dialog boxes vary depending on the selected window.

Select an active window from the "Specifics for" selection list that is displayed in the "Overview" and in all window-specific configuration dialog boxes.

The "Overview" and dialog boxes are updated to indicate the settings for the selected window.

## 5.2.2 Signal Description

**Access:** "Overview" > "Signal Description"

or: MEAS CONFIG > "Signal Description"

The signal description provides information on the expected input signal.

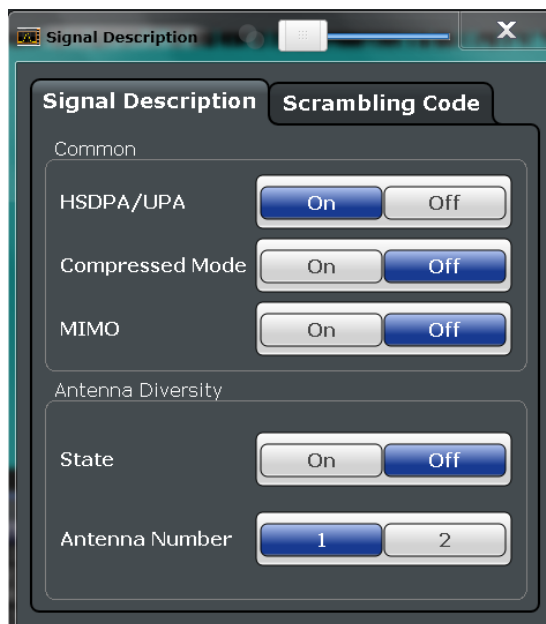
- [BTS Signal Description](#)..... 63
- [BTS Scrambling Code](#).....64
- [UE Signal Description \(UE Measurements\)](#)..... 66

### 5.2.2.1 BTS Signal Description

**Access:** "Overview" > "Signal Description"

or: MEAS CONFIG > "Signal Description"

The settings available to describe the input signal in BTS measurements are described here.



- [HSDPA/UPA](#)..... 63
- [Compressed Mode](#)..... 64
- [MIMO](#)..... 64
- [Antenna Diversity](#)..... 64
- [Antenna Number](#)..... 64

#### HSDPA/UPA

If enabled, the application detects all QPSK-modulated channels without pilot symbols (HSDPA channels) and displays them in the channel table. If the type of a channel can be fully recognized, as for example with a HS-PDSCH (based on modulation type), the type is indicated in the table. All other channels without pilot symbols are of type "CHAN".

Remote command:

[SENSe:] CDPower:HSDPamode on page 171

**Compressed Mode**

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). This mode must be enabled to detect compressed mode channels (see [Chapter 4.2, "BTS Channel Types"](#), on page 45).

Remote command:

[\[SENSe:\]CDPower:PCONtrol](#) on page 173

**MIMO**

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.

For details see ["MIMO channel types"](#) on page 48.

Remote command:

[\[SENSe:\]CDPower:MIMO](#) on page 172

**Antenna Diversity**

This option switches the antenna diversity mode on and off.

Remote command:

[\[SENSe:\]CDPower:ANTenna](#) on page 170

**Antenna Number**

This option switches between diversity antennas 1 and 2. Depending on the selected setting, the 3GPP FDD application synchronizes to the CPICH of antenna 1 or antenna 2.

Remote command:

[\[SENSe:\]CDPower:ANTenna](#) on page 170

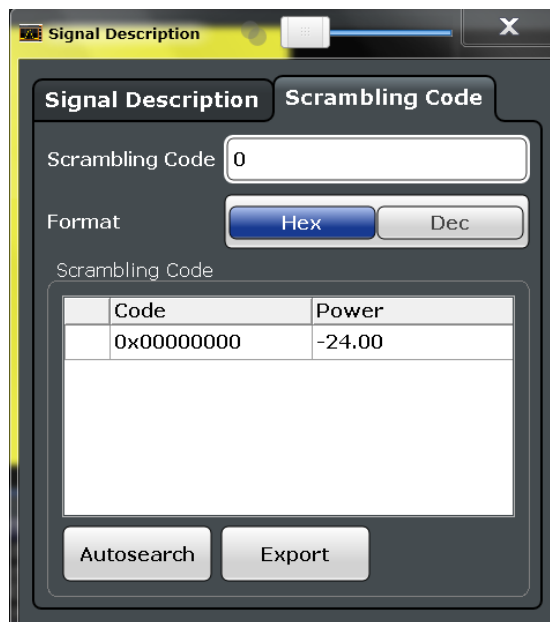
**5.2.2.2 BTS Scrambling Code**

**Access:** "Overview" > "Signal Description" > "Scrambling Code" tab

**or:** MEAS CONFIG > "Signal Description" > "Scrambling Code" tab

The scrambling code identifies the base station transmitting the signal. You can either define the used scrambling code manually, or perform a search on the input signal to detect a list of possible scrambling codes automatically.





Scrambling Code.....65  
 Format Hex/Dec.....65  
 Scrambling Codes.....65  
 Autosearch for Scrambling Code.....65  
 Export.....66

**Scrambling Code**

Defines 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 173

**Format Hex/Dec**

Switch the display format of the scrambling codes between hexadecimal and decimal.

Remote command:

[SENSe:]CDPower:LCODE:DVALue on page 173

[SENSe:]CDPower:LCODE[:VALue] on page 174

**Scrambling Codes**

This table includes all found scrambling codes from the last autosearch sequence. In the first column each detected scrambling code can be selected for export.

Remote command:

[SENSe:]CDPower:LCODE:SEARCh:LIST? on page 172

**Autosearch for Scrambling Code**

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 171

**Export**

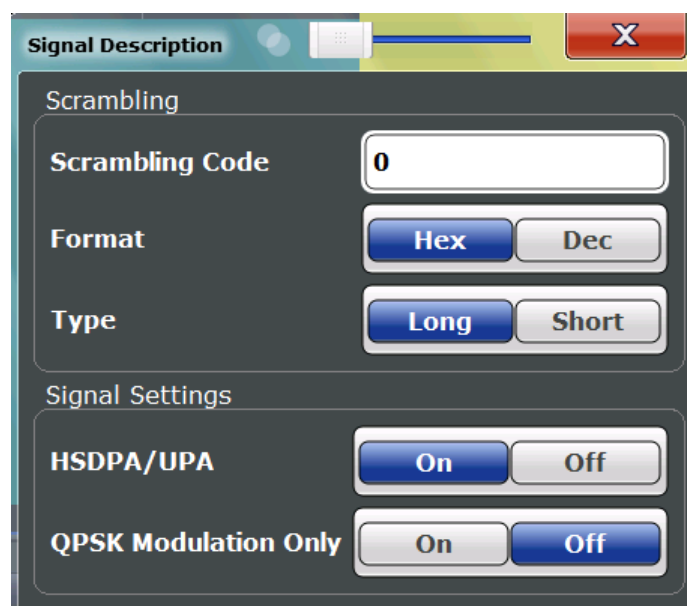
Writes the detected scrambling codes together with their powers into a text file in the R&S user directory (C:\R\_S\Instr\User\ScrCodes.txt)

**5.2.2.3 UE Signal Description (UE Measurements)**

**Access:** "Overview" > "Signal Description" > "Signal Description"

or: MEAS CONFIG > "Signal Description"

The settings available to describe the input signal in UE measurements are described here.



Scrambling Code.....66  
 Format.....67  
 Type.....67  
 HSDPA/UPA.....67  
 QPSK Modulation Only.....67

**Scrambling Code**

Defines the scrambling code used to transmit the signal in the specified format.

The scrambling code identifies the user equipment transmitting the signal. If an incorrect scrambling code is defined, a CDP measurement of the signal is not possible.

Remote command:

[SENSe:]CDPower:LCODE[:VALue] on page 174

#### Format

Switches the display format of the scrambling codes between hexadecimal and decimal.

Remote command:

SENS:CDP:LCOD:DVAL <numeric value> (see [SENSe:]CDPower:LCODE:DVALue on page 173)

#### Type

Defines whether the entered scrambling code is to be handled as a long or short scrambling code.

Remote command:

[SENSe:]CDPower:LCODE:TYPE on page 174

#### HSDPA/UPA

If enabled, the application detects all QPSK-modulated channels without pilot symbols (HSDPA channels) and displays them in the channel table. If the type of a channel can be fully recognized, as for example with a HS-PDSCH (based on modulation type), the type is indicated in the table. All other channels without pilot symbols are of type "CHAN".

Remote command:

[SENSe:]CDPower:HSDPamode on page 171

#### QPSK Modulation Only

If enabled, it is assumed that the signal uses QPSK modulation only. Thus, a special QPSK-based synchronization can be performed and the measurement therefore runs with optimized speed.

Do not enable this mode for signals that do not use QPSK modulation.

Remote command:

[SENSe:]CDPower:QPSK on page 174

### 5.2.3 Data Input and Output Settings

**Access:** "Overview" > "Input/Frontend"

**or:** INPUT/OUTPUT

The R&S FSW can analyze signals from different input sources and provide various types of output (such as noise or trigger signals).

- [Input Source Settings](#).....68
- [Output Settings](#).....76
- [Digital I/Q Output Settings](#).....79

### 5.2.3.1 Input Source Settings

**Access:** "Overview" > "Input/Frontend" > "Input Source"

The input source determines which data the R&S FSW will analyze.

The default input source for the R&S FSW is "Radio Frequency", i.e. the signal at the RF INPUT connector of the R&S FSW. If no additional options are installed, this is the only available input source.

Since the Digital I/Q input and the Analog Baseband input use the same digital signal path, both cannot be used simultaneously. When one is activated, established connections for the other are disconnected. When the second input is deactivated, connections to the first are re-established. This may cause a short delay in data transfer after switching the input source.

- [Radio Frequency Input](#).....68
- [Digital I/Q Input Settings](#)..... 70
- [Analog Baseband Input Settings](#).....72
- [Probe Settings](#).....75

#### Radio Frequency Input

**Access:** "Overview" > "Input/Frontend" > "Input Source" > "Radio Frequency"



- [Radio Frequency State](#)..... 68
- [Input Coupling](#)..... 69
- [Impedance](#)..... 69
- [Direct Path](#)..... 69
- [High-Pass Filter 1...3 GHz](#)..... 70
- [YIG-Preselector](#).....70
- [Input Connector](#).....70

#### Radio Frequency State

Activates input from the RF INPUT connector.

Remote command:

[INPut:SElect](#) on page 178

### Input Coupling

The RF input of the R&S FSW can be coupled by alternating current (AC) or direct current (DC).

This function is not available for input from the optional Digital Baseband Interface or from the optional Analog Baseband Interface.

AC coupling blocks any DC voltage from the input signal. This is the default setting to prevent damage to the instrument. Very low frequencies in the input signal may be distorted.

However, some specifications require DC coupling. In this case, you must protect the instrument from damaging DC input voltages manually. For details, refer to the data sheet.

Remote command:

[INPut:COUPling](#) on page 176

### Impedance

For some measurements, the reference impedance for the measured levels of the R&S FSW can be set to 50  $\Omega$  or 75  $\Omega$ .

Select 75  $\Omega$  if the 50  $\Omega$  input impedance is transformed to a higher impedance using a 75  $\Omega$  adapter of the RAZ type. (That corresponds to 25 $\Omega$  in series to the input impedance of the instrument.) The correction value in this case is 1.76 dB = 10 log (75 $\Omega$ /50 $\Omega$ ).

This value also affects the unit conversion (see "[Reference Level](#)" on page 81).

This function is not available for input from the optional Digital Baseband Interface or from the optional Analog Baseband Interface. For analog baseband input, an impedance of 50  $\Omega$  is always used.

Remote command:

[INPut:IMPedance](#) on page 178

### Direct Path

Enables or disables the use of the direct path for small frequencies.

In spectrum analyzers, passive analog mixers are used for the first conversion of the input signal. In such mixers, the LO signal is coupled into the IF path due to its limited isolation. The coupled LO signal becomes visible at the RF frequency 0 Hz. This effect is referred to as LO feedthrough.

To avoid the LO feedthrough the spectrum analyzer provides an alternative signal path to the A/D converter, referred to as the *direct path*. By default, the direct path is selected automatically for RF frequencies close to zero. However, this behavior can be deactivated. If "Direct Path" is set to "Off", the spectrum analyzer always uses the analog mixer path.

"Auto"	(Default) The direct path is used automatically for frequencies close to zero.
"Off"	The analog mixer path is always used.

Remote command:

`INPut:DPATH` on page 176

### High-Pass Filter 1...3 GHz

Activates an additional internal high-pass filter for RF input signals from 1 GHz to 3 GHz. This filter is used to remove the harmonics of the analyzer to measure the harmonics for a DUT, for example.

This function requires an additional hardware option.

(Note: for RF input signals outside the specified range, the high-pass filter has no effect. For signals with a frequency of approximately 4 GHz upwards, the harmonics are suppressed sufficiently by the YIG-preselector, if available.)

Remote command:

`INPut:FILTer:HPASs[:STATe]` on page 177

### YIG-Preselector

Activates or deactivates the YIG-preselector, if available on the R&S FSW.

An internal YIG-preselector at the input of the R&S FSW ensures that image frequencies are rejected. However, this is only possible for a restricted bandwidth. To use the maximum bandwidth for signal analysis you can deactivate the YIG-preselector at the input of the R&S FSW, which can lead to image-frequency display.

Note that the YIG-preselector is active only on frequencies greater than 8 GHz. Therefore, switching the YIG-preselector on or off has no effect if the frequency is below that value.

Remote command:

`INPut:FILTer:YIG[:STATe]` on page 177

### Input Connector

Determines whether the RF input data is taken from the RF INPUT connector (default) or the optional BASEBAND INPUT I connector. This setting is only available if the optional Analog Baseband Interface is installed and active for input. It is not available for the R&S FSW67 or R&S FSW85.

For more information on the Analog Baseband Interface (R&S FSW-B71), see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Remote command:

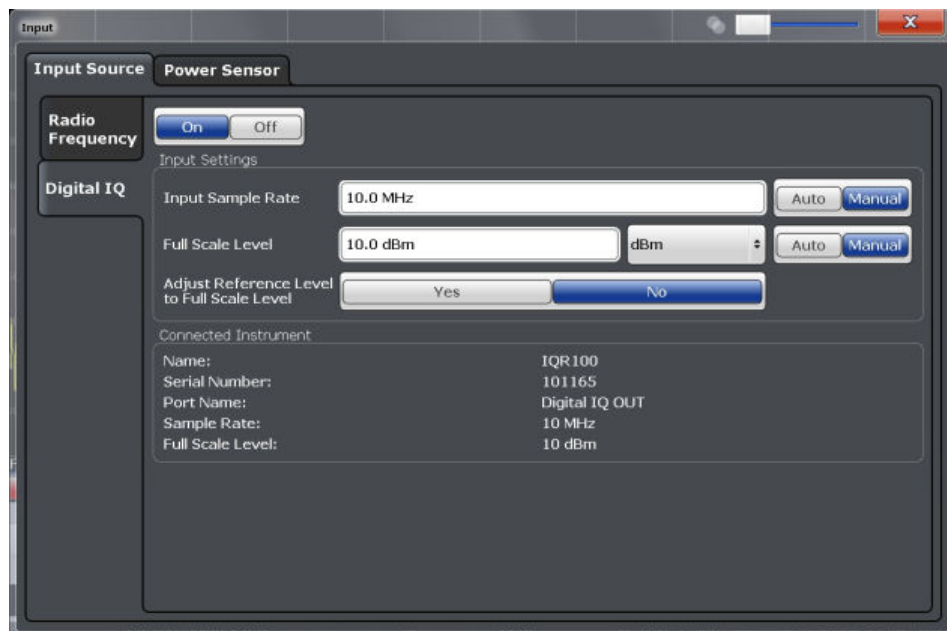
`INPut:CONNector` on page 176

### Digital I/Q Input Settings

**Access:** INPUT/OUTPUT > "Input Source Config" > "Digital I/Q" tab

The following settings and functions are available to provide input via the optional Digital Baseband Interface in the applications that support it.

These settings are only available if the Digital Baseband Interface option is installed on the R&S FSW.



For more information, see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Digital I/Q Input State..... 71  
 Input Sample Rate..... 71  
 Full Scale Level..... 71  
 Adjust Reference Level to Full Scale Level..... 72  
 Connected Instrument..... 72  
 DigIConf..... 72

**Digital I/Q Input State**

Enables or disable the use of the "Digital IQ" input source for measurements.

"Digital IQ" is only available if the optional Digital Baseband Interface is installed.

Remote command:

[INPut:SElect](#) on page 178

**Input Sample Rate**

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.

If "Auto" is selected, the sample rate is adjusted automatically by the connected device.

The allowed range is from 100 Hz to 10 GHz.

Remote command:

[INPut:DIQ:SRATe](#) on page 182

[INPut:DIQ:SRATe:AUTO](#) on page 182

**Full Scale Level**

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

If "Auto" is selected, the level is automatically set to the value provided by the connected device.

Remote command:

[INPut:DIQ:RANGe\[:UPPer\]](#) on page 181

[INPut:DIQ:RANGe\[:UPPer\]:UNIT](#) on page 181

[INPut:DIQ:RANGe\[:UPPer\]:AUTO](#) on page 181

### Adjust Reference Level to Full Scale Level

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 181

### Connected Instrument

Displays the status of the Digital Baseband Interface connection.

If an instrument is connected, the following information is displayed:

- Name and serial number of the instrument connected to the Digital Baseband Interface
- Used port
- Sample rate of the data currently being transferred via the Digital Baseband Interface
- Level and unit that corresponds to an I/Q sample with the magnitude "1" ([Full Scale Level](#)), if provided by connected instrument

Remote command:

[INPut:DIQ:CDEVIce](#) on page 179

### DigIConf

Starts the optional R&S DigIConf application. This function is available in the In-/Output menu, but only if the optional software is installed.

**Note that R&S DigIConf requires a USB connection (not LAN!) from the R&S FSW to the R&S EX-IQ-BOX in addition to the Digital Baseband Interface connection. R&S DigIConf version 2.20.360.86 Build 170 or higher is required.**

To return to the R&S FSW application, press any key. The R&S FSW application is displayed with the "Input/Output" 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.

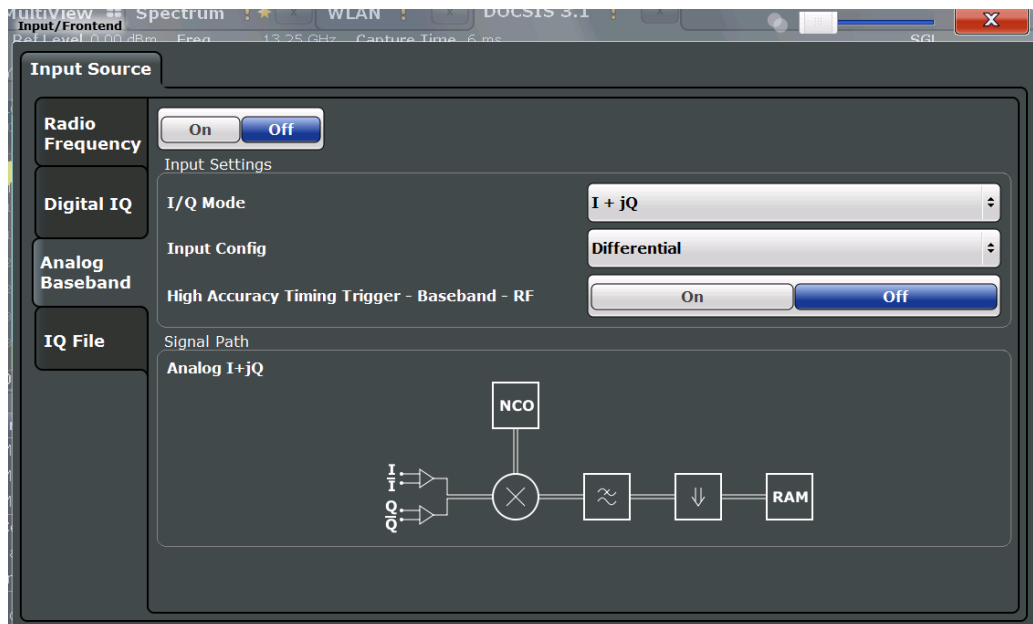
If you select the "File > Exit" menu item in the R&S DigIConf window, the application is closed. Note that in this case the settings are lost and the EX-IQ-BOX functionality is no longer available until you restart the application using the "DigIConf" softkey in the R&S FSW once again.

### Analog Baseband Input Settings

**Access:** INPUT/OUTPUT > "Input Source Config" > "Analog Baseband" tab



The following settings and functions are available to provide input via the optional Analog Baseband Interface in the applications that support it.



For more information on the optional Analog Baseband Interface, see the R&S FSW I/Q Analyzer and I/Q Input User Manual.



If Analog Baseband input is used, measurements in the frequency and time domain are not available.

<a href="#">Analog Baseband Input State</a> .....	73
<a href="#">I/Q Mode</a> .....	73
<a href="#">Input Configuration</a> .....	74
<a href="#">High Accuracy Timing Trigger - Baseband - RF</a> .....	74
<a href="#">Center Frequency</a> .....	75

**Analog Baseband Input State**

Enables or disable the use of the "Analog Baseband" input source for measurements. "Analog Baseband" is only available if the optional Analog Baseband Interface is installed.

Remote command:

[INPut:SElect](#) on page 178

**I/Q Mode**

Defines the format of the input signal.

For more information on I/Q data processing modes, see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

- "I + jQ" The input signal is filtered and resampled to the sample rate of the application.  
Two inputs are required for a complex signal, one for the in-phase component, and one for the quadrature component.
- "I Only / Low IF I" The input signal at the BASEBAND INPUT I connector is filtered and resampled to the sample rate of the application.  
If the center frequency is set to 0 Hz, the real baseband signal is displayed without down-conversion (**Real Baseband I**).  
If a center frequency greater than 0 Hz is set, the input signal is down-converted with the center frequency (**Low IF I**).
- "Q Only / Low IF Q" The input signal at the BASEBAND INPUT Q connector is filtered and resampled to the sample rate of the application.  
If the center frequency is set to 0 Hz, the real baseband signal is displayed without down-conversion (**Real Baseband Q**).  
If a center frequency greater than 0 Hz is set, the input signal is down-converted with the center frequency (**Low IF Q**).

Remote command:

[INPut:IQ:TYPE](#) on page 188

### Input Configuration

Defines whether the input is provided as a differential signal via all four Analog Baseband connectors or as a plain I/Q signal via two simple-ended lines.

**Note:** Both single-ended and differential probes are supported as input; however, since only one connector is occupied by a probe, the "Single-ended" setting must be used for all probes.

- "Single Ended" I, Q data only
- "Differential" I, Q and inverse I,Q data  
(Not available for R&S FSW85)

Remote command:

[INPut:IQ:BALanced\[:STATe\]](#) on page 187

### High Accuracy Timing Trigger - Baseband - RF

Activates a mode with enhanced timing accuracy between analog baseband, RF and external trigger signals.

**Note:** Prerequisites for previous models of R&S FSW.

For R&S FSW models with a serial number lower than 103000, special prerequisites and restrictions apply for high accuracy timing:

- To obtain this high timing precision, trigger port 1 and port 2 must be connected via the Cable for High Accuracy Timing (order number 1325.3777.00).
- As trigger port 1 and port 2 are connected via the cable, only trigger port 3 can be used to trigger a measurement.
- Trigger port 2 is configured as output if the high accuracy timing option is active. Make sure not to activate this option if you use trigger port 2 in your measurement setup.

- When you first enable this setting, you are prompted to connect the cable for high accuracy timing to trigger ports 1 and 2. If you cancel this prompt, the setting remains disabled. As soon as you confirm this prompt, the cable must be in place - the firmware does not check the connection. (In remote operation, the setting is activated without a prompt.)

For more information, see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Remote command:

`CALibration:AIQ:HATiming[:STATe]` on page 188

### Center Frequency

Defines the center frequency for analog baseband input.

For real-type baseband input (I or Q only), the center frequency is always 0 Hz.

**Note:** If the analysis bandwidth to either side of the defined center frequency exceeds the minimum frequency (0 Hz) or the maximum frequency (40 MHz/80 MHz), an error is displayed. In this case, adjust the center frequency or the analysis bandwidth.

Remote command:

`[SENSe:]FREQuency:CENTer` on page 193

### Probe Settings

Probes are configured in a separate tab on the "Input" dialog box which is displayed when you select the INPUT/OUTPUT key and then "Input Source Config".



For each possible probe connector (Baseband Input I, Baseband Input Q), the detected type of probe, if any, is displayed. The following information is provided for each connected probe:

- Probe name
- Serial number
- R&S part number
- Type of probe ("Differential", "Single Ended")

For more information on using probes with an R&S FSW, see the R&S FSW User Manual.

For general information on the R&S®RTO probes, see the device manuals.

<a href="#">Common Mode Offset</a> .....	76
<a href="#">Microbutton Action</a> .....	76

#### Common Mode Offset

Sets the common mode offset. The setting is only available if a differential probe is connected to the R&S FSW.

If the probe is disconnected, the common mode offset of the probe is reset to 0.0 V.

Remote command:

`[SENSe:] PROBe<p>:SETup:CMOffset` on page 189

#### Microbutton Action

Active R&S probes (except for RT-ZS10E) have a configurable microbutton on the probe head. By pressing this button, you can perform an action on the instrument directly from the probe.

Select the action that you want to start from the probe:

- "Run single"      Starts one data acquisition.
- "No action"      Prevents unwanted actions due to unintended usage of the microbutton.

Remote command:

`[SENSe:] PROBe<p>:SETup:MODE` on page 190

### 5.2.3.2 Output Settings

**Access:** INPUT/OUTPUT > "Output"

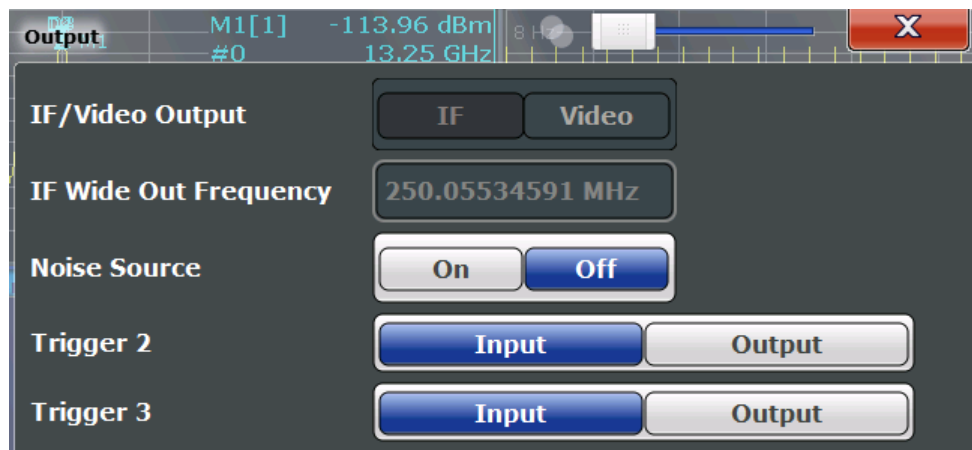
The R&S FSW can provide output to special connectors for other devices.

For details on connectors, refer to the R&S FSW Getting Started manual, "Front / Rear Panel View" chapters.



How to provide trigger signals as output is described in detail in the R&S FSW User Manual.

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Noise Source.....77

Trigger 2/3.....77

    L Output Type.....78

        L Level.....78

        L Pulse Length.....78

        L Send Trigger.....78

**Noise Source**

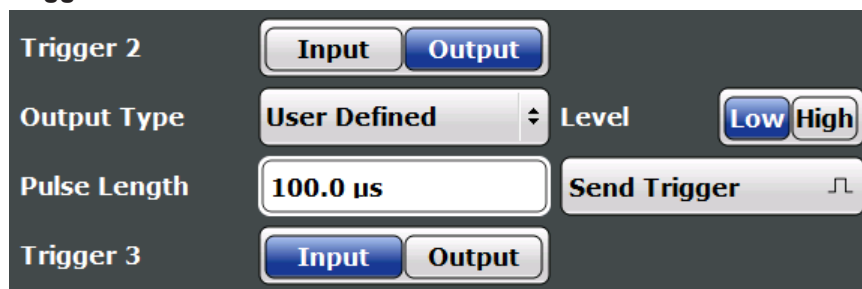
This command turns the 28 V supply of the BNC connector labeled NOISE SOURCE CONTROL on the R&S FSW on and off.

External noise sources are useful when you are measuring power levels that fall below the noise floor of the R&S FSW itself, for example when measuring the noise level of a DUT.

Remote command:

[DIAGnostic:SERvice:NSource](#) on page 192

**Trigger 2/3**



Defines the usage of the variable TRIGGER INPUT/OUTPUT connectors, where:

"Trigger 2": TRIGGER INPUT/OUTPUT connector on the front panel

"Trigger 3": TRIGGER 3 INPUT/ OUTPUT connector on the rear panel

(Trigger 1 is INPUT only.)

**Note:** Providing trigger signals as output is described in detail in the R&S FSW User Manual.

- "Input" The signal at the connector is used as an external trigger source by the R&S FSW. Trigger input parameters are available in the "Trigger" dialog box.
- "Output" The R&S FSW sends a trigger signal to the output connector to be used by connected devices.  
Further trigger parameters are available for the connector.

Remote command:

[OUTPut:TRIGger<port>:DIRection](#) on page 206

### Output Type ← Trigger 2/3

Type of signal to be sent to the output

- "Device Triggered" (Default) Sends a trigger when the R&S FSW triggers.
- "Trigger Armed" Sends a (high level) trigger when the R&S FSW is in "Ready for trigger" state.  
This state is indicated by a status bit in the `STATUS:OPERation` register (bit 5), as well as by a low-level signal at the AUX port (pin 9).
- "User Defined" Sends a trigger when you select the "Send Trigger" button.  
In this case, further parameters are available for the output signal.

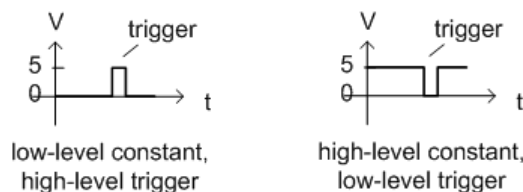
Remote command:

[OUTPut:TRIGger<port>:OTYPe](#) on page 207

### Level ← Output Type ← Trigger 2/3

Defines whether a high (1) or low (0) constant signal is sent to the trigger output connector.

The trigger pulse level is always opposite to the constant signal level defined here. For example, for "Level = High", a constant high signal is output to the connector until you select the [Send Trigger](#) function. Then, a low pulse is provided.



Remote command:

[OUTPut:TRIGger<port>:LEVel](#) on page 206

### Pulse Length ← Output Type ← Trigger 2/3

Defines the duration of the pulse (pulse width) sent as a trigger to the output connector.

Remote command:

[OUTPut:TRIGger<port>:PULSe:LENGth](#) on page 208

### Send Trigger ← Output Type ← Trigger 2/3

Sends a user-defined trigger to the output connector immediately.

Note that the trigger pulse level is always opposite to the constant signal level defined by the output [Level](#) setting. For example, for "Level = High", a constant high signal is output to the connector until you select the "Send Trigger" function. Then, a low pulse is sent.

Which pulse level will be sent is indicated by a graphic on the button.

Remote command:

`OUTPut:TRIGger<port>:PULSe:IMMediate` on page 207

### 5.2.3.3 Digital I/Q Output Settings

**Access:** "Overview" > "Output" > "Digital I/Q" tab

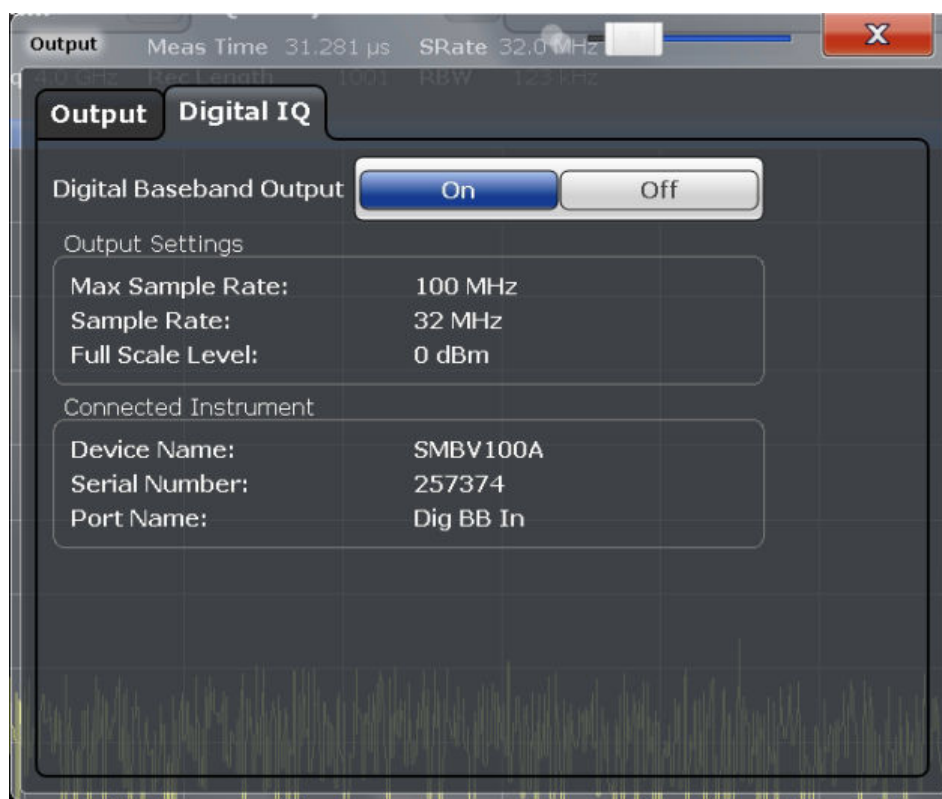
The optional Digital Baseband Interface allows you to output I/Q data from any R&S FSW application that processes I/Q data to an external device.

These settings are only available if the Digital Baseband Interface option is installed on the R&S FSW.



Digital I/Q output is available with bandwidth extension option R&S FSW-B500/ -B512, but not with R&S FSW-B512R (Real-Time).

However, see the note regarding digital I/Q output and the R&S FSW-B500/ -B512 option in the R&S FSW I/Q Analyzer and I/Q Input User Manual.



For details on digital I/Q output, see the R&S FSW I/Q Analyzer User Manual.

Digital Baseband Output.....	80
Output Settings Information.....	80
Connected Instrument.....	80

### Digital Baseband Output

Enables or disables a digital output stream to the optional Digital Baseband Interface, if available.

**Note:** If digital baseband output is active, the sample rate is restricted to 200 MHz (max. 160 MHz bandwidth).

The only data source that can be used for digital baseband output is RF input.

For details on digital I/Q output, see the R&S FSW I/Q Analyzer User Manual.

Remote command:

`OUTPut:DIQ` on page 182

### Output Settings Information

Displays information on the settings for output via the optional Digital Baseband Interface.

The following information is displayed:

- Maximum sample rate that can be used to transfer data via the Digital Baseband Interface (i.e. the maximum input sample rate that can be processed by the connected instrument)
- Sample rate currently used to transfer data via the Digital Baseband Interface
- Level and unit that corresponds to an I/Q sample with the magnitude "1" ([Full Scale Level](#))

Remote command:

`OUTPut:DIQ:CDEvice?` on page 182

### Connected Instrument

Displays information on the instrument connected to the optional Digital Baseband Interface, if available.

If an instrument is connected, the following information is displayed:

- Name and serial number of the instrument connected to the Digital Baseband Interface
- Used port

Remote command:

`OUTPut:DIQ:CDEvice?` on page 182

## 5.2.4 Frontend Settings

**Access:** "Overview" > "Input/Frontend"

Frequency, amplitude and y-axis scaling settings represent the "frontend" of the measurement setup.



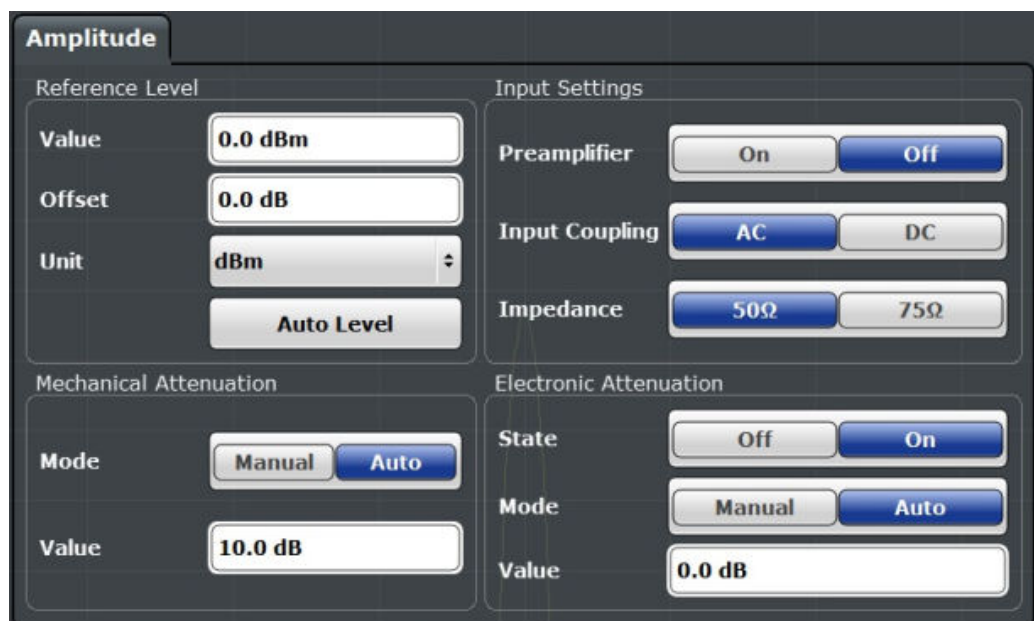
- [Amplitude Settings](#)..... 81
- [Amplitude Settings for Analog Baseband Input](#)..... 84
- [Y-Axis Scaling](#)..... 86
- [Frequency Settings](#)..... 87

### 5.2.4.1 Amplitude Settings

**Access:** "Overview" > "Input/Frontend" > "Amplitude"

Amplitude settings determine how the R&S FSW must process or display the expected input power levels.

Amplitude settings for input from the optional Analog Baseband interface are described in [Chapter 5.2.4.2, "Amplitude Settings for Analog Baseband Input"](#), on page 84.



- [Reference Level](#)..... 81
  - [Shifting the Display \(Offset\)](#)..... 82
  - [Unit](#)..... 82
  - [Setting the Reference Level Automatically \(Auto Level\)](#)..... 82
- [RF Attenuation](#)..... 82
  - [Attenuation Mode / Value](#)..... 83
- [Using Electronic Attenuation](#)..... 83
- [Input Settings](#)..... 83
  - [Preamplifier](#)..... 84

#### Reference Level

Defines the expected maximum input signal level. Signal levels above this value may not be measured correctly, which is indicated by the "IF OVLD" status display ("OVLD" for analog baseband or digital baseband input).

The reference level can also be used to scale power diagrams; the reference level is then used as the maximum on the y-axis.

Since the hardware of the R&S FSW is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level. Thus you ensure an optimum measurement (no compression, good signal-to-noise ratio).

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 196

#### **Shifting the Display (Offset) ← Reference Level**

Defines an arithmetic level offset. This offset is added to the measured level. In some result displays, the scaling of the y-axis is changed accordingly.

Define an offset if the signal is attenuated or amplified before it is fed into the R&S FSW so the application shows correct power results. All displayed power level results are shifted by this value.

The setting range is  $\pm 200$  dB in 0.01 dB steps.

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal) ignores any "Reference Level Offset". Thus, it is important to keep in mind the actual power level the R&S FSW must handle. Do not rely on the displayed reference level (internal reference level = displayed reference level - offset).

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` on page 196

#### **Unit ← Reference Level**

For CDA measurements, do not change the unit, as this would lead to useless results.

#### **Setting the Reference Level Automatically (Auto Level) ← Reference Level**

Automatically determines a reference level which ensures that no overload occurs at the R&S FSW for the current input data. At the same time, the internal attenuators and the preamplifier (for analog baseband input: the full scale level) are adjusted so the signal-to-noise ratio is optimized, while signal compression and clipping are minimized.

To determine the required reference level, a level measurement is performed on the R&S FSW.

If necessary, you can optimize the reference level further. Decrease the attenuation level manually to the lowest possible value before an overload occurs, then decrease the reference level in the same way.

You can change the measurement time for the level measurement if necessary (see "[Changing the Automatic Measurement Time \(Meastime Manual\)](#)" on page 110).

Remote command:

`[SENSe:]ADJust:LEVel` on page 229

#### **RF Attenuation**

Defines the attenuation applied to the RF input of the R&S FSW.

This function is not available for input from the optional Digital Baseband Interface.

### Attenuation Mode / Value ← RF Attenuation

The RF attenuation can be set automatically as a function of the selected reference level (Auto mode). This ensures that no overload occurs at the RF INPUT connector for the current reference level. It is the default setting.

By default and when no (optional) [electronic attenuation](#) is available, mechanical attenuation is applied.

This function is not available for input from the optional **Digital Baseband Interface**.

In "Manual" mode, you can set the RF attenuation in 1 dB steps (down to 0 dB). Other entries are rounded to the next integer value. The range is specified in the data sheet. If the defined reference level cannot be set for the defined RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is displayed.

**NOTICE!** Risk of hardware damage due to high power levels. When decreasing the attenuation manually, ensure that the power level does not exceed the maximum level allowed at the RF input, as an overload may lead to hardware damage.

Remote command:

[INPut:ATTenuation](#) on page 198

[INPut:ATTenuation:AUTO](#) on page 198

### Using Electronic Attenuation

If the (optional) Electronic Attenuation hardware is installed on the R&S FSW, you can also activate an electronic attenuator.

In "Auto" mode, the settings are defined automatically; in "Manual" mode, you can define the mechanical and electronic attenuation separately.

This function is not available for input from the optional Digital Baseband Interface.

**Note:** Electronic attenuation is not available for stop frequencies (or center frequencies in zero span) > 13.6 GHz.

In "Auto" mode, RF attenuation is provided by the electronic attenuator as much as possible to reduce the amount of mechanical switching required. Mechanical attenuation may provide a better signal-to-noise ratio, however.

When you switch off electronic attenuation, the RF attenuation is automatically set to the same mode (auto/manual) as the electronic attenuation was set to. Thus, the RF attenuation can be set to automatic mode, and the full attenuation is provided by the mechanical attenuator, if possible.

Both the electronic and the mechanical attenuation can be varied in 1 dB steps. Other entries are rounded to the next lower integer value.

For the R&S FSW85, the mechanical attenuation can be varied only in 10 dB steps.

If the defined reference level cannot be set for the given attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is displayed in the status bar.

Remote command:

[INPut:EATT:STATe](#) on page 199

[INPut:EATT:AUTO](#) on page 199

[INPut:EATT](#) on page 199

### Input Settings

Some input settings affect the measured amplitude of the signal, as well.

The parameters "Input Coupling" and "Impedance" are identical to those in the "Input" settings.

See [Chapter 5.2.3.1, "Input Source Settings"](#), on page 68.

#### Preamplicifier ← Input Settings

If the (optional) Preamplicifier hardware is installed, a preamplicifier can be activated for the RF input signal.

You can use a preamplicifier to analyze signals from DUTs with low output power.

This function is not available for input from the (optional) Digital Baseband Interface.

For R&S FSW26 or higher models, the input signal is amplified by 30 dB if the preamplicifier is activated.

For R&S FSW8 or 13 models, the following settings are available:

- "Off" Deactivates the preamplicifier.
- "15 dB" The RF input signal is amplified by about 15 dB.
- "30 dB" The RF input signal is amplified by about 30 dB.

Remote command:

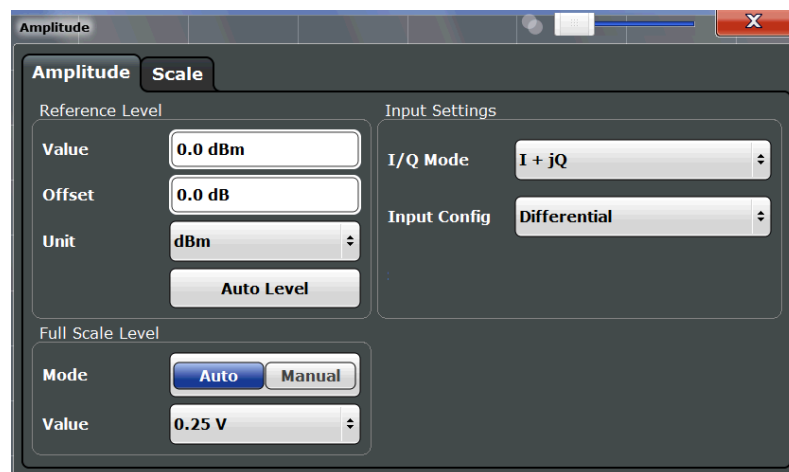
[INPut:GAIN:STATe](#) on page 197

[INPut:GAIN\[:VALue\]](#) on page 197

#### 5.2.4.2 Amplitude Settings for Analog Baseband Input

**Access:** "Overview" > "Amplitude"

The following settings and functions are available to define amplitude settings for input via the optional Analog Baseband Interface in the applications that support it.



The input settings provided here are identical to those in the "Input Source" > "Analog Baseband" tab, see ["Analog Baseband Input Settings"](#) on page 72.

For more information on the optional Analog Baseband Interface, see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Reference Level.....	85
L Shifting the Display (Offset).....	85
L Unit.....	85
L Setting the Reference Level Automatically (Auto Level).....	85
Full Scale Level Mode / Value.....	86

### Reference Level

Defines the expected maximum input signal level. Signal levels above this value may not be measured correctly, which is indicated by the "IF OVLD" status display ("OVLD" for analog baseband or digital baseband input).

The reference level can also be used to scale power diagrams; the reference level is then used as the maximum on the y-axis.

Since the hardware of the R&S FSW is adapted according to this value, it is recommended that you set the reference level close above the expected maximum signal level. Thus you ensure an optimum measurement (no compression, good signal-to-noise ratio).

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 196

### Shifting the Display (Offset) ← Reference Level

Defines an arithmetic level offset. This offset is added to the measured level. In some result displays, the scaling of the y-axis is changed accordingly.

Define an offset if the signal is attenuated or amplified before it is fed into the R&S FSW so the application shows correct power results. All displayed power level results are shifted by this value.

The setting range is  $\pm 200$  dB in 0.01 dB steps.

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal) ignores any "Reference Level Offset". Thus, it is important to keep in mind the actual power level the R&S FSW must handle. Do not rely on the displayed reference level (internal reference level = displayed reference level - offset).

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` on page 196

### Unit ← Reference Level

For CDA measurements, do not change the unit, as this would lead to useless results.

### Setting the Reference Level Automatically (Auto Level) ← Reference Level

Automatically determines a reference level which ensures that no overload occurs at the R&S FSW for the current input data. At the same time, the internal attenuators and the preamplifier (for analog baseband input: the full scale level) are adjusted so the signal-to-noise ratio is optimized, while signal compression and clipping are minimized.

To determine the required reference level, a level measurement is performed on the R&S FSW.

If necessary, you can optimize the reference level further. Decrease the attenuation level manually to the lowest possible value before an overload occurs, then decrease the reference level in the same way.

You can change the measurement time for the level measurement if necessary (see "Changing the Automatic Measurement Time (Meastime Manual)" on page 110).

Remote command:

`[SENSe:]ADJust:LEVel` on page 229

#### Full Scale Level Mode / Value

The full scale level defines the maximum power you can input at the Baseband Input connector without clipping the signal.

The full scale level can be defined automatically according to the reference level, or manually.

For manual input, the following values can be selected:

- 0.25 V
- 0.5 V
- 1 V
- 2 V

If probes are connected, the possible full scale values are adapted according to the probe's attenuation and maximum allowed power.

For details on probes, see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Remote command:

`INPut:IQ:FULLscale:AUTO` on page 187

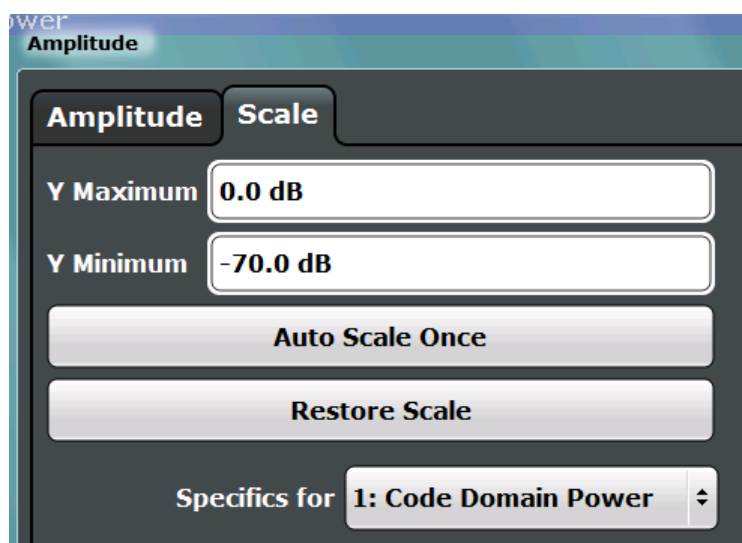
`INPut:IQ:FULLscale[:LEVel]` on page 188

### 5.2.4.3 Y-Axis Scaling

**Access:** "Overview" > "Input/Frontend" > "Scale"

**Or:** AMPT > "Scale Config"

The vertical axis scaling is configurable. In Code Domain Analysis, the y-axis usually displays the measured power levels.



Y-Maximum, Y-Minimum.....87  
 Auto Scale Once..... 87  
 Restore Scale (Window)..... 87

**Y-Maximum, Y-Minimum**

Defines the amplitude range to be displayed on the y-axis of the evaluation diagrams.

Remote command:

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum on page 195

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum on page 195

**Auto Scale Once**

Automatically determines the optimal range and reference level position to be displayed for the current measurement settings.

The display is only set once; it is not adapted further if the measurement settings are changed again.

Remote command:

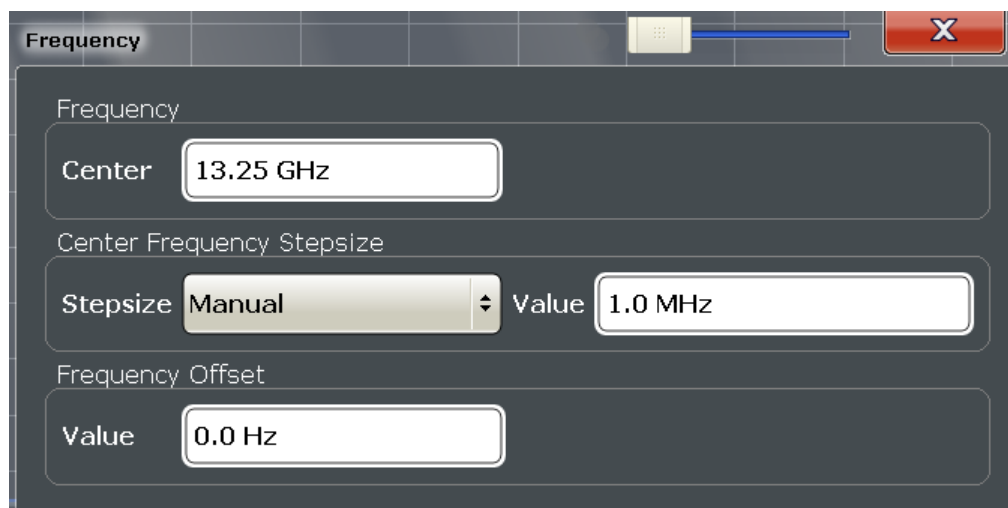
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE on page 195

**Restore Scale (Window)**

Restores the default scale settings in the currently selected window.

**5.2.4.4 Frequency Settings**

**Access:** "Overview" > "Input/Frontend" > "Frequency"



Center frequency.....87  
 Center Frequency Step size.....88  
 Frequency Offset.....88

**Center frequency**

Defines the center frequency of the signal in Hertz.

The allowed range of values for the center frequency depends on the frequency span.

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

$f_{\text{max}}$  and  $\text{span}_{\min}$  depend on the instrument and are specified in the data sheet.

Remote command:

[SENSe:] FREQuency:CENTer on page 193

### Center Frequency Stepsize

Defines the step size by which the center frequency is increased or decreased using the arrow keys.

When you use the rotary knob the center frequency changes in steps of only 1/10 of the span.

The step size can be coupled to another value or it can be manually set to a fixed value.

This setting is available for frequency and time domain measurements.

- |            |  |
|------------|--|
| "X * Span" | Sets the step size for the center frequency to a defined factor of the span. The "X-Factor" defines the percentage of the span. Values between 1 % and 100 % in steps of 1 % are allowed. The default setting is 10 %. |
| "= Center" | Sets the step size to the value of the center frequency. The used value is indicated in the "Value" field.   |
| "Manual"   | Defines a fixed step size for the center frequency. Enter the step size in the "Value" field.  |

Remote command:

[SENSe:] FREQuency:CENTer:STEP on page 193

### Frequency Offset

Shifts the displayed frequency range along the x-axis by the defined offset.

This parameter has no effect on the instrument's hardware, or on the captured data or on data processing. It is simply a manipulation of the final results in which absolute frequency values are displayed. Thus, the x-axis of a spectrum display is shifted by a constant offset if it shows absolute frequencies, but not if it shows frequencies relative to the signal's center frequency.

A frequency offset can be used to correct the display of a signal that is slightly distorted by the measurement setup, for example.

The allowed values range from -100 GHz to 100 GHz. The default setting is 0 Hz.

**Note:** In MSRA mode, this function is only available for the MSRA Master.

Remote command:

[SENSe:] FREQuency:OFFSet on page 194

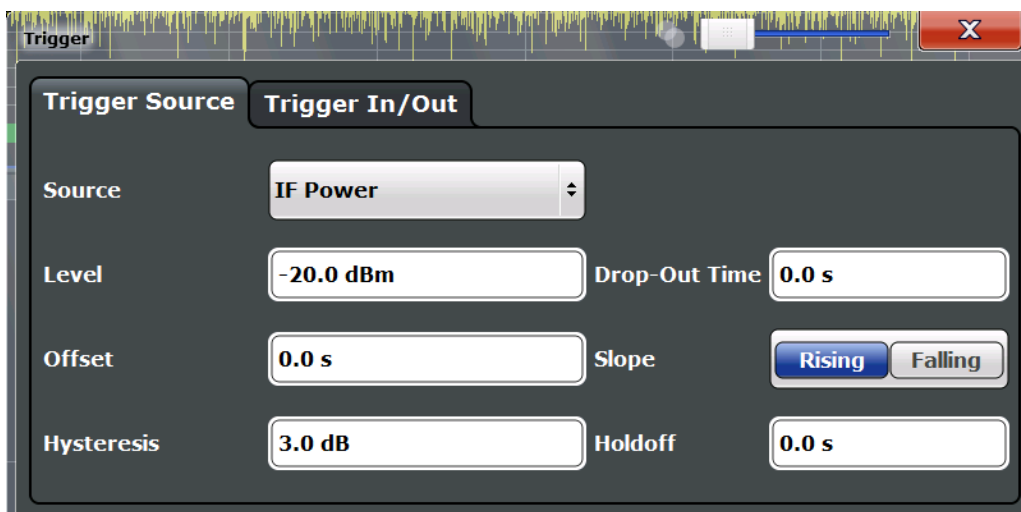
## 5.2.5 Trigger Settings

**Access:** "Overview" > "Signal Capture" > "Trigger Source"

**Access:** "Overview" > "Trigger"

Trigger settings determine when the input signal is measured.





External triggers from one of the TRIGGER INPUT/OUTPUT connectors on the R&S FSW are configured in a separate tab of the dialog box.



For step-by-step instructions on configuring triggered measurements, see the main R&S FSW User Manual.

- Trigger Source..... 90
  - L Trigger Source..... 90
    - L Free Run..... 90
    - L External Trigger 1/2/3..... 90
    - L Digital I/Q..... 91
    - L IF Power..... 91
  - L Trigger Level..... 92
  - L Drop-Out Time..... 92
  - L Trigger Offset..... 92
  - L Hysteresis..... 92
  - L Trigger Holdoff..... 92
  - L Slope..... 92

L Capture Offset.....	93
Trigger 2/3.....	93
L Output Type.....	93
L Level.....	94
L Pulse Length.....	94
L Send Trigger.....	94

### Trigger Source

The trigger settings define the beginning of a measurement.

#### Trigger Source ← Trigger Source

Defines the trigger source. If a trigger source other than "Free Run" is set, "TRG" is displayed in the channel bar and the trigger source is indicated.

Remote command:

`TRIGger [ :SEquence ] :SOURce` on page 204

#### Free Run ← Trigger Source ← Trigger Source

No trigger source is considered. Data acquisition is started manually or automatically and continues until stopped explicitly.

Remote command:

`TRIG:SOUR IMM`, see `TRIGger [ :SEquence ] :SOURce` on page 204

#### External Trigger 1/2/3 ← Trigger Source ← Trigger Source

Data acquisition starts when the TTL signal fed into the specified input connector meets or exceeds the specified trigger level.

(See "Trigger Level" on page 92).

**Note:** The "External Trigger 1" softkey automatically selects the trigger signal from the TRIGGER 1 INPUT connector on the front panel.

For details, see the "Instrument Tour" chapter in the R&S FSW Getting Started manual.

"External Trigger 1"

Trigger signal from the TRIGGER 1 INPUT connector.

"External Trigger 2"

Trigger signal from the TRIGGER 2 INPUT / OUTPUT connector.

Note: Connector must be configured for "Input" in the "Outputs" configuration (see "Trigger 2/3" on page 77).

"External Trigger 3"

Trigger signal from the TRIGGER 3 INPUT/ OUTPUT connector on the rear panel.

Note: Connector must be configured for "Input" in the "Outputs" configuration (see "Trigger 2/3" on page 77).

Remote command:

`TRIG:SOUR EXT`, `TRIG:SOUR EXT2`

`TRIG:SOUR EXT3`

See `TRIGger [ :SEquence ] :SOURce` on page 204

**Digital I/Q ← Trigger Source ← Trigger Source**

For applications that process I/Q data, such as the I/Q Analyzer or optional applications, and only if the optional Digital Baseband Interface is available:

Defines triggering of the measurement directly via the LVDS connector. In the selection list you must specify which general purpose bit (GP0 to GP5) will provide the trigger data.

**Note:**

If the Digital I/Q enhanced mode is used, i.e. the connected device supports transfer rates up to 200 Msps, only the general purpose bits GP0 and GP1 are available as a Digital I/Q trigger source.

The following table describes the assignment of the general purpose bits to the LVDS connector pins.

(For details on the LVDS connector, see the R&S FSW I/Q Analyzer User Manual.)

**Table 5-1: Assignment of general purpose bits to LVDS connector pins**

Bit	LVDS pin
GP0	SDATA4_P - Trigger1
GP1	SDATA4_P - Trigger2
GP2 *)	SDATA0_P - Reserve1
GP3 *)	SDATA4_P - Reserve2
GP4 *)	SDATA0_P - Marker1
GP5 *)	SDATA4_P - Marker2
*): not available for Digital I/Q enhanced mode	

Remote command:

TRIG:SOUR GP0, see TRIGger[:SEquence]:SOURce on page 204

**IF Power ← Trigger Source ← Trigger Source**

The R&S FSW starts capturing data as soon as the trigger level is exceeded around the third intermediate frequency.

For frequency sweeps, the third IF represents the start frequency. The trigger bandwidth at the third IF depends on the RBW and sweep type.

For measurements on a fixed frequency (e.g. zero span or I/Q measurements), the third IF represents the center frequency.

This trigger source is only available for RF input.

This trigger source is available for frequency and time domain measurements only.

It is not available for input from the optional Digital Baseband Interface or the optional Analog Baseband Interface.

The available trigger levels depend on the RF attenuation and preamplification. A reference level offset, if defined, is also considered.

For details on available trigger levels and trigger bandwidths, see the data sheet.

Remote command:

TRIG:SOUR IFP, see TRIGger[:SEquence]:SOURce on page 204

**Trigger Level ← Trigger Source**

Defines the trigger level for the specified trigger source.

For details on supported trigger levels, see the data sheet.

Remote command:

[TRIGger\[:SEQuence\]:LEVel\[:EXTernal<port>\]](#) on page 202

For analog baseband or digital baseband input only:

[TRIGger\[:SEQuence\]:LEVel:BBPower](#) on page 202

**Drop-Out Time ← Trigger Source**

Defines the time the input signal must stay below the trigger level before triggering again.

**Note:** For input from the optional Analog Baseband Interface using the baseband power trigger (BBP), the default drop out time is set to 100 ns. This avoids unintentional trigger events (as no hysteresis can be configured in this case).

Remote command:

[TRIGger\[:SEQuence\]:DTIME](#) on page 201

**Trigger Offset ← Trigger Source**

Defines the time offset between the trigger event and the start of the measurement.

Offset > 0:	Start of the measurement is delayed
Offset < 0:	Measurement starts earlier (pretrigger)

Remote command:

[TRIGger\[:SEQuence\]:HOLDoff\[:TIME\]](#) on page 201

**Hysteresis ← Trigger Source**

Defines the distance in dB to the trigger level that the trigger source must exceed before a trigger event occurs. Setting a hysteresis avoids unwanted trigger events caused by noise oscillation around the trigger level.

This setting is only available for "IF Power" trigger sources. The range of the value is between 3 dB and 50 dB with a step width of 1 dB.

Remote command:

[TRIGger\[:SEQuence\]:IFPower:HYSTeresis](#) on page 202

**Trigger Holdoff ← Trigger Source**

Defines the minimum time (in seconds) that must pass between two trigger events. Trigger events that occur during the holdoff time are ignored.

Remote command:

[TRIGger\[:SEQuence\]:IFPower:HOLDoff](#) on page 201

**Slope ← Trigger Source**

For all trigger sources except time, you can define whether triggering occurs when the signal rises to the trigger level or falls down to it.

Remote command:

[TRIGger\[:SEQuence\]:SLOPe](#) on page 204

**Capture Offset ← Trigger Source**

This setting is only available for slave applications in **MSRA operating mode**. It has a similar effect as the trigger offset in other measurements: it defines the time offset between the capture buffer start and the start of the extracted slave application data.

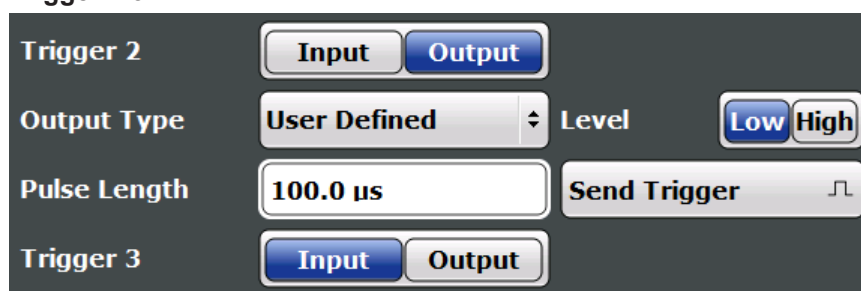
In MSRA mode, the offset must be a positive value, as the capture buffer starts at the trigger time = 0.

For details on the MSRA operating mode, see the R&S FSW MSRA User Manual.

For details on the MSRT operating mode, see the R&S FSW Real-Time Spectrum Application and MSRT Operating Mode User Manual.

Remote command:

[\[SENSe:\]MSRA:CAPTURE:OFFSet](#) on page 294

**Trigger 2/3**

Defines the usage of the variable TRIGGER INPUT/OUTPUT connectors, where:

"Trigger 2": TRIGGER INPUT/OUTPUT connector on the front panel

"Trigger 3": TRIGGER 3 INPUT/ OUTPUT connector on the rear panel

(Trigger 1 is INPUT only.)

**Note:** Providing trigger signals as output is described in detail in the R&S FSW User Manual.

"Input" The signal at the connector is used as an external trigger source by the R&S FSW. Trigger input parameters are available in the "Trigger" dialog box.

"Output" The R&S FSW sends a trigger signal to the output connector to be used by connected devices. Further trigger parameters are available for the connector.

Remote command:

[OUTPut:TRIGger<port>:DIRection](#) on page 206

**Output Type ← Trigger 2/3**

Type of signal to be sent to the output

"Device Triggered" (Default) Sends a trigger when the R&S FSW triggers.

"Trigger Armed" Sends a (high level) trigger when the R&S FSW is in "Ready for trigger" state. This state is indicated by a status bit in the `STATUS:OPERation` register (bit 5), as well as by a low-level signal at the AUX port (pin 9).

"User Defined" Sends a trigger when you select the "Send Trigger" button.  
In this case, further parameters are available for the output signal.

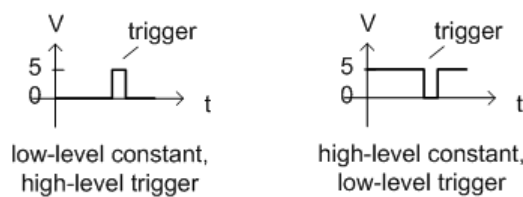
Remote command:

`OUTPut:TRIGger<port>:OTYPe` on page 207

#### Level ← Output Type ← Trigger 2/3

Defines whether a high (1) or low (0) constant signal is sent to the trigger output connector.

The trigger pulse level is always opposite to the constant signal level defined here. For example, for "Level = High", a constant high signal is output to the connector until you select the [Send Trigger](#) function. Then, a low pulse is provided.



Remote command:

`OUTPut:TRIGger<port>:LEVel` on page 206

#### Pulse Length ← Output Type ← Trigger 2/3

Defines the duration of the pulse (pulse width) sent as a trigger to the output connector.

Remote command:

`OUTPut:TRIGger<port>:PULSe:LENGth` on page 208

#### Send Trigger ← Output Type ← Trigger 2/3

Sends a user-defined trigger to the output connector immediately.

Note that the trigger pulse level is always opposite to the constant signal level defined by the output [Level](#) setting. For example, for "Level = High", a constant high signal is output to the connector until you select the "Send Trigger" function. Then, a low pulse is sent.

Which pulse level will be sent is indicated by a graphic on the button.

Remote command:

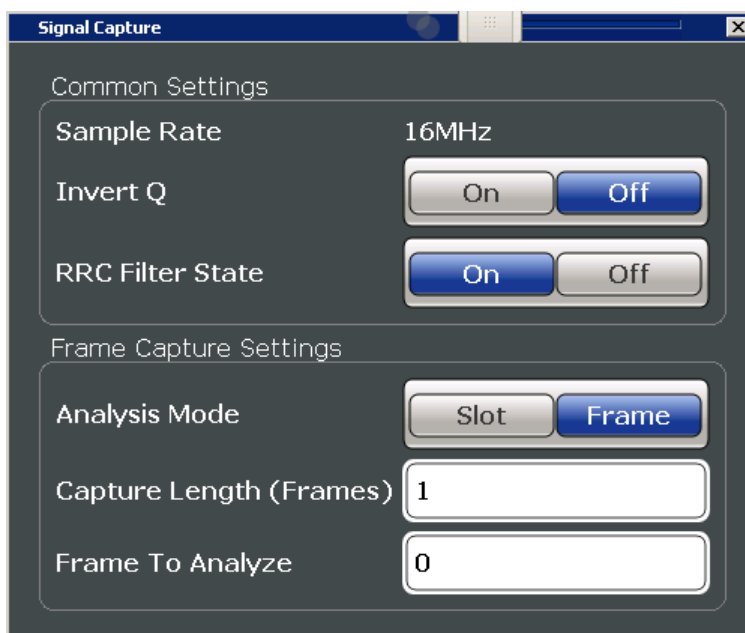
`OUTPut:TRIGger<port>:PULSe:IMMediate` on page 207

## 5.2.6 Signal Capture (Data Acquisition)

**Access:** "Overview" > "Signal Capture"

**or:** MEAS CONFIG > "Signal Capture"

How much and how data is captured from the input signal are defined in the "Signal Capture" settings.



**MSRA operating mode**

In MSRA operating mode, only the MSRA Master channel actually captures data from the input signal. The data acquisition settings for the 3GPP FDD BTS application in MSRA mode define the **application data extract**. See [Chapter 5.2.7, "Application Data \(MSRA\)"](#), on page 97.

For details on the MSRA operating mode see the R&S FSW MSRA User Manual.

<a href="#">Sample Rate</a> .....	95
<a href="#">Invert Q</a> .....	95
<a href="#">RRC Filter State</a> .....	95
<a href="#">Capture Mode</a> .....	96
<a href="#">Capture Length (Frames)</a> .....	96
<a href="#">Capture Offset</a> .....	96
<a href="#">Frame To Analyze</a> .....	96
<a href="#">Capture Time</a> .....	96

**Sample Rate**

The sample rate is always 16 MHz (indicated for reference only).

**Invert Q**

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

Remote command:

[\[SENSe:\]CDPower:QINVert](#) on page 209

**RRC Filter State**

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 signal is received (normal case), the RRC filter should be used to get a correct signal demodulation. (Default settings)
"OFF"	If a filtered 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 209

### Capture Mode

Captures a single slot or one complete frame.

Remote command:

[\[SENSe:\]CDPower:BASE](#) on page 208

### Capture Length (Frames)

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

Note: if this setting is not available, [Capture Mode](#) is set to "Slot", i.e. only one slot is captured.

Remote command:

[\[SENSe:\]CDPower:IQLength](#) on page 209

### Capture Offset

This setting is only available for slave applications in **MSRA operating mode**. It has a similar effect as the trigger offset in other measurements: it defines the time offset between the capture buffer start and the start of the extracted slave application data.

In MSRA mode, the offset must be a positive value, as the capture buffer starts at the trigger time = 0.

For details on the MSRA operating mode, see the R&S FSW MSRA User Manual.

For details on the MSRT operating mode, see the R&S FSW Real-Time Spectrum Application and MSRT Operating Mode User Manual.

Remote command:

[\[SENSe:\]MSRA:CAPTure:OFFSet](#) on page 294

### Frame To Analyze

Defines the frame to be analyzed and displayed.

Note: if this setting is not available in UE tests, [Capture Mode](#) is set to "Slot", i.e. only one slot is captured.

Remote command:

[\[SENSe:\]CDPower:FRAME\[:VALue\]](#) on page 229

### Capture Time

This setting is read-only.

It indicates the capture time determined by the capture length and sample rate.



## 5.2.7 Application Data (MSRA)

For the 3GPP FDD BTS application in MSRA operating mode, the application data range is defined by the same settings used to define the signal capturing in Signal and Spectrum Analyzer mode (see [Chapter 5.2.6, "Signal Capture \(Data Acquisition\)"](#), on page 94).

In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the analysis interval for the 3GPP FDD BTS measurement (see ["Capture Offset"](#) on page 93).

The **analysis interval** cannot be edited manually, but is determined automatically according to the selected channel, slot or frame to analyze which is defined for the evaluation range, depending on the result display. Note that the frame/slot/channel is analyzed *within the application data*.

## 5.2.8 Synchronization (BTS Measurements Only)

**Access:** "Overview" > "Synchronization" > "Antenna1"/"Antenna2"

**or:** MEAS CONFIG > "Sync"

For BTS tests, the individual channels in the input signal need to be synchronized to detect timing offsets in the slot spacings. These settings are described here.



Synchronization Type.....	97
Antenna1 / Antenna2.....	98
L CPICH Mode.....	98
L S-CPICH Code Nr.....	98
S-CPICH Antenna Pattern.....	98

### Synchronization Type

Defines whether the signal is synchronized to the CPICH or the synchronization channel (SCH).

"CPICH"           The 3GPP FDD application 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" The 3GPP FDD application 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 212

#### Antenna1 / Antenna2

Synchronization is configured for each diversity antenna individually, on separate tabs.

The 3GPP FDD standard defines two different CPICH patterns for diversity antenna 1 and antenna 2. The CPICH pattern used for synchronization can be defined depending on the antenna (standard configuration), or fixed to either pattern, independently of the antenna (user-defined configuration).

Remote command:

[SENSe:]CDPower:ANTenna on page 170

#### CPICH Mode ← Antenna1 / Antenna2

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:ANT<antenna>[:STATe] on page 211

#### S-CPICH Code Nr ← Antenna1 / Antenna2

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:ANT<antenna>:CODE on page 210

#### S-CPICH Antenna Pattern

Defines the pattern used for evaluation.

Remote command:

[SENSe:]CDPower:UCPich:ANT<antenna>:PATTern on page 211

## 5.2.9 Channel Detection

**Access:** "Overview" > "Channel Detection"

**or:** MEAS CONFIG > "Channel Detection"

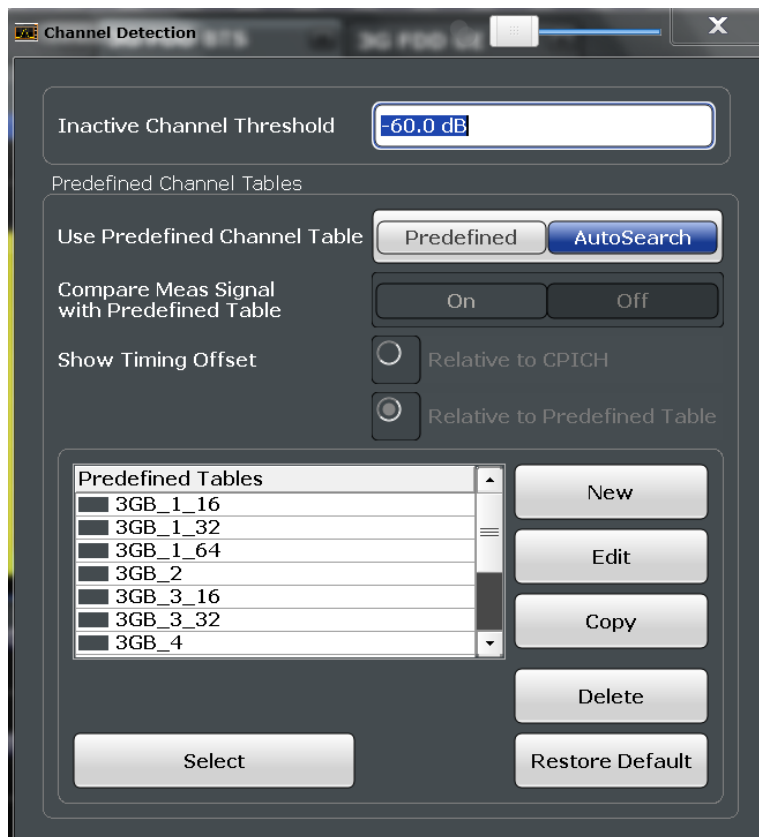
The channel detection settings determine which channels are found in the input signal.

- [General Channel Detection Settings](#).....99
- [Channel Table Management](#).....100
- [Channel Table Settings and Functions](#).....101
- [Channel Details \(BTS Measurements\)](#).....103
- [Channel Details \(UE Measurements\)](#).....105

### 5.2.9.1 General Channel Detection Settings

**Access:** "Overview" > "Channel Detection"

**or:** MEAS CONFIG > "Channel Detection"



- [Inactive Channel Threshold \(BTS measurements only\)](#).....99
- [Using Predefined Channel Tables](#).....99
- [Comparing the Measurement Signal with the Predefined Channel Table](#).....100
- [Timing Offset Reference](#).....100

#### Inactive Channel Threshold (BTS measurements only)

Defines 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 215

#### Using Predefined Channel Tables

Defines the channel search mode.

"Predefined" Compares the input signal to the predefined channel table selected in the "Predefined Tables" list

"Auto" Detects channels automatically using pilot sequences

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE\[:STATe\]](#) on page 215

UE measurements:

[CONFigure:WCDPower:MS:CTABLE\[:STATe\]](#) on page 218

### Comparing the Measurement Signal with the Predefined Channel Table

If enabled, the 3GPP FDD application compares the measured signal to the predefined channel tables. In the result summary, only the differences to the predefined table settings are displayed.

Remote command:

[CONFigure:WCDPower\[:BTS\]:CTABLE:COMPare](#) on page 214

### Timing Offset Reference

Defines the reference for the timing offset of the displayed measured signal.

"Relative to CPICH" The measured timing offset is shown in relation to the CPICH.

"Relative to Predefined Table" If the predefined table contains timing offsets, the delta between the defined and measured offsets are displayed in the evaluations.

Remote command:

[CONFigure:WCDPower\[:BTS\]:CTABLE:TOFFset](#) on page 214

## 5.2.9.2 Channel Table Management

**Access:** "Overview" > "Channel Detection"

<a href="#">Predefined Tables</a> .....	100
<a href="#">Selecting a Table</a> .....	101
<a href="#">Creating a New Table</a> .....	101
<a href="#">Editing a Table</a> .....	101
<a href="#">Copying a Table</a> .....	101
<a href="#">Deleting a Table</a> .....	101
<a href="#">Restoring Default Tables</a> .....	101

### Predefined Tables

The list shows all available channel tables and marks the currently used table with a checkmark. The currently *focussed* table is highlighted blue.

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:CATalog?](#) on page 216

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:CATalog?](#) on page 218

**Selecting a Table**

Selects the channel table currently focused in the "Predefined Tables" list and compares it to the measured signal to detect channels.

Remote command:

BTS measurements:

`CONFigure:WCDPower[:BTS]:CTABLE:SElect` on page 217

UE measurements:

`CONFigure:WCDPower:MS:CTABLE:SElect` on page 219

**Creating a New Table**

Creates a new channel table. See [Chapter 5.2.9.4, "Channel Details \(BTS Measurements\)"](#), on page 103.

For step-by-step instructions on creating a new channel table, see ["To define or edit a channel table"](#) on page 141.

**Editing a Table**

You can edit existing channel table definitions. The details of the selected channel are displayed in the "Channel Table" dialog box. See [Chapter 5.2.9.4, "Channel Details \(BTS Measurements\)"](#), on page 103.

**Copying a Table**

Copies an existing channel table definition. The details of the selected channel are displayed in the "Channel Table" dialog box. See [Chapter 5.2.9.4, "Channel Details \(BTS Measurements\)"](#), on page 103.

Remote command:

BTS measurements:

`CONFigure:WCDPower[:BTS]:CTABLE:COpy` on page 217

UE measurements:

`CONFigure:WCDPower:MS:CTABLE:COpy` on page 218

**Deleting a Table**

Deletes the currently selected channel table after a message is confirmed.

Remote command:

BTS measurements:

`CONFigure:WCDPower[:BTS]:CTABLE:DElete` on page 217

UE measurements:

`CONFigure:WCDPower:MS:CTABLE:DElete` on page 219

**Restoring Default Tables**

Restores the predefined channel tables delivered with the instrument.

### 5.2.9.3 Channel Table Settings and Functions

**Access:** "Overview" > "Channel Detection" > "New"/"Copy"/"Edit"

or: MEAS CONFIG > "Channel Detection" > "New"/"Copy"/"Edit"

Some general settings and functions are available when configuring a predefined channel table.

Name.....	102
Comment.....	102
Adding a Channel.....	102
Deleting a Channel.....	102
Creating a New Channel Table from the Measured Signal (Measure Table).....	102
Sorting the Table.....	102
Cancelling Configuration.....	102
Saving the Table.....	103

### Name

Name of the channel table that will be displayed in the "Predefined Channel Tables" list.

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:NAME](#) on page 220

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:NAME](#) on page 220

### Comment

Optional description of the channel table.

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:COMMENT](#) on page 220

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:COMMENT](#) on page 221

### Adding a Channel

Inserts a new row in the channel table to define another channel.

### Deleting a Channel

Deletes the currently selected channel from the table.

### Creating a New Channel Table from the Measured Signal (Measure Table)

Creates a completely new channel table according to the current measurement data.

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:MEASurement](#) on page 168

UE measurements:

[CONFigure:WCDPower:MS:MEASurement](#) on page 169

### Sorting the Table

Sorts the channel table entries.

### Cancelling Configuration

Closes the "Channel Table" dialog box without saving the changes.

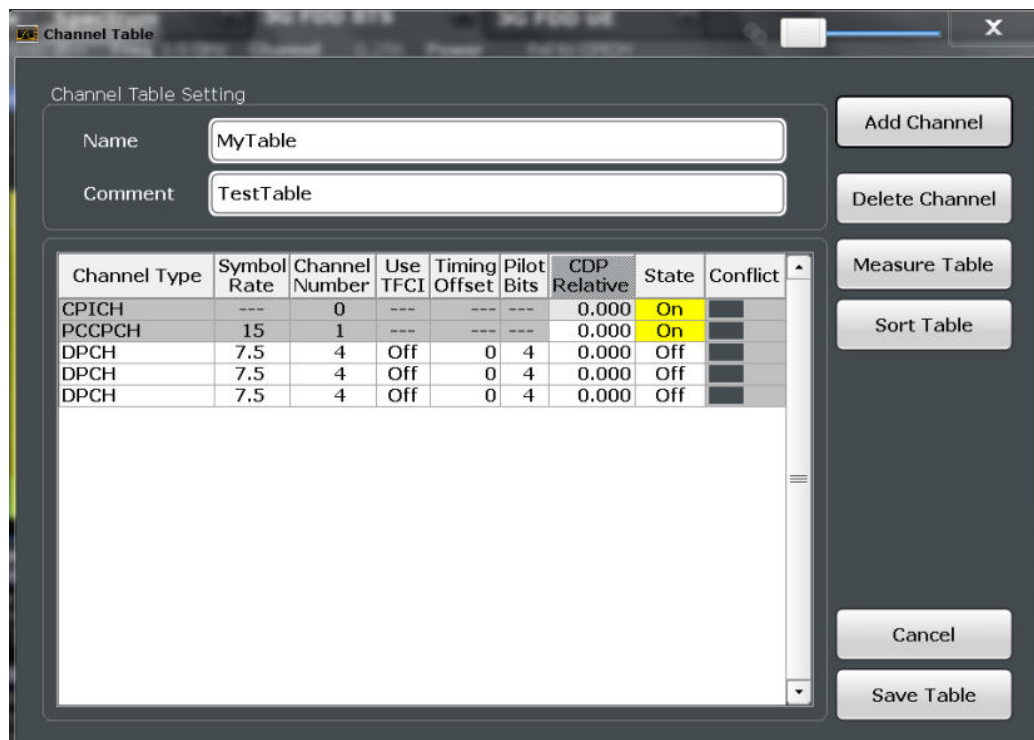
**Saving the Table**

Saves the changes to the table and closes the "Channel Table" dialog box.

**5.2.9.4 Channel Details (BTS Measurements)**

**Access:** "Overview" > "Channel Detection" > "New"/"Copy"/"Edit"

**or:** MEAS CONFIG > "Channel Detection" > "New"/"Copy"/"Edit"



Channel Type..... 103

Symbol Rate..... 104

Channel Number (Ch. SF)..... 104

Use TFCI..... 104

Timing Offset..... 104

Pilot Bits..... 104

CDP Relative..... 104

Status..... 104

Conflict..... 105

**Channel Type**

Type of channel. For a list of possible channel types see [Chapter 4.2, "BTS Channel Types"](#), on page 45.

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

**Symbol Rate**

Symbol rate at which the channel is transmitted.

**Channel Number (Ch. SF)**

Number of channel spreading code (0 to [spreading factor-1])

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

**Use TFCI**

Indicates whether the slot format and data rate are determined by the Transport Format Combination Indicator(TFCI).

Remote command:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

**Timing Offset**

Defines a timing offset in relation to the CPICH channel. During evaluation, the detected timing offset can be compared to this setting; only the delta is displayed (see "[Timing Offset Reference](#)" on page 100).

Remote command:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

**Pilot Bits**

Number of pilot bits of the channel (only valid for the control channel DPCCH)

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

**CDP Relative**

Code domain power (relative to the total power of the signal)

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

**Status**

Indicates the channel status. Codes that are not assigned are marked as inactive channels.

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221



UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

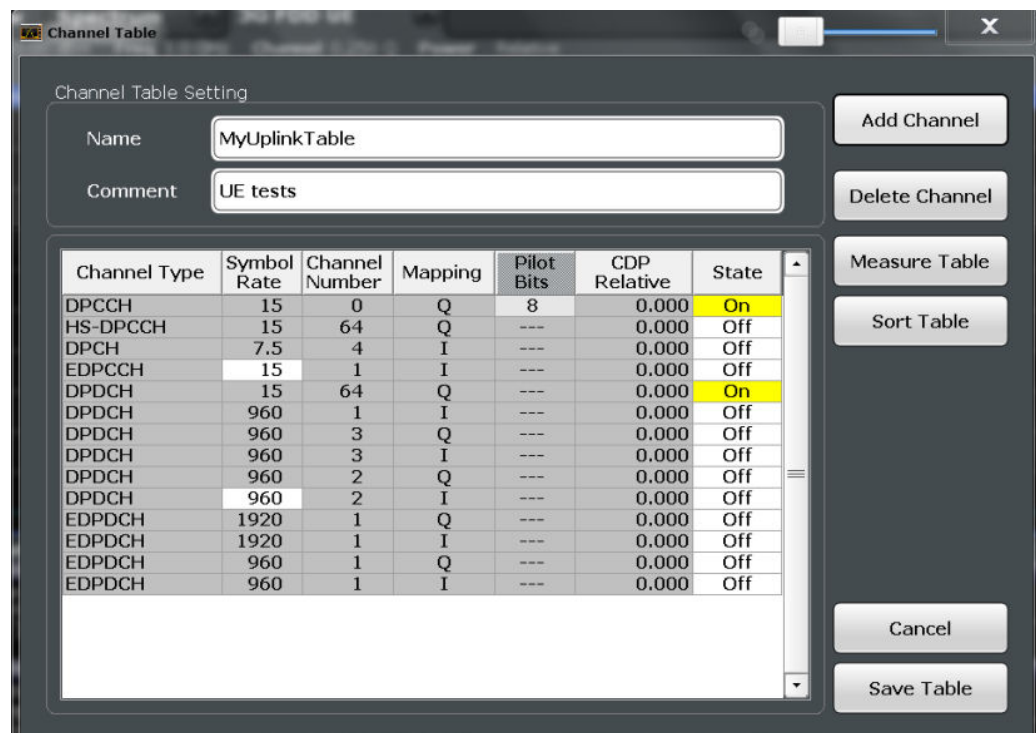
**Conflict**

Indicates a code domain conflict between channel definitions (e.g. overlapping channels).

**5.2.9.5 Channel Details (UE Measurements)**

**Access:** "Overview" > "Channel Detection" > "New"/"Copy"/"Edit"

**or:** MEAS CONFIG > "Channel Detection" > "New"/"Copy"/"Edit"



Channel Type..... 105

Symbol Rate..... 106

Channel Number (Ch. SF)..... 106

Mapping..... 106

Pilot Bits..... 106

CDP Relative..... 106

Status..... 106

**Channel Type**

Type of channel. For a list of possible channel types see [Chapter 4.2, "BTS Channel Types"](#), on page 45.

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

### Symbol Rate

Symbol rate at which the channel is transmitted.

### Channel Number (Ch. SF)

Number of channel spreading code (0 to [spreading factor-1])

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

### Mapping

Branch onto which the channel is mapped (I or Q). The setting is not editable, since the standard specifies the channel assignment for each channel.

### Pilot Bits

Number of pilot bits of the channel (only valid for the control channel DPCCH)

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

### CDP Relative

Code domain power (relative to the total power of the signal)

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

### Status

Indicates the channel status. Codes that are not assigned are marked as inactive channels.

Remote command:

BTS measurements:

[CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221

UE measurements:

[CONFigure:WCDPower:MS:CTABLE:DATA](#) on page 223

## 5.2.10 Sweep Settings

**Access:** SWEEP

The sweep settings define how the data is measured.

Continuous Sweep/RUN CONT.....	107
Single Sweep/ RUN SINGLE.....	107
Continue Single Sweep.....	107
Refresh ( MSRA only).....	108
Sweep / Average Count.....	108

### Continuous Sweep/RUN CONT

After triggering, starts the sweep and repeats it continuously until stopped. This is the default setting.

While the measurement is running, the "Continuous Sweep" softkey and the RUN CONT key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again. The results are not deleted until a new measurement is started.

**Note:** Sequencer. If the Sequencer is active, the "Continuous Sweep" softkey only controls the sweep mode for the currently selected channel. However, the sweep mode only takes effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in continuous sweep mode is swept repeatedly.

Furthermore, the RUN CONT key controls the Sequencer, not individual sweeps. RUN CONT starts the Sequencer in continuous mode.

For details on the Sequencer, see the R&S FSW User Manual.

Remote command:

`INITiate<n>:CONTInuous` on page 250

### Single Sweep/ RUN SINGLE

After triggering, starts the number of sweeps set in "Sweep Count". The measurement stops after the defined number of sweeps has been performed.

While the measurement is running, the "Single Sweep" softkey and the RUN SINGLE key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

**Note:** Sequencer. If the Sequencer is active, the "Single Sweep" softkey only controls the sweep mode for the currently selected channel. However, the sweep mode only takes effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, the Sequencer sweeps a channel in single sweep mode only once.

Furthermore, the RUN SINGLE key controls the Sequencer, not individual sweeps. RUN SINGLE starts the Sequencer in single mode.

If the Sequencer is off, only the evaluation for the currently displayed measurement channel is updated.

Remote command:

`INITiate<n>[:IMMEDIATE]` on page 250

### Continue Single Sweep

After triggering, repeats the number of sweeps set in "Sweep Count", without deleting the trace of the last measurement.

While the measurement is running, the "Continue Single Sweep" softkey and the RUN SINGLE key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

Remote command:

[INITiate<n>:CONMeas](#) on page 249

#### **Refresh ( MSRA only)**

This function is only available if the Sequencer is deactivated and only for **MSRA slave applications**.

The data in the capture buffer is re-evaluated by the currently active slave application only. The results for any other slave applications remain unchanged.

This is useful, for example, after evaluation changes have been made or if a new sweep was performed from another slave application; in this case, only that slave application is updated automatically after data acquisition.

**Note:** To update all active slave applications at once, use the "Refresh all" function in the "Sequencer" menu.

Remote command:

[INITiate<n>:REFresh](#) on page 294

#### **Sweep / Average Count**

Defines the number of measurements to be performed in the single sweep mode. Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one measurement is performed.

The sweep count is applied to all the traces in all diagrams.

If the trace modes "Average", "Max Hold" or "Min Hold" are set, this 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 measurements. For sweep count = 1, no averaging, maxhold or minhold operations are performed.

Remote command:

[\[SENSe:\]SWEep:COUNT](#) on page 225

[\[SENSe:\]AVERage<n>:COUNT](#) on page 225

### **5.2.11 Automatic Settings**

**Access:** AUTO SET

Some settings can be adjusted by the R&S FSW automatically according to the current measurement settings. In order to do so, a measurement is performed. The duration of this measurement can be defined automatically or manually.



### MSRA operating mode

In MSRA operating mode, the following automatic settings are not available, as they require a new data acquisition. However, 3GPP FDD applications cannot perform data acquisition in MSRA operating mode.

Adjusting all Determinable Settings Automatically (Auto All).....	109
Setting the Reference Level Automatically (Auto Level).....	109
Autosearch for Scrambling Code.....	109
Auto Scale Window.....	110
Auto Scale All.....	110
Restore Scale (Window).....	110
Resetting the Automatic Measurement Time (Meastime Auto).....	110
Changing the Automatic Measurement Time (Meastime Manual).....	110
Upper Level Hysteresis.....	110
Lower Level Hysteresis.....	110

#### Adjusting all Determinable Settings Automatically (Auto All)

Activates all automatic adjustment functions for the current measurement settings.

This includes:

- [Auto Level](#)
- ["Autosearch for Scrambling Code"](#) on page 65
- ["Auto Scale All"](#) on page 110

**Note:** MSRA operating modes. In MSRA operating mode, this function is only available for the MSRA Master, not the applications.

Remote command:

`[SENSe:]ADJust:ALL` on page 227

#### Setting the Reference Level Automatically (Auto Level)

Automatically determines a reference level which ensures that no overload occurs at the R&S FSW for the current input data. At the same time, the internal attenuators and the preamplifier (for analog baseband input: the full scale level) are adjusted so the signal-to-noise ratio is optimized, while signal compression and clipping are minimized.

To determine the required reference level, a level measurement is performed on the R&S FSW.

If necessary, you can optimize the reference level further. Decrease the attenuation level manually to the lowest possible value before an overload occurs, then decrease the reference level in the same way.

You can change the measurement time for the level measurement if necessary (see ["Changing the Automatic Measurement Time \(Meastime Manual\)"](#) on page 110).

Remote command:

`[SENSe:]ADJust:LEVel` on page 229

#### Autosearch for Scrambling Code

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 171

#### **Auto Scale Window**

Automatically determines the optimal range and reference level position to be displayed for the *current* measurement settings in the currently selected window. No new measurement is performed.

#### **Auto Scale All**

Automatically determines the optimal range and reference level position to be displayed for the *current* measurement settings in all displayed diagrams. No new measurement is performed.

#### **Restore Scale (Window)**

Restores the default scale settings in the currently selected window.

#### **Resetting the Automatic Measurement Time (Meastime Auto)**

Resets the measurement duration for automatic settings to the default value.

Remote command:

[\[SENSe:\]ADJust:CONFigure:DURation:MODE](#) on page 228

#### **Changing the Automatic Measurement Time (Meastime Manual)**

This function allows you to change the measurement duration for automatic setting adjustments. Enter the value in seconds.

Remote command:

[\[SENSe:\]ADJust:CONFigure:DURation:MODE](#) on page 228

[\[SENSe:\]ADJust:CONFigure:DURation](#) on page 227

#### **Upper Level Hysteresis**

When the reference level is adjusted automatically using the [Auto Level](#) function, the internal attenuators and the preamplifier are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Remote command:

[\[SENSe:\]ADJust:CONFigure:HYSteresis:UPPer](#) on page 228

#### **Lower Level Hysteresis**

When the reference level is adjusted automatically using the [Auto Level](#) function, the internal attenuators and the preamplifier are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Remote command:

[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer on page 228

## 5.3 Time Alignment Error Measurements

**Access:** "Overview" > "Select Measurement" >

Time Alignment Error measurements are only available in the 3GPP FDD BTS application.

### 5.3.1 Configuration Overview



**Access:** MEAS CONFIG > "Overview"

For Time Alignment Error measurements, the "Overview" provides quick access to the following configuration dialog boxes (listed in the recommended order of processing):

1. "Select Measurement"  
See [Chapter 3, "Measurements and Result Display"](#), on page 15
2. "Scrambling Code"  
See [Chapter 5.2.2.2, "BTS Scrambling Code"](#), on page 64
3. "Input/ Frontend"  
See [Chapter 5.2.3, "Data Input and Output Settings"](#), on page 67
4. (Optionally:) "Trigger"  
See [Chapter 5.2.5, "Trigger Settings"](#), on page 88
5. "Signal Capture"  
See [Chapter 5.2.6, "Signal Capture \(Data Acquisition\)"](#), on page 94
6. "Synchronization"  
See [Chapter 5.2.8, "Synchronization \(BTS Measurements Only\)"](#), on page 97
7. "Analysis"  
See [Chapter 6, "Analysis"](#), on page 122
8. "Display Configuration"  
See [Chapter 3.1.2, "Evaluation Methods for Code Domain Analysis"](#), on page 18 and ["Evaluation Methods"](#) on page 33

All settings required for Time Alignment Error measurements are identical to those described for Code Domain Analysis (see [Chapter 5.2, "Code Domain Analysis"](#), on page 60).

For TAE measurement on multiple base stations, however, the carrier table must be defined.

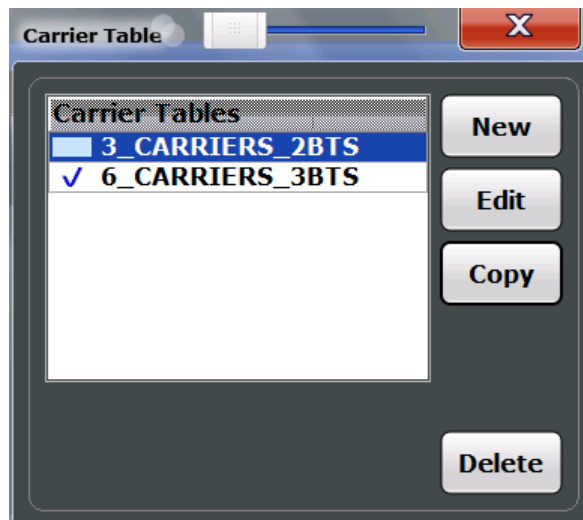
### 5.3.2 Carrier Table Configuration

For Time Alignment Error measurements on signals from different base stations, the number of base stations and the transmit frequency of the base stations can be defined using a table.

#### 5.3.2.1 Carrier Table Management

**Access:** "Overview" > "Carrier Table"

Carrier tables are managed in the "Carrier Table " dialog box which is displayed when you select the "Carrier Table" softkey in the "Time Align Error" menu.



Carrier Tables.....	112
Selecting a Table.....	112
Creating a New Table.....	112
Editing a Table.....	113
Copying a Table.....	113
Deleting a Table.....	113

#### Carrier Tables

The list shows all carrier tables found in the default directory and marks the currently used table with a checkmark. The currently *focussed* table is highlighted blue.

The default directory for carrier tables is

C:\R\_SInstr\user\chan\_tab\carrier\_table\.

Remote command:

[SENSe:]TAERror:CATalog? on page 237

#### Selecting a Table

Selects the currently highlighted carrier table.

#### Creating a New Table

Creates a new carrier table. See [Chapter 5.3.2.2, "Carrier Table Settings and Functions"](#), on page 113.



Remote command:

[SENSe:] TAERror:NEW on page 238

### Editing a Table

You can edit existing carrier table definitions. The details of the selected carrier are displayed in the "Carrier table" dialog box. See [Chapter 5.3.2.2, "Carrier Table Settings and Functions"](#), on page 113.

### Copying a Table

Copies an existing carrier table definition. The details of the selected carrier are displayed in the "Carrier table" dialog box. See [Chapter 5.3.2.2, "Carrier Table Settings and Functions"](#), on page 113.

### Deleting a Table

Deletes the currently selected carrier table after a message is confirmed.

The default table ("RECENT") cannot be deleted.

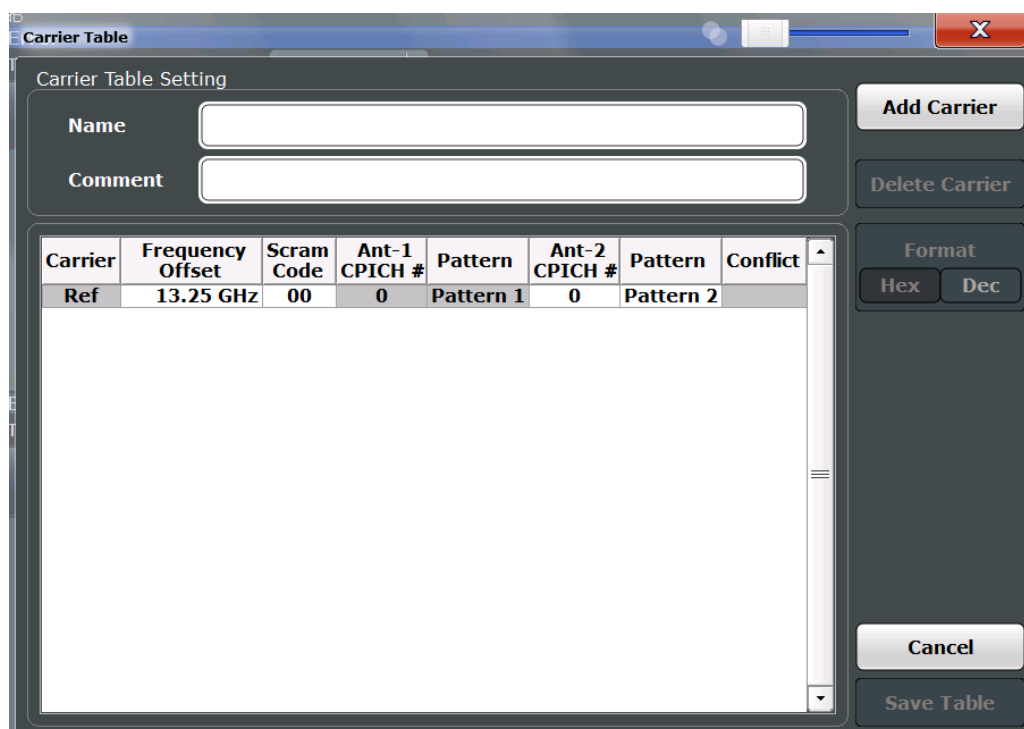
Remote command:

[SENSe:] TAERror:DELeTe on page 238

## 5.3.2.2 Carrier Table Settings and Functions

Some general settings and functions are available when configuring a carrier table.

Carrier tables are configured in the "Carrier Table Settings" dialog box which is displayed when you select the "New", "Copy" or "Edit" buttons for a carrier table in the "Carrier Table" dialog box.



Name.....	114
Comment.....	114
Adding a Carrier.....	114
Deleting a Carrier.....	114
Selecting the Scrambling Code Format.....	114
Cancelling Configuration.....	114
Saving the Table.....	114

**Name**

Name of the carrier table that will be displayed in the "Carrier Tables" list.

**Comment**

Optional description of the carrier table.

**Adding a Carrier**

Inserts a new row in the carrier table to define another carrier. Up to 4 carriers can be defined.

Remote command:

`[SENSe:]TAERror:CARRier<c>:INSert` on page 236

**Deleting a Carrier**

Deletes the currently selected carrier from the table.

Remote command:

`[SENSe:]TAERror:CARRier<c>:DELete` on page 236

**Selecting the Scrambling Code Format**

The [Scrambling Code](#) can be defined in hexadecimal (default) or in decimal format.

**Cancelling Configuration**

Closes the "Carrier Table Settings" dialog box without saving the changes.

**Saving the Table**

Saves the changes to the table and closes the "Carrier Table Settings" dialog box.

The new or edited table is stored in the default directory for carrier tables:

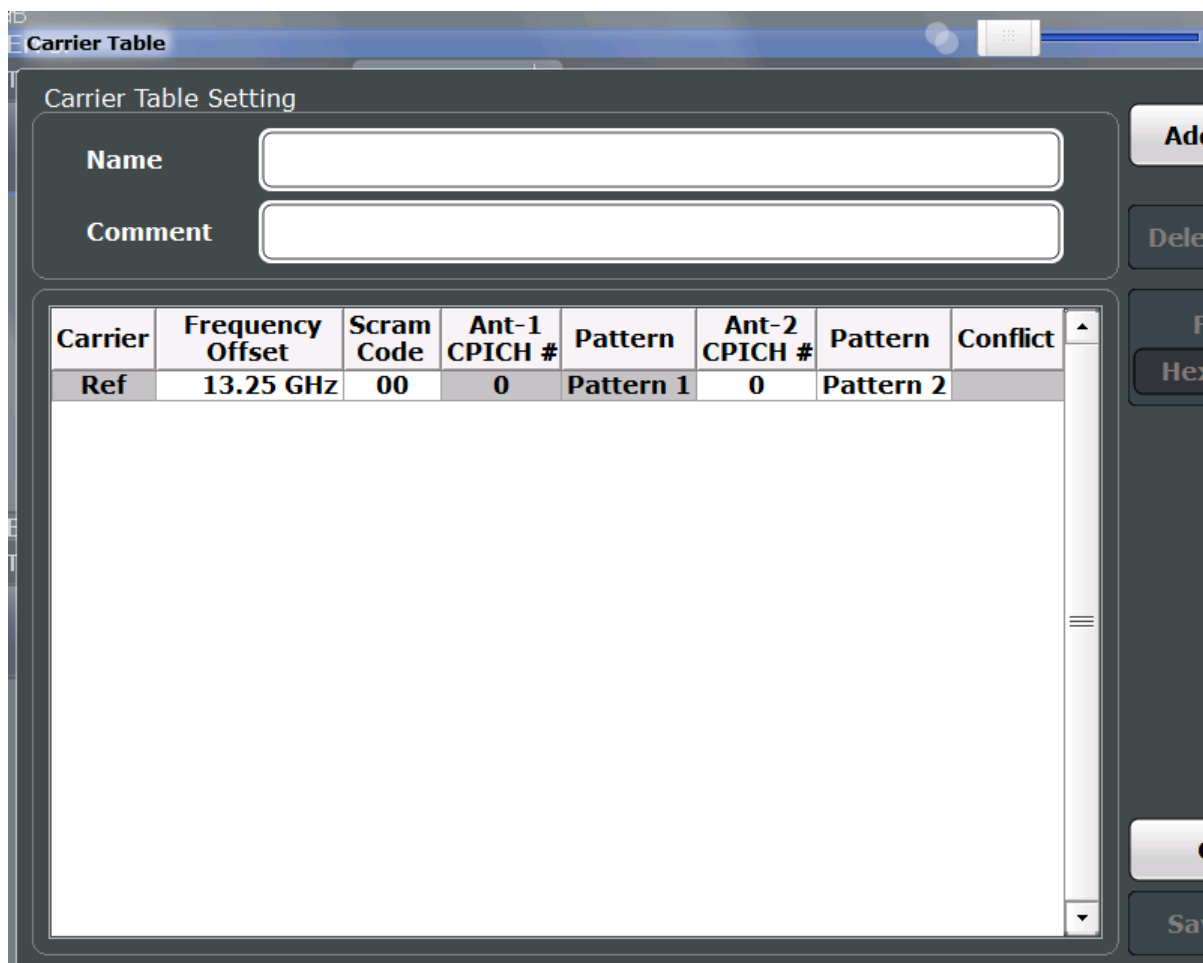
`C:\R_SInstr\user\chan_tab\carrier_table\.`

Remote command:

`[SENSe:]TAERror:SAVE` on page 239

**5.3.2.3 Carrier Details**

Carrier details are configured in the "Carrier Table Settings" dialog box which is displayed when you select the "New", "Copy" or "Edit" buttons for a carrier table in the "Carrier Detection" dialog box.



Carrier..... 115  
 Frequency Offset..... 115  
 Scrambling Code..... 116  
 Antenna 1: CPICH-Number..... 116  
 Antenna 1: CPICH-Pattern..... 116  
 Antenna 2: CPICH-Number..... 116  
 Antenna 2: CPICH-Pattern..... 116  
 Conflict..... 117

**Carrier**

Consecutive carrier number. The first carrier to be defined is used as the reference carrier for relative measurement results.

Remote command:

[SENSe:]TAERror:CARRier:COUNT? on page 236

**Frequency Offset**

The frequency offset with respect to the reference carrier. (The reference carrier is set to the current center frequency, thus the offset is always 0.)

By default, an offset of 5 MHz is defined for each newly inserted carrier. The minimum spacing between two carriers is 2.5 MHz. If this minimum spacing is not maintained, a [Conflict](#) is indicated and the conflicting carriers are indicated below the table.

The maximum positive and negative frequency offset which a carrier can have from the reference depends on the available analysis bandwidth (see "[Carrier frequencies](#)" on page 56).

If the maximum offsets from the reference are exceeded, a [Conflict](#) is indicated and the carrier that is out of range is indicated below the table.

Remote command:

`[SENSe:] TAERror:CARRier<c>:OFFSet` on page 237

#### Scrambling Code

The scrambling code identifying the base station transmitting the signal. This code can be defined in hexadecimal (default) or decimal format (see "[Selecting the Scrambling Code Format](#)" on page 114).

The scrambling code for the reference carrier is taken from the Signal Description settings for CDA measurements (see [Chapter 5.2.2.2, "BTS Scrambling Code"](#), on page 64).

Remote command:

`[SENSe:] TAERror:CARRier<c>:SCODE` on page 237

#### Antenna 1: CPICH-Number

The CPICH number used for synchronization

Remote command:

`[SENSe:] TAERror:CARRier<c>:ANTenna<antenna>:CPICH` on page 235

#### Antenna 1: CPICH-Pattern

The CPICH pattern used for synchronization

If "NONE" is selected, this antenna is considered to be unused. The time alignment error of this antenna is not measured and its status does not enter into the overall status for the overall signal.

Remote command:

`[SENSe:] TAERror:CARRier<c>:ANTenna<antenna>:PATTern` on page 235

#### Antenna 2: CPICH-Number

The CPICH number used for synchronization

Remote command:

`[SENSe:] TAERror:CARRier<c>:ANTenna<antenna>:CPICH` on page 235

#### Antenna 2: CPICH-Pattern

The CPICH pattern used for synchronization

If "NONE" is selected, this antenna is considered to be unused. The time alignment error of this antenna is not measured and its status does not enter into the overall status for the overall signal.

Remote command:

`[SENSe:] TAERror:CARRier<c>:ANTenna<antenna>:PATTern` on page 235

**Conflict**

Indicates a conflict between carriers, such as overlapping frequencies or frequencies outside the allowed range (see "Frequency Offset" on page 115). The detailed conflict message is displayed beneath the carrier table.

## 5.4 RF Measurements

3GPP FDD measurements require a special application on the R&S FSW, which you activate using the MODE key.

When you activate a 3GPP FDD application, Code Domain Analysis of the input signal is started automatically. However, the 3GPP FDD applications also provide various RF measurement types.

**Selecting the measurement type**

- ▶ To select an RF measurement type, do one of the following:
  - Select the "Overview" softkey. In the "Overview", select the "Select Measurement" button. Select the required measurement.
  - Press the MEAS key. In the "Select Measurement" dialog box, select the required measurement.

Some parameters are set automatically according to the 3GPP standard the first time a measurement is selected (since the last PRESET operation). A list of these parameters is given with each measurement type. The parameters can be changed, but are not reset automatically the next time you re-enter the measurement.

The main measurement configuration menus for the RF measurements are identical to the Spectrum application.

For details refer to "General Measurement Configuration" in the R&S FSW User Manual.

The measurement-specific settings for the following measurements are available in the "Analysis" dialog box (via the "Overview").

- [Channel Power \(ACLR\) Measurements](#)..... 117
- [Occupied Bandwidth](#)..... 118
- [Output Power Measurements](#)..... 119
- [Spectrum Emission Mask](#)..... 119
- [RF Combi](#)..... 120
- [CCDF](#)..... 121

### 5.4.1 Channel Power (ACLR) Measurements

Channel Power ACLR measurements are performed as in the Spectrum application with the following predefined settings according to 3GPP specifications (adjacent channel leakage ratio).

**Table 5-2: Predefined settings for 3GPP FDD ACLR Channel Power measurements**

Standard	(BTS measurements only): "Normal" base station
Number of adjacent channels	2

For further details about the ACLR measurements refer to "Measuring Channel Power and Adjacent-Channel Power" in the R&S FSW User Manual.

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

- Reference level and reference level offset
- RBW, VBW
- Sweep time
- Span
- Number of adjacent channels
- Fast ACLR mode

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

#### **BTS 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\[:BTS\]:STD](#) on page 240

## **5.4.2 Occupied Bandwidth**

The Occupied Bandwidth measurement determines 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 measurement is performed as in the Spectrum application with default settings.

**Table 5-3: Predefined settings for 3GPP FDD OBW measurements**

Setting	Default value
% Power Bandwidth	99 %
Channel bandwidth	3.84 MHz

For further details about the Occupied Bandwidth measurements refer to "Measuring the Occupied Bandwidth" in the R&S FSW User Manual.

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

- Reference level and reference level offset

- RBW, VBW
- Sweep time
- Span

### 5.4.3 Output Power Measurements

The Output Power measurement determines the 3GPP FDD signal channel power.

In order to determine the Output Power, the 3GPP FDD application performs a Channel Power measurement as in the Spectrum application with the following settings:

**Table 5-4: Predefined settings for 3GPP FDD Output Channel Power measurements**

Standard	W-CDMA 3GPP REV (BTS) / W-CDMA 3GPP FWD (UE) By default, the "Normal" base station standard is used. However, you can switch to the "Home" base station standard using the <a href="#">BTS Standard</a> softkey.
Number of adjacent channels	0

### 5.4.4 Spectrum Emission Mask

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

For further details about the Spectrum Emission Mask measurements refer to "Spectrum Emission Mask Measurement" in the R&S FSW User Manual.

The 3GPP FDD applications perform the SEM measurement as in the Spectrum application with the following settings:

**Table 5-5: Predefined settings for 3GPP FDD SEM measurements**

Standard	W-CDMA 3GPP REV (BTS) / W-CDMA 3GPP FWD (UE) By default, the "Normal" base station standard is used. However, you can switch to the "Home" base station standard using the <a href="#">BTS Standard</a> softkey.
Span	+/- 8 MHz
Number of ranges	11
Fast SEM	ON
Number of power classes	4
Power reference type	Channel power



Changing the RBW and the VBW is restricted due to the definition of the limits by the standard.

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

- Reference level and reference level offset
- Sweep time
- Span

### 5.4.5 RF Combi

This measurement combines the following measurements:

- [Chapter 5.4.1, "Channel Power \(ACLR\) Measurements"](#), on page 117
- [Chapter 5.4.2, "Occupied Bandwidth"](#), on page 118
- [Chapter 5.4.4, "Spectrum Emission Mask"](#), on page 119

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 individual measurements.

The RF Combi measurement is performed as in the Spectrum application with the following settings:

**Table 5-6: Predefined settings for 3GPP FDD RF Combi measurements**

Standard	W-CDMA 3GPP REV (BTS) / W-CDMA 3GPP FWD (UE) By default, the "Normal" base station standard is used. However, you can switch to the "Home" base station standard using the <a href="#">BTS Standard</a> softkey.
Number of adjacent channels	2
Span	25.5 MHz
Detector	RMS
RBW	30 kHz
Sweep time	100 ms
CP/ACLR	Active on trace 1
OBW	Active on trace 1
SEM	Active on trace 2

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

- RBW, VBW
- Sweep time
- Span
- Number of adjacent channels



### 5.4.6 CCDF

The CCDF measurement determines the distribution of the signal amplitudes (complementary cumulative distribution function).

The CCDF measurement is performed as in the Spectrum application with the following settings:

**Table 5-7: Predefined settings for 3GPP FDD CCDF measurements**

CCDF	Active on trace 1
Analysis bandwidth	10 MHz
Number of samples	62500
VBW	5 MHz

For further details about the CCDF measurements refer to "Statistical Measurements" in the R&S FSW User Manual.

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

- Reference level and reference level offset
- Analysis bandwidth
- Number of samples

## 6 Analysis

**Access:** "Overview" > "Analysis"

General result analysis settings concerning the evaluation range, trace, markers, etc. can be configured



### Analysis of RF Measurements

General result analysis settings concerning the trace, markers, lines etc. for RF measurements are identical to the analysis functions in the Spectrum application except for some special marker functions and spectrograms, which are not available in the 3GPP FDD applications.

For details see the "Common Analysis and Display Functions" chapter in the R&S FSW User Manual.

The remote commands required to perform these tasks are described in [Chapter 11.10, "Analysis"](#), on page 279.

- [Evaluation Range](#).....122
- [Code Domain Analysis Settings \(BTS Measurements\)](#).....125
- [Code Domain Analysis Settings \(UE Measurements\)](#).....127
- [Traces](#).....128
- [Markers](#).....130

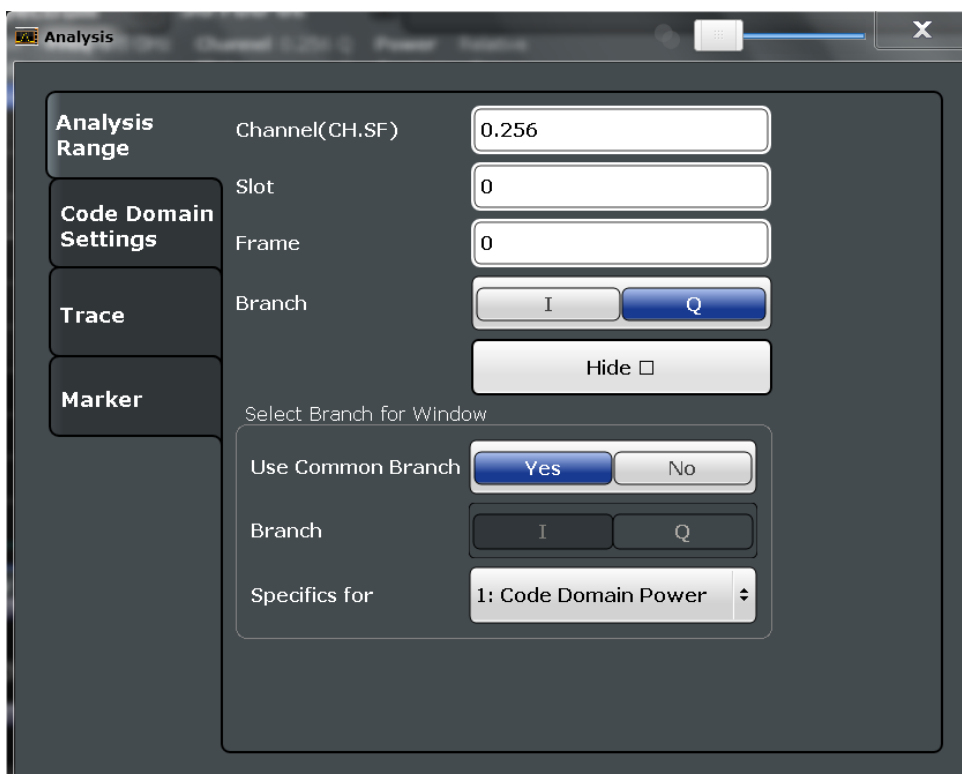
### 6.1 Evaluation Range

**Access:** "Overview" > "Analysis" > "Evaluation Range"

**or:** MEAS CONFIG > "Evaluation Range"

The evaluation range defines which channel, slot or frame is evaluated in the result display.

For UE measurements, the branch to be evaluated can also be defined.



Channel..... 123

Slot..... 124

Frame To Analyze..... 124

Branch (UE measurements only)..... 124

    L Details..... 124

    L Selecting a Different Branch for a Window..... 125

**Channel**

Selects a channel for the following evaluations:

- Code Domain Power
- Power vs Slot
- Symbol Constellation
- Symbol EVM

Enter a channel number and spreading factor, separated by a decimal point.

The specified channel is selected and marked in red, if active. If no spreading factor is specified, the code on the basis of the spreading factor 512 is marked. 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.

Remote command:

[SENSe:]CDPower:CODE on page 229

**Slot**

Selects the slot for evaluation. This affects the following evaluations (see also [Chapter 3.1.2, "Evaluation Methods for Code Domain Analysis"](#), on page 18):

- 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 230

**Frame To Analyze**

Defines the frame to be analyzed and displayed.

Note: if this setting is not available in UE tests, [Capture Mode](#) is set to "Slot", i.e. only one slot is captured.

Remote command:

`[SENSe:]CDPower:FRAMe[:VALue]` on page 229

**Branch (UE measurements only)**

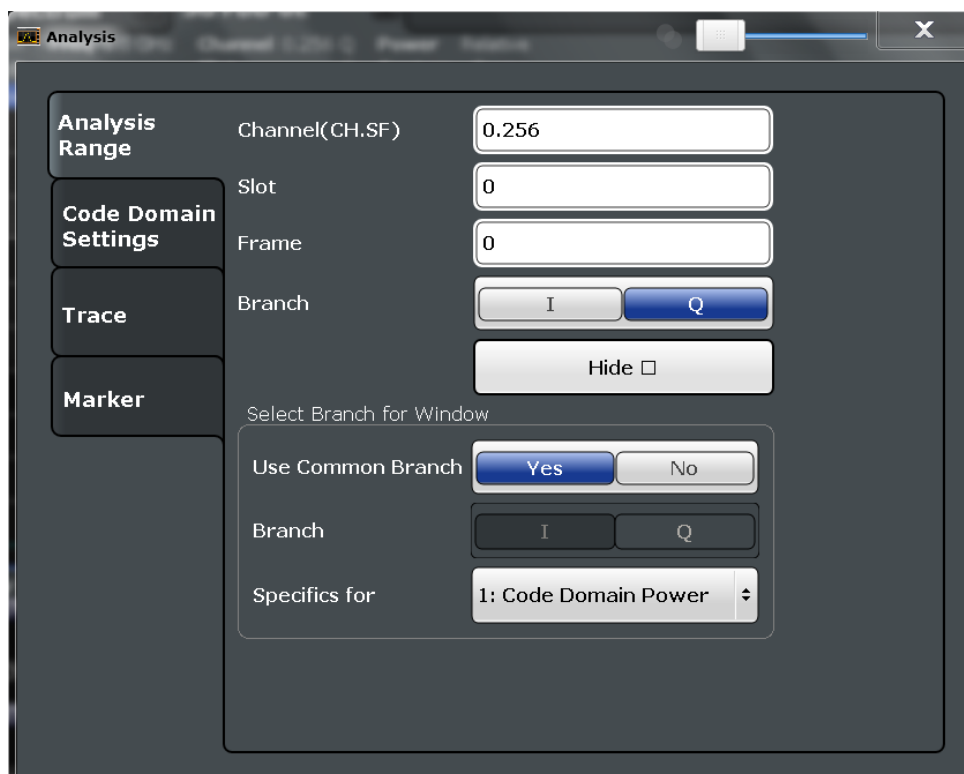
Switches between the evaluation of the I and the Q branch in UE measurements.

Remote command:

`CALCulate<n>:CDPower:Mapping` on page 230

**Details ← Branch (UE measurements only)**

By default, the same branch is used for all evaluations. However, you can select a different branch for individual windows. These settings are only available in the detailed dialog box, which is displayed when you select the "Details" button in the "Evaluation Range" dialog box.



To hide the detailed dialog box for individual windows, select the "Hide" button.

#### Selecting a Different Branch for a Window ← Branch (UE measurements only)

By default, the same (common) branch is used by all windows, namely the one specified by the [Branch \(UE measurements only\)](#) setting.

In order to evaluate a different branch for an individual window, toggle the "Use Common Branch" setting to "No". Select the window from the list of active windows under "Specifics for", then select the "Branch".

Remote command:

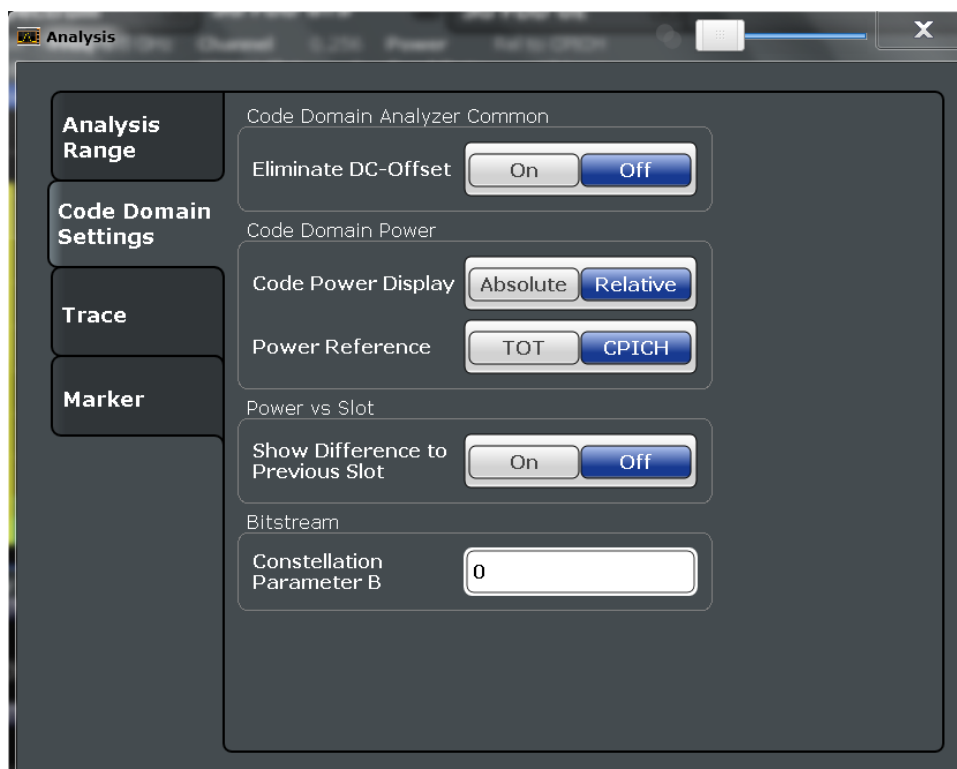
[CALCulate<n>:CDPower:Mapping](#) on page 230

## 6.2 Code Domain Analysis Settings (BTS Measurements)

**Access:** "Overview" > "Analysis" > "Code Domain Settings"

**or:** MEAS CONFIG > "Code Domain Settings"

Some evaluations provide further settings for the results. The settings for BTS measurements are described here.



Compensate IQ Offset.....	126
Code Power Display.....	126
Show Difference to Previous Slot.....	126
Constellation Parameter B.....	127

### Compensate IQ Offset

If enabled, the I/Q offset is eliminated from the measured signal. This is useful to deduct a DC offset to the baseband caused by the DUT, thus improving the EVM. Note, however, that for EVM measurements according to standard, compensation must be disabled.

Remote command:

[\[SENSe:\]CDPower:NORMalize](#) on page 232

### Code Power Display

For Code Domain Power evaluation:

Defines whether the absolute power or the power relative to the chosen reference is displayed.

"TOT"                   Relative to the total signal power

"CPICH"                Relative to the power of the CPICH

Remote command:

[\[SENSe:\]CDPower:PDISplay](#) on page 232

[\[SENSe:\]CDPower:PREference](#) on page 233

### Show Difference to Previous Slot

For Power vs. Slot evaluation:

If enabled, the slot power difference between the current slot and the previous slot is displayed in the "Power vs. Slot" evaluation.

Remote command:

[SENSe:]CDPower:PDIFf on page 232

### Constellation Parameter B

For Bitstream evaluation:

Defines the constellation parameter B. According to 3GPP specification, the mapping of 16QAM symbols to an assigned bitstream 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 231

## 6.3 Code Domain Analysis Settings (UE Measurements)

**Access:** "Overview" > "Analysis" > "Code Domain Settings"

**or:** MEAS CONFIG > "Code Domain Settings"

Some evaluations provide further settings for the results. The settings for UE measurements are described here.

Measurement Interval.....	127
Compensate IQ Offset.....	127
Eliminate Tail Chips.....	128
Code Power Display.....	128

### Measurement Interval

Switches between the analysis of a half slot or a full slot.

Both measurement intervals are influenced by the settings of [Eliminate Tail Chips](#): If "Eliminate Tail Chips" is set to "On", 96 chips at both ends of the measurement interval are not taken into account for analysis.

"Slot"                      The length of each analysis interval is 2560 chips, corresponding to one time slot of the 3GPP signal. The time reference for the start of slot 0 is the start of a 3GPP radio frame.

"Halfslot"                The length of each analysis interval is reduced to 1280 chips, corresponding to half of one time slot of the 3GPP signal.

Remote command:

[SENSe:]CDPower:HSLot on page 234

### Compensate IQ Offset

If enabled, the I/Q offset is eliminated from the measured signal. This is useful to deduct a DC offset to the baseband caused by the DUT, thus improving the EVM. Note, however, that for EVM measurements according to standard, compensation must be disabled.

Remote command:

[\[SENSe:\]CDPower:NORMalize](#) on page 232

#### Eliminate Tail Chips

Selects the length of the measurement interval for calculation of error vector magnitude (EVM) in accordance with 3GPP specification Release 5.

"On" Changes of power are expected. Therefore an EVM measurement interval of one slot minus 25  $\mu$ s at each end of the burst (3904 chips) is considered.

"Off" Changes of power are not expected. Therefore an EVM measurement interval of one slot (4096 chips) is considered. (Default settings)

Remote command:

[\[SENSe:\]CDPower:ETCHips](#) on page 233

#### Code Power Display

For "Code Domain Power" evaluation:

Defines whether the absolute power or the power relative to the total signal is displayed.

"Absolute" Absolute power levels

"Relative" Relative to the total signal power

Remote command:

[\[SENSe:\]CDPower:PDISplay](#) on page 232

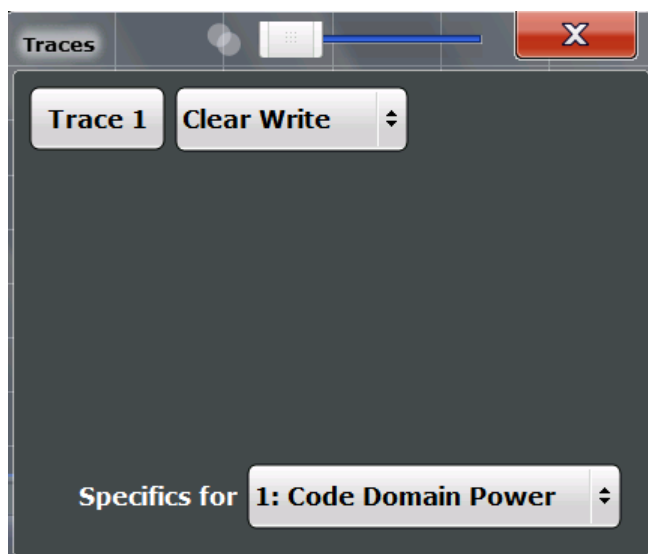
## 6.4 Traces

**Access:** "Overview" > "Analysis" > "Trace"

**Or:** TRACE > "Trace Config"

The trace settings determine how the measured data is analyzed and displayed on the screen.





In CDA evaluations, only one trace can be active in each diagram at any time.



Trace data from measurements in the R&S FSW 3GPP FDD Measurements application can be exported to an ASCII file using the common R&S FSW trace export functionality.

For details, see the trace configuration chapter in the R&S FSW User Manual.



#### Window-specific configuration

The settings in this dialog box are specific to the selected window. To configure the settings for a different window, select the window outside the displayed dialog box, or select the window from the "Specifics for" selection list in the dialog box.

#### Trace Mode

Defines the update mode for subsequent traces.

"Clear Write"	Overwrite mode: the trace is overwritten by each measurement. This is the default setting.
"Max Hold"	The maximum value is determined over several measurements and displayed. The R&S FSW saves each trace point in the trace memory only if the new value is greater than the previous one.
"Min Hold"	The minimum value is determined from several measurements and displayed. The R&S FSW saves each trace point in the trace memory only if the new value is lower than the previous one.
"Average"	The average is formed over several measurements. The <a href="#">Sweep / Average Count</a> determines the number of averaging procedures.
"View"	The current contents of the trace memory are frozen and displayed.
"Blank"	Removes the selected trace from the display.

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 279

## 6.5 Markers

**Access:** "Overview" > "Analysis" > "Marker"

**Or:** MKR

Markers help you analyze your measurement results by determining particular values in the diagram. Thus you can extract numeric values from a graphical display.



### Markers in Code Domain Analysis measurements

In Code Domain Analysis measurements, the markers are set to individual symbols, codes, slots or channels, depending on the result display. Thus you can use the markers to identify individual codes, for example.

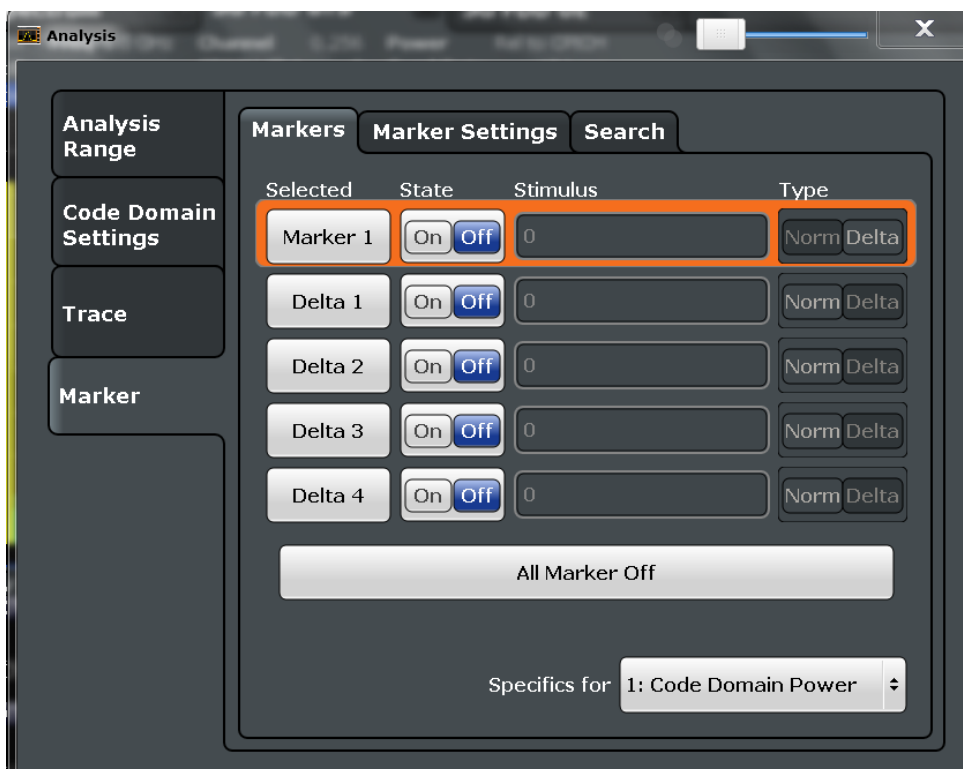
- [Individual Marker Settings](#)..... 130
- [General Marker Settings](#)..... 132
- [Marker Search Settings](#)..... 133
- [Marker Positioning Functions](#)..... 134

### 6.5.1 Individual Marker Settings

**Access:** "Overview" > "Analysis" > "Marker" > "Markers"

**Or:** MKR > "Marker Config"

In CDA evaluations, up to four markers can be activated in each diagram at any time.



Selected Marker..... 131  
 Marker State..... 131  
 X-value..... 131  
 Marker Type..... 132  
 All Markers Off..... 132

**Selected Marker**

Marker name. The marker which is currently selected for editing is highlighted orange.

Remote command:

Marker selected via suffix <m> in remote commands.

**Marker State**

Activates or deactivates the marker in the diagram.

Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 281

[CALCulate<n>:DELTAmarker<m>\[:STATe\]](#) on page 282

**X-value**

Defines the position of the marker on the x-axis (channel, slot, symbol, depending on evaluation).

Remote command:

[CALCulate<n>:DELTAmarker<m>:X](#) on page 283

[CALCulate<n>:MARKer<m>:X](#) on page 282

**Marker Type**

Toggles the marker type.

The type for marker 1 is always "Normal", the type for delta marker 1 is always "Delta". These types cannot be changed.

**Note:** If normal marker 1 is the active marker, switching the "Mkr Type" activates an additional delta marker 1. For any other marker, switching the marker type does not activate an additional marker, it only switches the type of the selected marker.

"Normal"            A normal marker indicates the absolute value at the defined position in the diagram.

"Delta"            A delta marker defines the value of the marker relative to the specified reference marker (marker 1 by default).

Remote command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 281

[CALCulate<n>:DELTAmarker<m>\[:STATe\]](#) on page 282

**All Markers Off**

Deactivates all markers in one step.

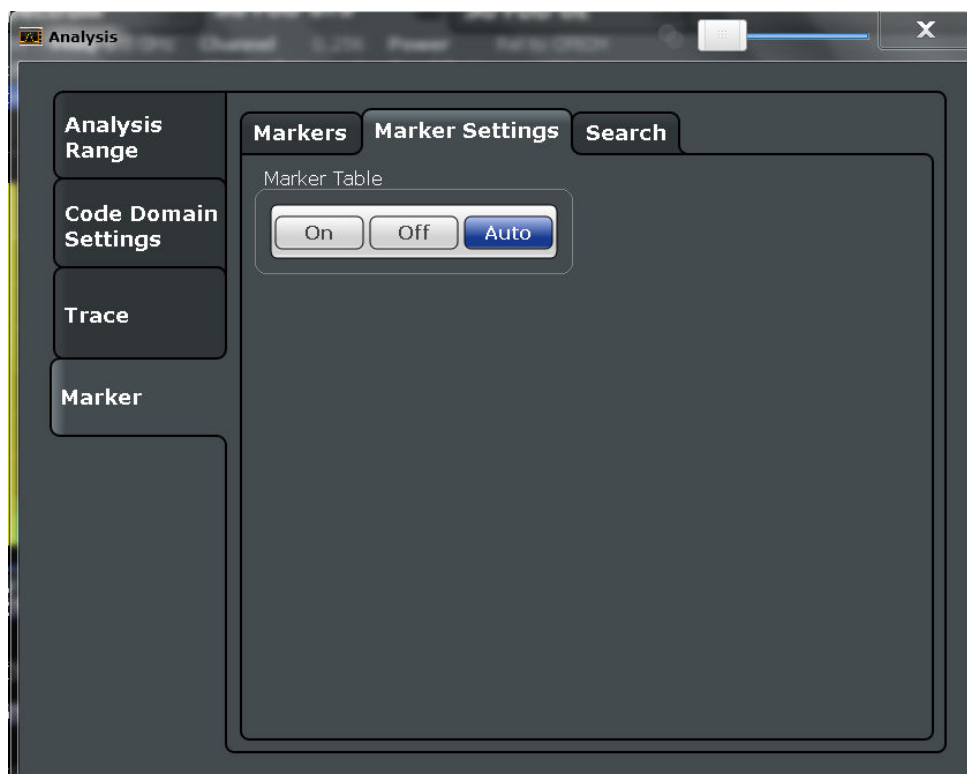
Remote command:

[CALCulate<n>:MARKer<m>:AOFF](#) on page 282

## 6.5.2 General Marker Settings

**Access:** "Overview" > "Analysis" > "Marker" > "Marker Settings"

**Or:** MKR > "Marker Config" > "Marker Settings" tab



### Marker Table Display

Defines how the marker information is displayed.

- "On" Displays the marker information in a table in a separate area beneath the diagram.
- "Off" Displays the marker information within the diagram area. No separate marker table is displayed.
- "Auto" (Default) Up to two markers are displayed in the diagram area. If more markers are active, the marker table is displayed automatically.

Remote command:

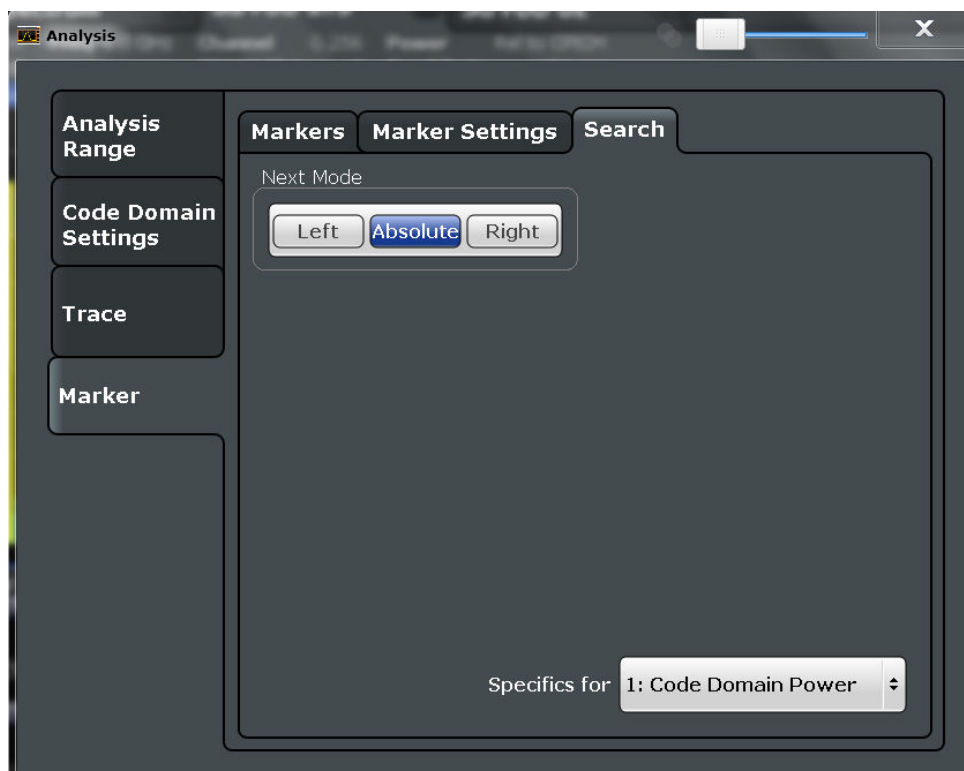
[DISPlay:MTABLE](#) on page 284

### 6.5.3 Marker Search Settings

**Access:** "Overview" > "Analysis" > "Marker" > "Search"

**Access:** MKR -> > "Search Config"

Several functions are available to set the marker to a specific position very quickly and easily. In order to determine the required marker position, searches can be performed. The search results are affected by special settings.



[Search Mode for Next Peak](#)..... 134

**Search Mode for Next Peak**

Selects the search mode for the next peak search.

- "Left"                 Determines the next maximum/minimum to the left of the current peak.
- "Absolute"            Determines the next maximum/minimum to either side of the current peak.
- "Right"                Determines the next maximum/minimum to the right of the current peak.

Remote command:  
[Chapter 11.10.2.3, "Positioning the Marker"](#), on page 285

**6.5.4 Marker Positioning Functions**

**Access:** MKR ->

The following functions set the currently selected marker to the result of a peak search.



**Markers in Code Domain Analysis measurements**

In Code Domain Analysis measurements, the markers are set to individual symbols, codes, slots or channels, depending on the result display. Thus you can use the markers to identify individual codes, for example.

Search Next Peak.....	135
Search Next Minimum.....	135
Peak Search.....	135
Search Minimum.....	135
Marker To CPICH.....	135
Marker To PCCPCH.....	136

### Search Next Peak

Sets the selected marker/delta marker to the next (lower) maximum of the assigned trace. If no marker is active, marker 1 is activated.

Remote command:

`CALCulate<n>:MARKer<m>:MAXimum:NEXT` on page 286  
`CALCulate<n>:MARKer<m>:MAXimum:RIGHT` on page 287  
`CALCulate<n>:MARKer<m>:MAXimum:LEFT` on page 286  
`CALCulate<n>:DELTamarker<m>:MAXimum:NEXT` on page 289  
`CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT` on page 290  
`CALCulate<n>:DELTamarker<m>:MAXimum:LEFT` on page 289

### Search Next Minimum

Sets the selected marker/delta marker to the next (higher) minimum of the selected trace. If no marker is active, marker 1 is activated.

Remote command:

`CALCulate<n>:MARKer<m>:MINimum:NEXT` on page 287  
`CALCulate<n>:MARKer<m>:MINimum:LEFT` on page 287  
`CALCulate<n>:MARKer<m>:MINimum:RIGHT` on page 288  
`CALCulate<n>:DELTamarker<m>:MINimum:NEXT` on page 290  
`CALCulate<n>:DELTamarker<m>:MINimum:LEFT` on page 290  
`CALCulate<n>:DELTamarker<m>:MINimum:RIGHT` on page 291

### Peak Search

Sets the selected marker/delta marker to the maximum of the trace. If no marker is active, marker 1 is activated.

Remote command:

`CALCulate<n>:MARKer<m>:MAXimum[:PEAK]` on page 286  
`CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]` on page 289

### Search Minimum

Sets the selected marker/delta marker to the minimum of the trace. If no marker is active, marker 1 is activated.

Remote command:

`CALCulate<n>:MARKer<m>:MINimum[:PEAK]` on page 287  
`CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]` on page 290

### Marker To CPICH

Sets the marker to the CPICH channel.

Remote command:

`CALCulate<n>:MARKer<m>:FUNCTION:CPICH` on page 285

**Marker To PCCPCH**

Sets the marker to the PCCPCH channel.

Remote command:

[CALCulate<n>:MARKer<m>:FUNction:PCCPch](#) on page 286



## 7 I/Q Data Import and Export

Baseband signals mostly occur as so-called complex baseband signals, i.e. a signal representation that consists of two channels; the in phase (I) and the quadrature (Q) channel. Such signals are referred to as I/Q signals. The complete modulation information and even distortion that originates from the RF, IF or baseband domains can be analyzed in the I/Q baseband.

Importing and exporting I/Q signals is useful for various applications:

- Generating and saving I/Q signals in an RF or baseband signal generator or in external software tools to analyze them with the R&S FSW later
- Capturing and saving I/Q signals with an RF or baseband signal analyzer to analyze them with the R&S FSW or an external software tool later

As opposed to storing trace data, which may be averaged or restricted to peak values, I/Q data is stored as it was captured, without further processing. The data is stored as complex values in 32-bit floating-point format. Multi-channel data is not supported. The I/Q data is stored in a format with the file extension `.iq.tar`.

For a detailed description see the R&S FSW I/Q Analyzer and I/Q Input User Manual.



### Export only in MSRA mode

In MSRA mode, I/Q data can only be exported to other applications; I/Q data cannot be imported to the MSRA Master or any MSRA applications.

- [Import/Export Functions](#)..... 137

## 7.1 Import/Export Functions



**Access:** "Save"/ "Open" icon in the toolbar > "Import" / "Export"



These functions are only available if no measurement is running.

In particular, if [Continuous Sweep/RUN CONT](#) is active, the import/export functions are not available.

For a description of the other functions in the "Save/Recall" menu, see the R&S FSW User Manual.

<a href="#">Import</a> .....	137
L <a href="#">I/Q Import</a> .....	138
<a href="#">Export</a> .....	138
L <a href="#">I/Q Export</a> .....	138



### Import

**Access:** "Save/Recall" > Import

 Provides functions to import data.

#### **I/Q Import ← Import**

Opens a file selection dialog box to select an import file that contains I/Q data. This function is only available in single sweep mode and only in applications that process I/Q data, such as the I/Q Analyzer or optional applications.

Note that the I/Q data must have a specific format as described in the R&S FSW I/Q Analyzer and I/Q Input User Manual.

Remote command:

[MMEMory:LOAD:IQ:STATe](#) on page 291



#### **Export**

**Access:** "Save/Recall" > Export



Opens a submenu to configure data export.

#### **I/Q Export ← Export**

Opens a file selection dialog box to define an export file name to which the I/Q data is stored. This function is only available in single sweep mode.

**Note:** Storing large amounts of I/Q data (several Gigabytes) can exceed the available (internal) storage space on the R&S FSW. In this case, it can be necessary to use an external storage medium.

**Note:** Secure user mode.

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the R&S FSW User Manual.

Remote command:

[MMEMory:STORe<n>:IQ:STATe](#) on page 292

[MMEMory:STORe<n>:IQ:COMMeNt](#) on page 291

## 8 Optimizing and Troubleshooting the Measurement

If the results do not meet your expectations, try the following methods to optimize the measurement:

### Synchronization fails:

- Check the frequency.
- Check the reference level.
- Check the scrambling code.
- When using an external trigger, check whether an external trigger is being sent to the R&S FSW.

### 8.1 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 the 3GPP FDD applications 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: <ul style="list-style-type: none"> <li>• Incorrectly sent pilot symbols in the received frame.</li> <li>• Low signal to noise ratio (SNR) of the W-CDMA signal.</li> <li>• 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.</li> <li>• 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</li> </ul>

## 9 How to Perform Measurements in 3GPP FDD Applications

The following step-by-step instructions demonstrate how to perform measurements with the 3GPP FDD applications.

### To perform Code Domain Analysis

1. Press the MODE key and select the "3GPP FDD BTS" applications for base station tests, or "3GPP FDD UE" for user equipment tests.

Code Domain Analysis of the input signal is performed by default.

2. Select the "Overview" softkey to display the "Overview" for Code Domain Analysis.
3. Select the "Signal Description" button and configure the expected input signal and used scrambling code.
4. Select the "Input/Frontend" button and then the "Frequency" tab to define the input signal's center frequency.
5. Optionally, select the "Trigger" button and define a trigger for data acquisition, for example an external trigger to start capturing data only when a useful signal is transmitted.
6. Select the "Signal Capture" button and define the acquisition parameters for the input signal.  
In MSRA mode, define the application data instead, see ["To select the application data for MSRA measurements"](#) on page 143.
7. If necessary, select the "Synchronization" button and change the channel synchronization settings.
8. Select the "Channel Detection" button and define how the individual channels are detected within the input signal. If necessary, define a channel table as described in ["To define or edit a channel table"](#) on page 141.
9. Select the "Display Config" button and select the evaluation methods that are of interest to you.  
Arrange them on the display to suit your preferences.
10. Exit the SmartGrid mode and select the "Overview" softkey to display the "Overview" again.
11. Select the "Analysis" button in the "Overview" to configure how the data is evaluated in the individual result displays.
  - Select the channel, slot or frame to be evaluated.
  - Configure specific settings for the selected evaluation method(s).
  - Optionally, configure the trace to display the average over a series of sweeps. If necessary, increase the "Sweep/Average Count" in the "Sweep Config" dialog box.

- Configure markers and delta markers to determine deviations and offsets within the results, e.g. when comparing errors or peaks.
12. Start a new sweep with the defined settings.  
In MSRA mode you may want to stop the continuous measurement mode by the Sequencer and perform a single data acquisition:
    - a) Select the Sequencer icon (🔌) from the toolbar.
    - b) Set the Sequencer state to "OFF".
    - c) Press the RUN SINGLE key.

#### To define or edit a channel table

Channel tables contain a list of channels to be detected and their specific parameters. You can create user-defined and edit pre-defined channel tables.

1. Select the "Channel Detection" softkey from the main "Code Domain Analyzer" menu to open the "Channel Detection" dialog box.
2. To define a new channel table, select the "New" button next to the "Predefined Tables" list.  
To edit an existing channel table:
  - a) Select the existing channel table in the "Predefined Tables" list.
  - b) Select the "Edit" button next to the "Predefined Tables" list.
3. In the "Channel Table" dialog box, define a name and, optionally, a comment that describes the channel table. The comment is displayed when you set the focus on the table in the "Predefined Tables" list.
4. Define the channels to be detected using one of the following methods:  
Select the "Measure Table" button to create a table that consists of the channels detected in the currently measured signal.  
Or:
  - a) Select the "Add Channel" button to insert a row for a new channel below the currently selected row in the channel table.
  - b) Define the channel specifications required for detection:
    - Symbol rate
    - Channel number
    - Whether TFCI is used
    - Timing offset, if applicable
    - Number of pilot bits (for DPCH only)
    - The channel's code domain power (relative to the total signal power)
5. Select the "Save Table" button to store the channel table.  
The table is stored and the dialog box is closed. The new channel table is included in the "Predefined Tables" list in the "Channel Detection" dialog box.
6. To activate the use of the new channel table:
  - a) Select the table in the "Predefined Tables" list.

- b) Select the "Select" button.  
A checkmark is displayed next to the selected table.
- c) Toggle the "Use Predefined Channel Table" setting to "Predefined".
- d) Toggle the "Compare Meas Signal with Predefined Table" setting to "On".
- e) Start a new measurement.

#### To determine the Time Alignment Error

1. Press the MODE key and select the "3GPP FDD BTS" applications for base station tests, or "3GPP FDD UE" for user equipment tests.

Code Domain Analysis of the input signal is performed by default.

2. Press the "Synch." softkey to display the "Synchronization" dialog box. Configure the location of the S-CPICH for antenna 2 and select the "Antenna Pattern".
3. Select the Time Alignment Error measurement:
  - a) Press the MEAS key.
  - b) In the "Select Measurement" dialog box, select the "Time Alignment Error" button.

The Time Alignment Error is calculated and displayed immediately.

#### To determine the Time Alignment Error for multiple carriers

1. Press the MODE key and select the "3GPP FDD BTS" application for base station tests.

Code Domain Analysis of the input signal is performed by default.

2. Select the Time Alignment Error measurement:
  - a) Press the MEAS key.
  - b) In the "Select Measurement" dialog box, select the "Time Alignment Error" button.
3. Select Carrier Table and define up to 4 carriers to be included in the measurement:
  - a) Define the reference carrier first. Its frequency is set to the center frequency.
  - b) Define the frequencies of all other carriers as an offset to the reference carrier.
  - c) Define the required synchronization information for the carriers.
  - d) Save the table.

The Time Alignment Error is calculated and the results for each carrier are displayed immediately.

#### To perform an RF measurement

1. Press the MODE key and select the "3GPP FDD BTS" applications for base station tests, or "3GPP FDD UE" for user equipment tests.

The R&S FSW opens a new measurement channel for the 3GPP FDD application. Code Domain Analysis of the input signal is performed by default.

2. Select the RF measurement:

- a) Press the MEAS key.
- b) In the "Select Measurement" dialog box, select the required measurement.

The selected measurement is activated with the default settings for the 3GPP FDD application immediately.

3. If necessary, adapt the settings as described for the individual measurements in the R&S FSW User Manual.
4. Select the "Display Config" button and select the evaluation methods that are of interest to you.  
Arrange them on the display to suit your preferences.
5. Exit the SmartGrid mode and select the "Overview" softkey to display the "Overview" again.
6. Select the "Analysis" button in the "Overview" to make use of the advanced analysis functions in the result displays.
  - Configure a trace to display the average over a series of sweeps; if necessary, increase the "Sweep Count" in the "Sweep" settings.
  - Configure markers and delta markers to determine deviations and offsets within the evaluated signal.
  - Use special marker functions to calculate noise or a peak list.
  - Configure a limit check to detect excessive deviations.
7. Optionally, export the trace data of the graphical evaluation results to a file.
  - a) In the "Traces" tab of the "Analysis" dialog box, switch to the "Trace Export" tab.
  - b) Select "Export Trace to ASCII File".
  - c) Define a file name and storage location and select "OK".

#### To select the application data for MSRA measurements

In multi-standard radio analysis you can analyze the data captured by the MSRA Master in the 3GPP FDD BTS application. Assuming you have detected a suspect area of the captured data in another application, you would now like to analyze the same data in the 3GPP FDD BTS application.

1. Select the "Overview" softkey to display the "Overview" for Code Domain Analysis.
2. Select the "Signal Capture" button.
3. Define the application data range as the "Capture Length (Frames)". You must determine the number of frames according to the following formula:  

$$\langle \text{No of frames} \rangle = \langle \text{measurement time in seconds} \rangle / 10 \text{ ms (time per frame)}$$
 Add an additional frame as the first frame may start before the suspect measurement range.
4. Define the starting point of the application data as the "Capture offset". The offset is calculated according to the following formula:  

$$\langle \text{capture offset} \rangle = \langle \text{starting point for application} \rangle - \langle \text{starting point in capture buffer} \rangle$$

5. The analysis interval is automatically determined according to the selected channel, slot or frame to analyze (defined for the evaluation range), depending on the result display. Note that the frame/slot/channel is analyzed *within the application data*. If the analysis interval does not yet show the required area of the capture buffer, move through the frames/slots/channels in the evaluation range or correct the application data range.
6. If the Sequencer is off, select the "Refresh" softkey in the "Sweep" menu to update the result displays for the changed application data.



## 10 Measurement Examples

Some practical examples for basic 3GPP<sup>®</sup>FDD Base station tests are provided here. They describe how operating and measurement errors can be avoided using correct presets. The measurements are performed with an R&S FSW equipped with option R&S FSW-K72.

Key settings are shown as examples to avoid measurement errors. Following the correct setting, the effect of an incorrect setting is shown.

The measurements are performed using the following instruments and accessories:

- The R&S FSW with Application Firmware R&S FSW-K72: 3GPP FDD BTS (base station test)
- The Vector Signal Generator R&S SMW100A with option R&S SMW-K42: digital standard 3GPP FDD (requires options R&S SMW-B10, R&S SMW-B13 and R&S SMW-B103)
- 1 coaxial cable, 50Ω, approx. 1 m, N connector
- 1 coaxial cable, 50Ω, approx. 1 m, BNC connector

The following measurements are described:

- [Measurement 1: Measuring the Signal Channel Power](#)..... 145
- [Measurement 2: Determining the Spectrum Emission Mask](#)..... 146
- [Measurement 3: Measuring the Relative Code Domain Power](#)..... 148
- [Measurement 4: Triggered Measurement of Relative Code Domain Power](#)..... 152
- [Measurement 5: Measuring the Composite EVM](#)..... 154
- [Measurement 6: Determining the Peak Code Domain Error](#)..... 155

### 10.1 Measurement 1: Measuring the Signal Channel Power

The measurement of the spectrum gives an overview of the 3GPP FDD BTS signal and the spurious emissions close to the carrier.

#### Test setup

- ▶ Connect the RF output of the R&S SMW200A to the RF input of the R&S FSW (coaxial cable with N connectors).

#### Settings on the R&S SMW200A

1. PRESET
2. "FREQ" = 2.1175 GHz
3. "LEVEL" = 0 dBm
4. "BASEBAND A > CDMA Standards > 3GPP FDD"
5. "General" tab: "LINK DIRECTION > DOWN/FORWARD"

## Measurement 2: Determining the Spectrum Emission Mask

6. "Base station" tab: "TEST MODELS > Test\_Model\_1\_16\_channels"
7. "Base station" tab: "Select Base station > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"

**Settings on the R&S FSW**

1. PRESET
2. "MODE > 3GPP FDD BTS"
3. "AMPT > Reference level" = 0 dBm
4. "FREQ > Center frequency" = 2.1175 GHz
5. "MEAS > POWER"
6. "AMPT > Scale Config > Auto Scale Once"

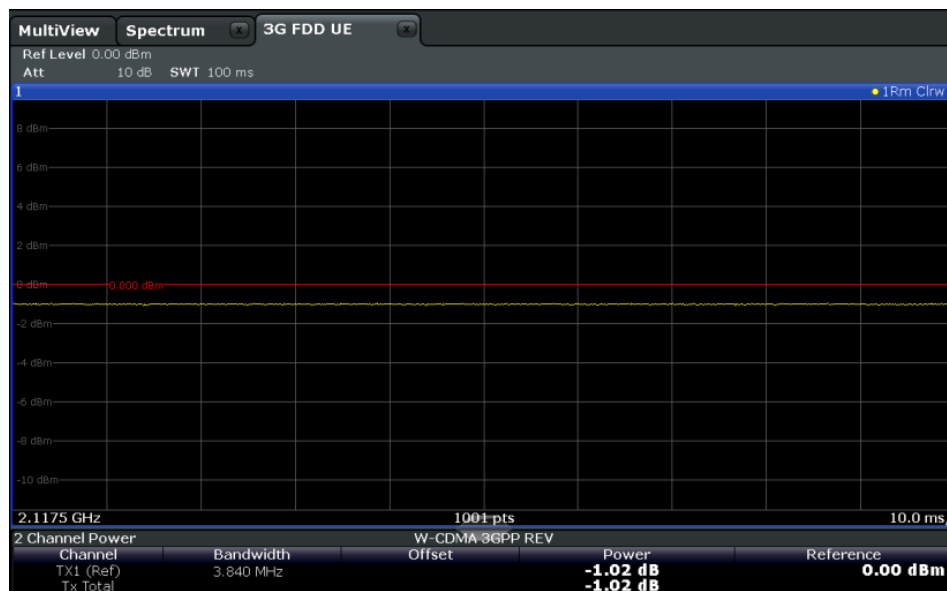
**Result**

Figure 10-1: Measurement Example 1: Measuring the Signal Channel Power

## 10.2 Measurement 2: Determining the Spectrum Emission Mask

The 3GPP specification defines a measurement which monitors the compliance with a spectral mask in a range of at least  $\pm 12.5$  MHz around the 3GPP FDD BTS carrier. To assess the power emissions in the specified range, the signal power is measured in the range near the carrier using a 30kHz filter, in the ranges far away from the carrier using a 1MHz filter. The resulting trace is compared to a limit line defined in the 3GPP specification.

## Measurement 2: Determining the Spectrum Emission Mask

**Test setup**

- ▶ Connect the RF output of the R&S SMW200A to the RF input of the R&S FSW (coaxial cable with N connectors).

**Settings on the R&S SMW200A**

1. PRESET
2. "FREQ" = *2.1175 GHz*
3. "LEVEL"= *0 dBm*
4. "DIGITAL STD" = "WCDMA/3GPP"
5. "DIGITAL STD > Set Default"
6. "DIGITAL STD > LINK DIRECTION > DOWN/FORWARD"
7. "DIGITAL STD > TEST MODELS > Test\_Model\_1\_16\_channels"
8. "DIGITAL STD > Select Base station > UE 1 " = "ON"
9. "DIGITAL STD > WCDMA/3GPP > STATE"= "ON"

**Settings on the R&S FSW**

1. PRESET
2. "MODE > 3GPP FDD BTS"
3. "AMPT > Reference level"= *0 dBm*
4. "FREQ > Center frequency" = *2.1175 GHz*
5. "MEAS > Spectrum Emission Mask"
6. "AMPT > Scale Config > Auto Scale Once"

**Result**

The following results are displayed:

- Spectrum of the 3GPP FDD BTS signal
- Limit line defined in the standard
- Information on limit line violations (passed/failed)

## Measurement 3: Measuring the Relative Code Domain Power

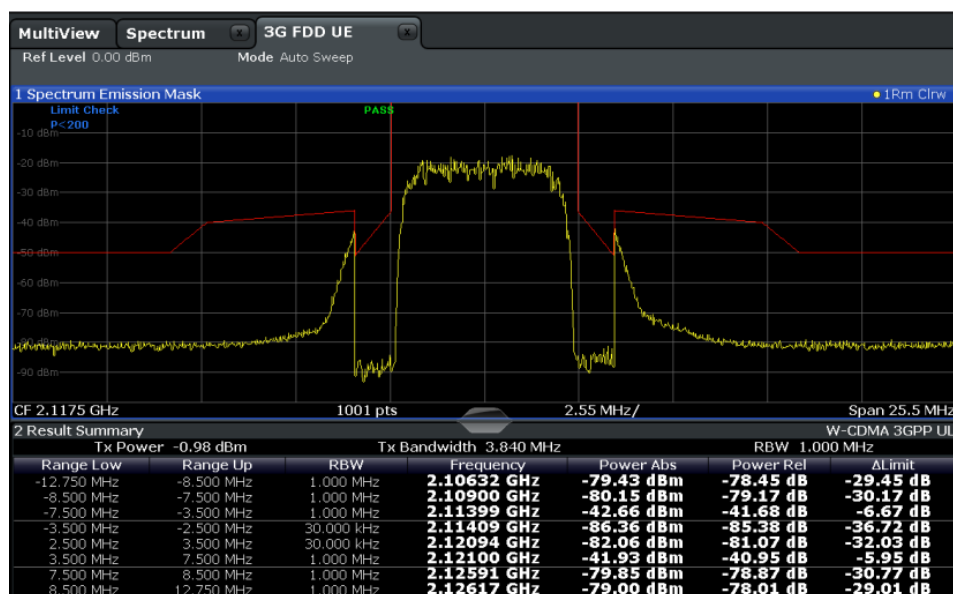


Figure 10-2: Measurement Example 2: Determining the Spectrum Emission Mask

## 10.3 Measurement 3: Measuring the Relative Code Domain Power

A code domain power measurement on one of the channel configurations is shown in the following. Basic parameters of CDP analysis are changed to demonstrate the effects of values that are not adapted to the input signal.

### Test setup

1. Connect the RF output of the R&S SMW200A to the RF input of the R&S FSW (coaxial cable with N connectors).
2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference output (REF) on the rear panel of R&S SMW200A (coaxial cable with BNC connectors).

### Settings on the R&S SMW200A

1. PRESET
2. "FREQ" = 2.1175 GHz
3. "LEVEL" = 0 dBm
4. "BASEBAND A > CDMA Standards > 3GPP FDD"
5. "General" tab: "LINK DIRECTION > DOWN/FORWARD"
6. "Base station" tab: "TEST MODELS > Test\_Model\_1\_16\_channels"

## Measurement 3: Measuring the Relative Code Domain Power

7. "Base station" tab: "Select Base station > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"

**Settings on the R&S FSW**

1. PRESET
2. "MODE > 3GPP FDD BTS"
3. "AMPT > Reference level"= 10 dBm
4. "FREQ > Center frequency" = 2.1175 GHz
5. "AMPT > Scale Config > Auto Scale Once"

**Result**

Window 1 shows the code domain power of the signal, on the Q branch.

Window 2 shows the result summary, i.e. the numeric results of the CDP measurement.



Figure 10-3: Measurement Example 3: Measuring the Relative Code Domain Power

### 10.3.1 Synchronizing the Reference Frequencies

The synchronization of the reference oscillators both of the DUT and R&S FSW strongly reduces the measured frequency error.

**Test setup**

- ▶ Connect the reference input (REF INPUT (1...20 MHz)) on the rear panel of the R&S FSW to the reference output (REF) on the rear panel of R&S SMW200A (coaxial cable with BNC connectors).

### Settings on the R&S SMW200A

The settings on the R&S SMW200A remain the same.

### Settings on the R&S FSW

In addition to the settings of the basic test, activate the use of an external reference:

- ▶ "SETUP > Reference > Reference Frequency Input = External Reference 10 MHz"

The displayed carrier frequency error should be < 10 Hz.

## 10.3.2 Behaviour with Deviating Center Frequency

In the following, the behaviour of the DUT and the R&S FSW with an incorrect center frequency setting is shown.

1. Tune the center frequency of the signal generator in 0.5 kHz steps.
2. Watch the measurement results on the R&S FSW screen:
  - Up to 1 kHz, a frequency error causes no apparent difference in measurement accuracy of the code domain power measurement.
  - Above a frequency error of 1 kHz, the probability of an impaired synchronization increases. With continuous measurements, at times all channels are displayed in blue with almost the same level.
  - Above a frequency error of approx. 2 kHz, a CDP measurement cannot be performed. The R&S FSW displays all possible codes in blue with a similar level.
3. Reset the frequency to 2.1175 GHz both on the R&S SMW200A and on the R&S FSW.

## Measurement 3: Measuring the Relative Code Domain Power

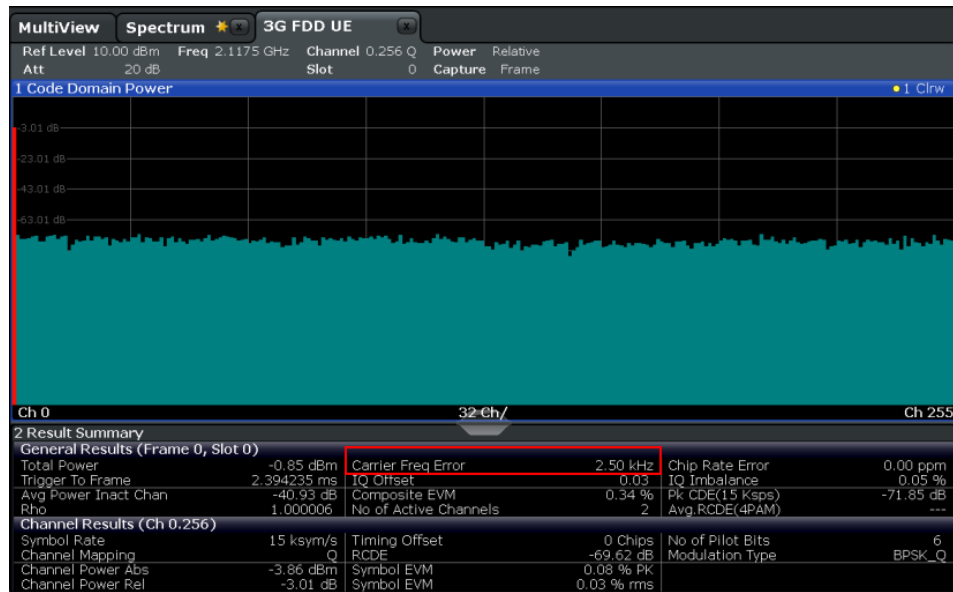


Figure 10-4: Measurement Example 3: Measuring the Relative Code Domain Power with Incorrect Center Frequency

### 10.3.3 Behaviour with Incorrect Scrambling Code

A valid CDP measurement can be carried out only if the scrambling code set on the R&S FSW is identical to that of the transmitted signal.

#### Settings on the R&S SMW200A

- "Base stations" tab > BS 1 > "Common" tab: "SCRAMBLING CODE" = 0000

#### Settings on the R&S FSW

- "Meas Config > Signal Description > Scrambling Code" = 0001

#### Result

The CDP display shows all possible codes with approximately the same level.

## Measurement 4: Triggered Measurement of Relative Code Domain Power

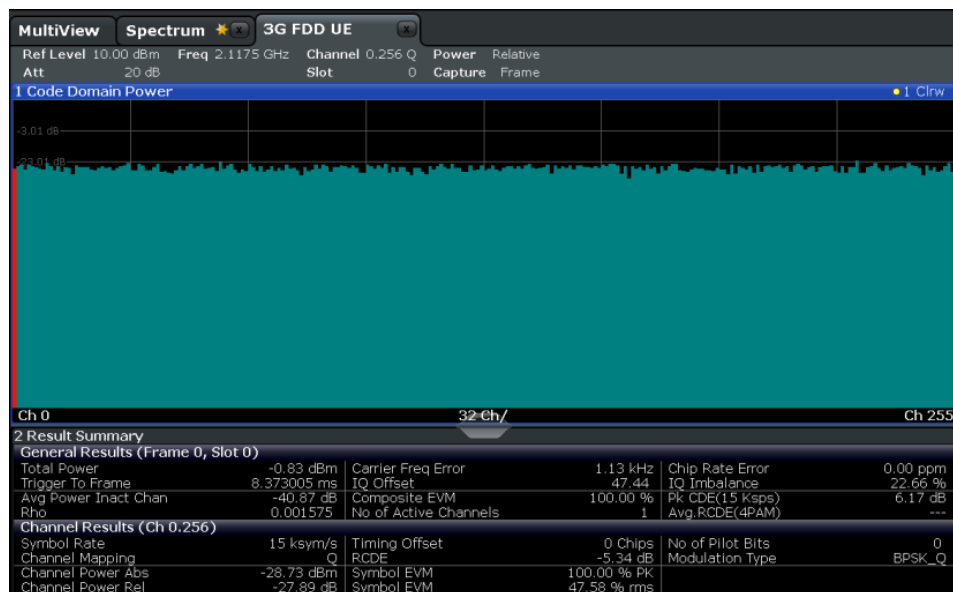


Figure 10-5: Measurement Example 3: Measuring the Relative Code Domain Power with Incorrect Scrambling Code

## 10.4 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.

### Test setup

1. Connect the RF output of the R&S SMW200A to the input of the R&S FSW.
2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference input (REF) on the rear panel of the R&S SMW200A (coaxial cable with BNC connectors).
3. Connect the external trigger input of the R&S FSW (TRIGGER INPUT) to the external trigger output of the R&S SMW200A (TRIGOUT1 of PAR DATA).

### Settings on the R&S SMW200A

1. PRESET
2. "FREQ" = 2.1175 GHz
3. "LEVEL" = 0 dBm
4. "BASEBAND A > CDMA Standards > 3GPP FDD"



## Measurement 4: Triggered Measurement of Relative Code Domain Power

5. "General" tab: "LINK DIRECTION > DOWN/FORWARD"
6. "Base station" tab: "TEST MODELS > Test\_Model\_1\_16\_channels"
7. "Base station" tab: "Select Base station > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"

**Settings on the R&S FSW**

1. PRESET
2. "MODE > 3GPP FDD BTS"
3. "AMPT > Reference level" = 10 dBm
4. "FREQ > Center frequency" = 2.1175 GHz
5. "Meas Config > Signal Description > Scrambling Code" = 0000
6. "TRIG > External Trigger 1"
7. "AMPT > Scale Config > Auto Scale Once"

**Results**

The following is displayed:

- Window 1: Code domain power of signal
- Window 2: Result summary, including the Trigger to Frame, i.e. offset between trigger event and start of 3GPP FDD BTS frame

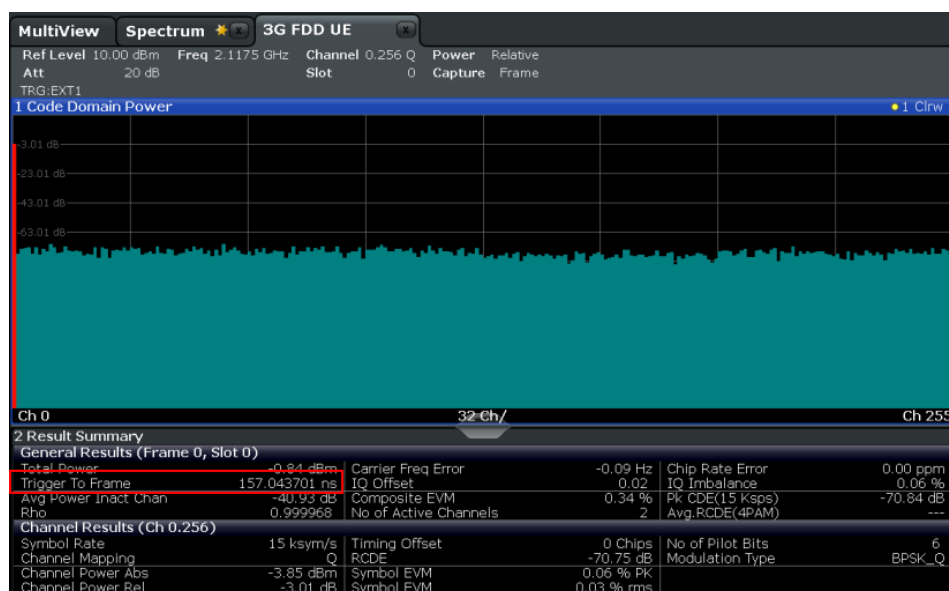


Figure 10-6: Measurement Example 4: Triggered Measurement of Relative Code Domain Power



The repetition rate of the measurement increases considerably compared to the repetition rate of a measurement without an external trigger.

### 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.

- ▶ Setting on the R&S FSW:

"TRIG > Trigger Offset" = 100  $\mu$ s

The "Trigger to Frame" parameter in the Result Summary (Window 2) changes:

"Trigger to Frame" = -100  $\mu$ s

## 10.5 Measurement 5: Measuring 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.

### Test setup

1. Connect the RF output of the R&S SMW200A to the input of the R&S FSW.
2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference input (REF) on the rear panel of the R&S SMW200A (coaxial cable with BNC connectors).
3. Connect the external trigger input of the R&S FSW (TRIGGER INPUT) to the external trigger output of the R&S SMW200A (TRIGOUT1 of PAR DATA).

### Settings on the R&S SMW200A

1. PRESET
2. "FREQ" = 2.1175 GHz
3. "LEVEL" = 0 dBm
4. "BASEBAND A > CDMA Standards > 3GPP FDD"
5. "General" tab: "LINK DIRECTION > DOWN/FORWARD"
6. "Base station" tab: "TEST MODELS > Test\_Model\_1\_16\_channels"
7. "Base station" tab: "Select Base station > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"

### Settings on the R&S FSW

1. PRESET
2. "MODE > 3GPP FDD BTS"

## Measurement 6: Determining the Peak Code Domain Error

3. "AMPT > Reference level"= 10 dBm
4. "FREQ > Center frequency" = 2.1175 GHz
5. "TRIG > External Trigger 1"
6. "MEAS CONFIG > Display Config > Composite EVM" (Window 2)
7. "AMPT > Scale Config > Auto Scale Once"

### Results

The following is displayed:

- Window 1: Code domain power of signal
- Window 2: Composite EVM (EVM for total signal)



Figure 10-7: Measurement Example 5: Measuring the Composite EVM

## 10.6 Measurement 6: Determining the Peak Code Domain Error

The peak code domain error measurement is defined in the 3GPP specification for FDD 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 up the symbols of each difference signal slot and searching for the maximum error code.

## Measurement 6: Determining the Peak Code Domain Error

**Test setup**

1. Connect the RF output of the R&S SMW200A to the input of the R&S FSW.
2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference input (REF) on the rear panel of the R&S SMW200A (coaxial cable with BNC connectors).
3. Connect the external trigger input of the R&S FSW (TRIGGER INPUT) to the external trigger output of the R&S SMW200A (TRIGOUT1 of PAR DATA).

**Settings on the R&S SMW200A**

1. PRESET
2. "FREQ" = 2.1175 GHz
3. "LEVEL" = 0 dBm
4. "BASEBAND A > CDMA Standards > 3GPP FDD"
5. "General" tab: "LINK DIRECTION > DOWN/FORWARD"
6. "Base station" tab: "TEST MODELS > Test\_Model\_1\_16\_channels"
7. "Base station" tab: "Select Base station > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"

**Settings on the R&S FSW**

1. PRESET
2. "MODE > 3GPP FDD BTS"
3. "AMPT > Reference level" = 0 dBm
4. "FREQ > Center frequency" = 2.1175 GHz
5. "TRIG > External Trigger 1"
6. "MEAS CONFIG > Display Config > Peak Code Domain Error" (Window 2)
7. "AMPT > Scale Config > Auto Scale Once"

**Results**

The following is displayed:

- Window 1: Code domain power of signal
- Window 2: Peak code domain error (projection of error onto the class with spreading factor 256)

Measurement 6: Determining the Peak Code Domain Error



Figure 10-8: Measurement Example 6: Determining the Peak Code Domain Error

# 11 Remote Commands for 3GPP FDD Measurements

The following commands are required to perform measurements in 3GPP FDD applications in a remote environment.

It is assumed that the R&S FSW has already been set up for remote control in a network as described in the R&S FSW User Manual.



Note that basic tasks that are also performed in the base unit in the same way are not described here. For a description of such tasks, see the R&S FSW User Manual.

In particular, this includes:

- Managing Settings and Results, i.e. storing and loading settings and result data
- Basic instrument configuration, e.g. checking the system configuration, customizing the screen layout, or configuring networks and remote operation
- Using the common status registers

The following topics specific to 3GPP applications are described here:

• <a href="#">Introduction</a> .....	158
• <a href="#">Common Suffixes</a> .....	163
• <a href="#">Activating 3GPP FDD Measurements</a> .....	164
• <a href="#">Selecting a Measurement</a> .....	168
• <a href="#">Configuring Code Domain Analysis and Time Alignment Error Measurements</a> ....	170
• <a href="#">Configuring RF Measurements</a> .....	239
• <a href="#">Configuring the Result Display</a> .....	240
• <a href="#">Starting a Measurement</a> .....	248
• <a href="#">Retrieving Results</a> .....	253
• <a href="#">Analysis</a> .....	279
• <a href="#">Importing and Exporting I/Q Data and Results</a> .....	291
• <a href="#">Configuring the Slave Application Data Range (MSRA mode only)</a> .....	292
• <a href="#">Querying the Status Registers</a> .....	295
• <a href="#">Deprecated Commands</a> .....	298
• <a href="#">Programming Examples (R&amp;S FSW-k72)</a> .....	301

## 11.1 Introduction

Commands are program messages that a controller (e.g. a PC) sends to the instrument or software. They operate its functions ('setting commands' or 'events') and request information ('query commands'). Some commands can only be used in one way, others work in two ways (setting and query). If not indicated otherwise, the commands can be used for settings and queries.

The syntax of a SCPI command consists of a header and, in most cases, one or more parameters. To use a command as a query, you have to append a question mark after the last header element, even if the command contains a parameter.

A header contains one or more keywords, separated by a colon. Header and parameters are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). If there is more than one parameter for a command, these are separated by a comma from one another.

Only the most important characteristics that you need to know when working with SCPI commands are described here. For a more complete description, refer to the User Manual of the R&S FSW.



### Remote command examples

Note that some remote command examples mentioned in this general introduction may not be supported by this particular application.

## 11.1.1 Conventions used in Descriptions

Note the following conventions used in the remote command descriptions:

- **Command usage**  
If not specified otherwise, commands can be used both for setting and for querying parameters.  
If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.
- **Parameter usage**  
If not specified otherwise, a parameter can be used to set a value and it is the result of a query.  
Parameters required only for setting are indicated as **Setting parameters**.  
Parameters required only to refine a query are indicated as **Query parameters**.  
Parameters that are only returned as the result of a query are indicated as **Return values**.
- **Conformity**  
Commands that are taken from the SCPI standard are indicated as **SCPI confirmed**. All commands used by the R&S FSW follow the SCPI syntax rules.
- **Asynchronous commands**  
A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an **Asynchronous command**.
- **Reset values (\*RST)**  
Default parameter values that are used directly after resetting the instrument (\*RST command) are indicated as **\*RST** values, if available.
- **Default unit**  
This is the unit used for numeric values if no other unit is provided with the parameter.
- **Manual operation**

If the result of a remote command can also be achieved in manual operation, a link to the description is inserted.

### 11.1.2 Long and Short Form

The keywords have a long and a short form. You can use either the long or the short form, but no other abbreviations of the keywords.

The short form is emphasized in upper case letters. Note however, that this emphasis only serves the purpose to distinguish the short from the long form in the manual. For the instrument, the case does not matter.

**Example:**

`SENSe:FREQuency:CENTer` is the same as `SENS:FREQ:CENT`.

### 11.1.3 Numeric Suffixes

Some keywords have a numeric suffix if the command can be applied to multiple instances of an object. In that case, the suffix selects a particular instance (e.g. a measurement window).

Numeric suffixes are indicated by angular brackets (<n>) next to the keyword.

If you don't quote a suffix for keywords that support one, a 1 is assumed.

**Example:**

`DISPlay[:WINDow<1...4>]:ZOOM:STATe` enables the zoom in a particular measurement window, selected by the suffix at `WINDow`.

`DISPlay:WINDow4:ZOOM:STATe ON` refers to window 4.

### 11.1.4 Optional Keywords

Some keywords are optional and are only part of the syntax because of SCPI compliance. You can include them in the header or not.

Note that if an optional keyword has a numeric suffix and you need to use the suffix, you have to include the optional keyword. Otherwise, the suffix of the missing keyword is assumed to be the value 1.

Optional keywords are emphasized with square brackets.



**Example:**

Without a numeric suffix in the optional keyword:

```
[SENSe:]FREQuency:CENTer is the same as FREQuency:CENTer
```

With a numeric suffix in the optional keyword:

```
DISPlay[:WINDow<1...4>]:ZOOM:STATe
```

DISPlay:ZOOM:STATe ON enables the zoom in window 1 (no suffix).

DISPlay:WINDow4:ZOOM:STATe ON enables the zoom in window 4.

### 11.1.5 Alternative Keywords

A vertical stroke indicates alternatives for a specific keyword. You can use both keywords to the same effect.

**Example:**

```
[SENSe:]BANDwidth|BWIDth[:RESolution]
```

In the short form without optional keywords, BAND 1MHZ would have the same effect as BWID 1MHZ.

### 11.1.6 SCPI Parameters

Many commands feature one or more parameters.

If a command supports more than one parameter, these are separated by a comma.

**Example:**

```
LAYout:ADD:WINDow Spectrum,LEFT,MTABLE
```

Parameters may have different forms of values.

- [Numeric Values](#)..... 161
- [Boolean](#)..... 162
- [Character Data](#)..... 163
- [Character Strings](#)..... 163
- [Block Data](#)..... 163

#### 11.1.6.1 Numeric Values

Numeric values can be entered in any form, i.e. with sign, decimal point or exponent. In case of physical quantities, you can also add the unit. If the unit is missing, the command uses the basic unit.

**Example:**

with unit: SENSe:FREQuency:CENTer 1GHZ

without unit: SENSe:FREQuency:CENTer 1E9 would also set a frequency of 1 GHz.

Values exceeding the resolution of the instrument are rounded up or down.

If the number you have entered is not supported (e.g. in case of discrete steps), the command returns an error.

Instead of a number, you can also set numeric values with a text parameter in special cases.

- **MIN/MAX**  
Defines the minimum or maximum numeric value that is supported.
- **DEF**  
Defines the default value.
- **UP/DOWN**  
Increases or decreases the numeric value by one step. The step size depends on the setting. In some cases you can customize the step size with a corresponding command.

### Querying numeric values

When you query numeric values, the system returns a number. In case of physical quantities, it applies the basic unit (e.g. Hz in case of frequencies). The number of digits after the decimal point depends on the type of numeric value.

#### Example:

Setting: `SENSe:FREQuency:CENTer 1GHZ`

Query: `SENSe:FREQuency:CENTer?` would return `1E9`

In some cases, numeric values may be returned as text.

- **INF/NINF**  
Infinity or negative infinity. Represents the numeric values `9.9E37` or `-9.9E37`.
- **NAN**  
Not a number. Represents the numeric value `9.91E37`. NAN is returned in case of errors.

### 11.1.6.2 Boolean

Boolean parameters represent two states. The "ON" state (logically true) is represented by "ON" or a numeric value 1. The "OFF" state (logically untrue) is represented by "OFF" or the numeric value 0.

#### Querying boolean parameters

When you query boolean parameters, the system returns either the value 1 ("ON") or the value 0 ("OFF").

#### Example:

Setting: `DISPlay:WINDow:ZOOM:STATe ON`

Query: `DISPlay:WINDow:ZOOM:STATe?` would return `1`

### 11.1.6.3 Character Data

Character data follows the syntactic rules of keywords. You can enter text using a short or a long form. For more information see [Chapter 11.1.2, "Long and Short Form"](#), on page 160.

#### Querying text parameters

When you query text parameters, the system returns its short form.

#### Example:

Setting: `SENSe:BANDwidth:RESolution:TYPE NORMal`

Query: `SENSe:BANDwidth:RESolution:TYPE?` would return `NORM`

### 11.1.6.4 Character Strings

Strings are alphanumeric characters. They have to be in straight quotation marks. You can use a single quotation mark ( ' ) or a double quotation mark ( " ).

#### Example:

`INSTRument:DELeTe 'Spectrum'`

### 11.1.6.5 Block Data

Block data is a format which is suitable for the transmission of large amounts of data.

The ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all end or other control signs are ignored until all bytes are transmitted. #0 specifies a data block of indefinite length. The use of the indefinite format requires an `NL^END` message to terminate the data block. This format is useful when the length of the transmission is not known or if speed or other considerations prevent segmentation of the data into blocks of definite length.

## 11.2 Common Suffixes

In the R&S FSW 3GPP FDD Measurements application, the following common suffixes are used in remote commands:

**Table 11-1: Common suffixes used in remote commands in the R&S FSW 3GPP FDD Measurements application**

Suffix	Value range	Description
<m>	1 to 4 (RF: 1 to 16)	Marker
<n>	1 to 16	Window (in the currently selected measurement channel)

Suffix	Value range	Description
<t>	1 (RF: 1 to 6)	Trace
<k>	not applicable (RF: 1 to 6)	Limit line

## 11.3 Activating 3GPP FDD Measurements

3GPP FDD measurements require a special application on the R&S FSW. The measurement is started immediately with the default settings.

<a href="#">INSTrument:CREate:DUPLicate</a> .....	164
<a href="#">INSTrument:CREate[:NEW]</a> .....	164
<a href="#">INSTrument:CREate:REPLace</a> .....	165
<a href="#">INSTrument:DELeTe</a> .....	165
<a href="#">INSTrument:LIST?</a> .....	165
<a href="#">INSTrument:REName</a> .....	167
<a href="#">INSTrument[:SELeCt]</a> .....	167
<a href="#">SYSTem:PRESet:CHANnel[:EXECute]</a> .....	167

---

### INSTrument:CREate:DUPLicate

This command duplicates the currently selected measurement channel, i.e. creates a new measurement channel of the same type and with the identical measurement settings. The name of the new channel is the same as the copied channel, extended by a consecutive number (e.g. "IQAnalyzer" -> "IQAnalyzer2").

The channel to be duplicated must be selected first using the `INST:SEL` command.

This command is not available if the MSRA Master channel is selected.

**Example:**

```
INST:SEL 'IQAnalyzer'
```

```
INST:CRE:DUPL
```

Duplicates the channel named 'IQAnalyzer' and creates a new measurement channel named 'IQAnalyzer2'.

**Usage:** Event

---

### INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>

This command adds an additional measurement channel.

The number of measurement channels you can configure at the same time depends on available memory.

**Parameters:**

<ChannelType> Channel type of the new channel.  
For a list of available channel types see [INSTrument:LIST?](#) on page 165.

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.  
 Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see [INSTrument:LIST?](#) on page 165).

**Example:** `INST:CRE IQ, 'IQAnalyzer2'`  
 Adds an additional I/Q Analyzer channel named "IQAnalyzer2".

#### **INSTrument:CREate:REPLace** <ChannelName1>,<ChannelType>,<ChannelName2>

This command replaces a measurement channel with another one.

##### **Setting parameters:**

<ChannelName1> String containing the name of the measurement channel you want to replace.

<ChannelType> Channel type of the new channel.  
 For a list of available channel types see [INSTrument:LIST?](#) on page 165.

<ChannelName2> String containing the name of the new channel.  
 Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see [INSTrument:LIST?](#) on page 165).

**Example:** `INST:CRE:REPL 'IQAnalyzer2', IQ, 'IQAnalyzer'`  
 Replaces the channel named 'IQAnalyzer2' by a new measurement channel of type 'IQ Analyzer' named 'IQAnalyzer'.

**Usage:** Setting only

#### **INSTrument:DELeTe** <ChannelName>

This command deletes a measurement channel.

If you delete the last measurement channel, the default "Spectrum" channel is activated.

##### **Parameters:**

<ChannelName> String containing the name of the channel you want to delete.  
 A measurement channel must exist in order to be able delete it.

**Example:** `INST:DEL 'IQAnalyzer4'`  
 Deletes the channel with the name 'IQAnalyzer4'.

**Usage:** Event

#### **INSTrument:LIST?**

This command queries all active measurement channels. This is useful in order to obtain the names of the existing measurement channels, which are required in order to replace or delete the channels.

**Return values:**

<ChannelType>  
<ChannelName>

For each channel, the command returns the channel type and channel name (see tables below).

Tip: to change the channel name, use the `INSTRUMENT:REName` command.

**Example:**

`INST:LIST?`

Result for 3 measurement channels:

```
'ADEM', 'Analog Demod', 'IQ', 'IQ Analyzer', 'IQ', 'IQ Analyzer2'
```

**Usage:**

Query only

**Table 11-2: Available measurement channel types and default channel names in Signal and Spectrum Analyzer mode**

Application	<ChannelType> Parameter	Default Channel Name*)
Spectrum	SANALYZER	Spectrum
1xEV-DO BTS (R&S FSW-K84)	BDO	1xEV-DO BTS
1xEV-DO MS (R&S FSW-K85)	MDO	1xEV-DO MS
3GPP FDD BTS (R&S FSW-K72)	BWCD	3G FDD BTS
3GPP FDD UE (R&S FSW-K73)	MWCD	3G FDD UE
802.11ad (R&S FSW-K95)	WIGIG	802.11ad
Amplifier Measurements (R&S FSW-K18)	AMPLifier	Amplifier
Analog Demodulation (R&S FSW-K7)	ADEM	Analog Demod
Avionics (R&S FSW-K15)	AVIonics	Avionics
cdma2000 BTS (R&S FSW-K82)	BC2K	CDMA2000 BTS
cdma2000 MS (R&S FSW-K83)	MC2K	CDMA2000 MS
DOCSIS 3.1 (R&S FSW-K192/193)	DOCSis	DOCSIS 3.1
GSM (R&S FSW-K10)	GSM	GSM
I/Q Analyzer	IQ	IQ Analyzer
LTE (R&S FSW-K10x)	LTE	LTE
Multi-Carrier Group Delay (R&S FSW-K17)	MCGD	MC Group Delay
Noise (R&S FSW-K30)	NOISE	Noise
Phase Noise (R&S FSW-K40)	PNOISE	Phase Noise
Pulse (R&S FSW-K6)	PULSE	Pulse
Real-Time Spectrum (R&S FSW-B160R/-K160RE)	RTIM	Real-Time Spectrum
Spurious Measurements (R&S FSW-K50)	SPUR	Spurious

\*) the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.

Application	<ChannelType> Parameter	Default Channel Name*)
TD-SCDMA BTS (R&S FSW-K76)	BTDS	TD-SCDMA BTS
TD-SCDMA UE (R&S FSW-K77)	MTDS	TD-SCDMA UE
Transient Analysis (R&S FSW-K60)	TA	Transient Analysis
VSA (R&S FSW-K70)	DDEM	VSA
WLAN (R&S FSW-K91)	WLAN	WLAN

\*) the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.

---

**INSTrument:REName** <ChannelName1>, <ChannelName2>

This command renames a measurement channel.

**Parameters:**

<ChannelName1> String containing the name of the channel you want to rename.

<ChannelName2> String containing the new channel name.  
Note that you cannot assign an existing channel name to a new channel; this will cause an error.

**Example:**

```
INST:REN 'IQAnalyzer2', 'IQAnalyzer3'
```

Renames the channel with the name 'IQAnalyzer2' to 'IQAnalyzer3'.

**Usage:** Setting only

---

**INSTrument[:SElect]** <ChannelType>

This command activates a new measurement channel with the defined channel type, or selects an existing measurement channel with the specified name.

See also [INSTrument:CREate\[:NEW\]](#) on page 164.

For a list of available channel types see [Table 11-2](#).

**Parameters:**

<ChannelType> **BWCD**  
3GPP FDD BTS option, R&S FSW-K72  
**MWCD**  
3GPP FDD UE option, R&S FSW-K73

---

**SYSTem:PRESet:CHANnel[:EXECute]**

This command restores the default instrument settings in the current channel.

Use `INST:SEL` to select the channel.

<b>Example:</b>	<pre>INST:SEL 'Spectrum2'</pre> Selects the channel for "Spectrum2". <pre>SYST:PRES:CHAN:EXEC</pre> Restores the factory default settings to the "Spectrum2" channel.
<b>Usage:</b>	Event
<b>Manual operation:</b>	See " <a href="#">Preset Channel</a> " on page 62

## 11.4 Selecting a Measurement

The following commands are required to define the measurement type in a remote environment. For details on available measurements see [Chapter 3, "Measurements and Result Display"](#), on page 15.

<a href="#">CONFigure:WCDPower[:BTS]:MEASurement.....</a>	168
<a href="#">CONFigure:WCDPower:MS:MEASurement.....</a>	169

---

### 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 BWCD`

#### POWER

Channel power measurement (standard 3GPP WCDMA Forward) with predefined settings

#### OBANdwith | OBWidth

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: WCDPower

**Example:** `CONF:WCDP:MEAS TAE`



<b>Mode:</b>	BTS application only
<b>Manual operation:</b>	See <a href="#">"Result List"</a> on page 33 See <a href="#">"Channel Power ACLR"</a> on page 35 See <a href="#">"Occupied Bandwidth"</a> on page 35 See <a href="#">"Power"</a> on page 36 See <a href="#">"RF Combi"</a> on page 36 See <a href="#">"Spectrum Emission Mask"</a> on page 37 See <a href="#">"CCDF"</a> on page 38 See <a href="#">"Creating a New Channel Table from the Measured Signal (Measure Table)"</a> on page 102

---

### CONFigure:WCDPower:MS:MEASurement <Type>

This command selects the 3GPP FDD UE user equipment tests.

#### Parameters:

<Type>

ACLR | ESpectrum | WCDPower | POWER | OBANdwith | OBWidth | CCDF

#### ACLR

Adjacent-channel power measurement (standard 3GPP WCDMA Reverse) with predefined settings

#### ESpectrum

Measurement of spectrum emission mask

#### WCDPower

Code domain power measurement. This selection has the same effect as command `INSTRument:SElect MWCD`

#### POWER

Channel power measurement (standard 3GPP WCDMA Reverse) with predefined settings

#### OBANdwith | OBWidth

Measurement of occupied power bandwidth.

#### CCDF

Measurement of complementary cumulative distribution function.

\*RST: WCDPower

#### Example:

`CONF:WCDP:MS:MEAS TAE`

#### Mode:

UE application only

#### Manual operation:

See ["Creating a New Channel Table from the Measured Signal \(Measure Table\)"](#) on page 102

## 11.5 Configuring Code Domain Analysis and Time Alignment Error Measurements

The following commands are required to configure Code Domain Analysis and Time Alignment Error measurements.

• Signal Description.....	170
• Configuring the Data Input and Output.....	175
• Frontend Configuration.....	192
• Configuring Triggered Measurements.....	200
• Signal Capturing.....	208
• Synchronization.....	210
• Channel Detection.....	212
• Sweep Settings.....	225
• Automatic Settings.....	226
• Evaluation Range.....	229
• Code Domain Analysis Settings (BTS Measurements).....	231
• Code Domain Analysis Settings (UE Measurements).....	233
• Configuring Carrier Tables for Time Alignment Measurements.....	234

### 11.5.1 Signal Description

The signal description provides information on the expected input signal.

• BTS Signal Description.....	170
• BTS Scrambling Code.....	173
• UE Signal Description.....	174

#### 11.5.1.1 BTS Signal Description

The following commands describe the input signal in BTS measurements.

[SENSe:]CDPower:ANTenna.....	170
[SENSe:]CDPower:HSDPamode.....	171
[SENSe:]CDPower:LCODE:SEARch[:IMMediate]?.....	171
[SENSe:]CDPower:LCODE:SEARch:LIST?.....	172
[SENSe:]CDPower:MIMO.....	172
[SENSe:]CDPower:PCONtrol.....	173

---

#### [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:** BTS application only

**Manual operation:** See "Antenna Diversity" on page 64  
 See "Antenna Number" on page 64  
 See "Antenna1 / Antenna2" on page 98

#### [SENSe:]CDPower:HSDPamode <State>

This command defines whether the HS-DPCCH channel is searched or not.

#### Parameters:

<State> ON | OFF | 0 | 1

**ON | 1**  
 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 | 0**  
 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: 1

**Example:** SENS:CDP:HSDP OFF

**Manual operation:** See "HSDPA/UPA" on page 63

#### [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:** BTS application only

**Manual operation:** See "[Autosearch for Scrambling Code](#)" on page 65

---

### [SENSe:]CDPower:LCODE:SEARch:LIST?

This command returns the automatic search sequence (see [SENSe:]CDPower:LCODE:SEARch[:IMMediate]? on page 171) as a comma-separated list of results for each detected scrambling code.

**Return values:**

<Code1> Scrambling code in decimal format.

Range: 16 \* n, with n = 0...511

<Code2> Scrambling code in hexadecimal format.

Range: 0x0000h – 0x1FF0h, where the last digit is always 0

<CPICHPower> Highest power value for the corresponding scrambling code.

**Example:** SENS:CDP:LCOD:SEAR:LIST?

Result:

16,0x10,-18.04,32,0x20,-22.87,48,0x30,-27.62,  
64,0x40,-29.46

(Explanation in table below)

**Usage:** Query only

**Mode:** BTS application only

**Manual operation:** See "[Scrambling Codes](#)" on page 65

*Table 11-3: Description of query results in example:*

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: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 64.

**Parameters:**

<State> ON | OFF

\*RST: OFF

**Example:** SENS:CDP:MIMO ON

**Mode:** BTS application only  
**Manual operation:** See "MIMO" on page 64

---

**[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:** BTS application only  
**Manual operation:** See "Compressed Mode" on page 64

### 11.5.1.2 BTS Scrambling Code

The scrambling code identifies the base station transmitting the signal in BTS measurements.

[SENSe:]CDPower:LCODE:DVALue..... 173  
[SENSe:]CDPower:LCODE[:VALue]..... 174

---

**[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.
```

**Manual operation:** See "Scrambling Code" on page 65  
 See "Format Hex/Dec" on page 65  
 See "Format" on page 67

---

**[SENSe:]CDPower:LCODE[:VALue] <ScramblingCode>**

This command defines the scrambling code in hexadecimal format.

**Parameters:**

<ScramblingCode> Range: #H0 to #H1fff  
 \*RST: #H0

**Example:** SENS:CDP:LCOD #H2  
 Defines the scrambling code in hexadecimal format.

**Manual operation:** See "Format Hex/Dec" on page 65  
 See "Scrambling Code" on page 66

### 11.5.1.3 UE Signal Description

The following commands describe the input signal in UE measurements.

Useful commands for describing UE signals described elsewhere:

- [SENSe:]CDPower:LCODE[:VALue] on page 174
- [SENSe:]CDPower:HSDPamode on page 171

**Remote commands exclusive to describing UE signals:**

[SENSe:]CDPower:LCODE:TYPE.....	174
[SENSe:]CDPower:QPSK.....	174
[SENSe:]CDPower:SFACTOR.....	175

---

**[SENSe:]CDPower:LCODE:TYPE <Type>**

This command switches between long and short scrambling code.

**Parameters:**

<Type> LONG | SHORT  
 \*RST: LONG

**Example:** CDP:LCOD:TYPE SHOR

**Mode:** UE application only

**Manual operation:** See "Type" on page 67

---

**[SENSe:]CDPower:QPSK <State>**

If enabled, it is assumed that the signal uses QPSK modulation only. Thus, no synchronization is required and the measurement can be performed with optimized settings and speed.

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Mode:** BTS application only

**Manual operation:** See "QPSK Modulation Only" on page 67

**[SENSe:]CDPower:SFACTOR <SpreadingFactor>**

This command defines the spreading factor. The spreading factor is only significant for Peak Code Domain Error evaluation.

**Parameters:**

<SpreadingFactor> 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512  
 \*RST: 512

**Example:** SENS:CDP:SFACTOR 16

**11.5.2 Configuring the Data Input and Output**

- [RF Input](#)..... 175
- [Remote Commands for the Digital Baseband Interface \(R&S FSW-B17\)](#)..... 179
- [Configuring Input via the Optional Analog Baseband Interface](#)..... 186
- [Setting up Probes](#)..... 189
- [Configuring the Outputs](#)..... 192

**11.5.2.1 RF Input**

<a href="#">INPut:ATTenuation:PROTection:RESet</a> .....	175
<a href="#">INPut:CONNector</a> .....	176
<a href="#">INPut:COUPling</a> .....	176
<a href="#">INPut:DPATH</a> .....	176
<a href="#">INPut:FILTer:HPASs[:STATe]</a> .....	177
<a href="#">INPut:FILTer:YIG[:STATe]</a> .....	177
<a href="#">INPut:IMPedance</a> .....	178
<a href="#">INPut:SELect</a> .....	178

**INPut:ATTenuation:PROTection:RESet**

This command resets the attenuator and reconnects the RF input with the input mixer after an overload condition occurred and the protection mechanism intervened. The error status bit (bit 3 in the STAT:QUES:POW status register) and the INPUT OVLD message in the status bar are cleared.

(For details on the status register see the R&S FSW User Manual).

The command works only if the overload condition has been eliminated first.

**Usage:** Event

---

**INPut:CONNector** <ConnType>

Determines whether the RF input data is taken from the RF input connector or the optional Analog Baseband I connector. This command is only available if the Analog Baseband interface (R&S FSW-B71) is installed and active for input. It is not available for the R&S FSW67 or R&S FSW85.

For more information on the Analog Baseband Interface (R&S FSW-B71) see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

**Parameters:**

<ConnType>           **RF**  
RF input connector

**AIQI**  
Analog Baseband I connector

\*RST:           RF

**Example:**           INP:CONN:AIQI  
Selects input from the analog baseband I connector.

**Usage:**           SCPI confirmed

**Manual operation:** See "[Input Connector](#)" on page 70

---

**INPut:COUPling** <CouplingType>

This command selects the coupling type of the RF input.

The command is not available for measurements with the optional Digital Baseband Interface.

**Parameters:**

<CouplingType>       **AC**  
AC coupling

**DC**  
DC coupling

\*RST:           AC

**Example:**           INP:COUP DC

**Usage:**           SCPI confirmed

**Manual operation:** See "[Input Coupling](#)" on page 69

---

**INPut:DPATH** <State>

Enables or disables the use of the direct path for frequencies close to 0 Hz.



**Parameters:**

<State>                   **AUTO | 1**  
 (Default) the direct path is used automatically for frequencies close to 0 Hz.

**OFF | 0**  
 The analog mixer path is always used.

\*RST:                    1

**Example:**                INP:DPAT OFF

**Usage:**                   SCPI confirmed

**Manual operation:**    See "[Direct Path](#)" on page 69

**INPut:FILTer:HPASs[:STATe] <State>**

Activates an additional internal high-pass filter for RF input signals from 1 GHz to 3 GHz. This filter is used to remove the harmonics of the R&S FSW in order to measure the harmonics for a DUT, for example.

This function requires an additional high-pass filter hardware option.

(Note: for RF input signals outside the specified range, the high-pass filter has no effect. For signals with a frequency of approximately 4 GHz upwards, the harmonics are suppressed sufficiently by the YIG-preselector, if available.)

**Parameters:**

<State>                    ON | OFF

\*RST:                    OFF

**Example:**                INP:FILT:HPAS ON  
 Turns on the filter.

**Usage:**                   SCPI confirmed

**Manual operation:**    See "[High-Pass Filter 1...3 GHz](#)" on page 70

**INPut:FILTer:YIG[:STATe] <State>**

This command turns the YIG-preselector on and off.

Note the special conditions and restrictions for the YIG-preselector described in "[YIG-Preselector](#)" on page 70.

**Parameters:**

<State>                    ON | OFF | 0 | 1

\*RST:                    1 (0 for I/Q Analyzer, GSM, VSA, Pulse, Amplifier, Transient Analysis, DOCSIS and MC Group Delay measurements)

**Example:**                INP:FILT:YIG OFF  
 Deactivates the YIG-preselector.

**Manual operation:**    See "[YIG-Preselector](#)" on page 70

**INPut:IMPedance** <Impedance>

This command selects the nominal input impedance of the RF input. In some applications, only 50 Ω are supported.

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

The command is not available for measurements with the optional Digital Baseband Interface.

**Parameters:**

<Impedance> 50 | 75  
\*RST: 50 Ω

**Example:** INP:IMP 75

**Usage:** SCPI confirmed

**Manual operation:** See "[Impedance](#)" on page 69

**INPut:SElect** <Source>

This command selects the signal source for measurements, i.e. it defines which connector is used to input data to the R&S FSW.

If no additional input options are installed, only RF input is supported.

**Parameters:**

<Source> **RF**  
Radio Frequency ("RF INPUT" connector)

**DIQ**  
Digital IQ data (only available with optional Digital Baseband Interface  
For details on I/Q input see the R&S FSW I/Q Analyzer User Manual.

**AIQ**  
Analog Baseband signal (only available with optional Analog Baseband Interface R&S FSW-B71)  
For details on Analog Baseband input see the R&S FSW I/Q Analyzer User Manual.

\*RST: RF

**Manual operation:** See "[Radio Frequency State](#)" on page 68  
See "[Digital I/Q Input State](#)" on page 71  
See "[Analog Baseband Input State](#)" on page 73

### 11.5.2.2 Remote Commands for the Digital Baseband Interface (R&S FSW-B17)

The following commands are required to control the Digital Baseband Interface (R&S FSW-B17) in a remote environment. They are only available if this option is installed.

Information on the `STATus:QUESTionable:DIQ` register can be found in "[STATus:QUESTionable:DIQ Register](#)" on page 183.

- [Configuring Digital I/Q Input and Output](#)..... 179
- [STATus:QUESTionable:DIQ Register](#)..... 183

#### Configuring Digital I/Q Input and Output



#### Remote commands for the R&S DigIConf software

Remote commands for the R&S DigIConf software always begin with `SOURce:EBOX`. Such commands are passed on from the R&S FSW 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.

#### Remote commands exclusive to digital I/Q data input and output

<a href="#">INPut:DIQ:CDEvice</a> .....	179
<a href="#">INPut:DIQ:RANGe[:UPPer]:AUTO</a> .....	181
<a href="#">INPut:DIQ:RANGe:COUPling</a> .....	181
<a href="#">INPut:DIQ:RANGe[:UPPer]</a> .....	181
<a href="#">INPut:DIQ:RANGe[:UPPer]:UNIT</a> .....	181
<a href="#">INPut:DIQ:SRATe</a> .....	182
<a href="#">INPut:DIQ:SRATe:AUTO</a> .....	182
<a href="#">OUTPut:DIQ</a> .....	182
<a href="#">OUTPut:DIQ:CDEvice?</a> .....	182

#### INPut:DIQ:CDEvice

This command queries the current configuration and the status of the digital I/Q input from the optional Digital Baseband Interface.

For details see the section "Interface Status Information" for the optional Digital Baseband Interface in the R&S FSW I/Q Analyzer User Manual.

**Return values:**

<ConnState>	Defines whether a device is connected or not. <b>0</b> No device is connected. <b>1</b> 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 sample 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. <b>Not Started</b> <b>Has to be Started</b> <b>Started</b> <b>Passed</b> <b>Failed</b> <b>Done</b>
<PRBSTestState>	State of the PRBS test. <b>Not Started</b> <b>Has to be Started</b> <b>Started</b> <b>Passed</b> <b>Failed</b> <b>Done</b>
<SampleRateType>	<b>0</b> Maximum sample rate is displayed <b>1</b> Current sample rate is displayed
<FullScaleLevel>	The level (in dBm) that should correspond to an I/Q sample with the magnitude "1" (if transferred from connected device); If not available, 1.#QNAN (not a number) is returned

**Example:**

INP:DIQ:CDEV?

Result:

1, SMW200A, 101190, BBMM 1 OUT,  
100000000, 200000000, Passed, Passed, 1, 1.#QNAN

**Manual operation:** See ["Connected Instrument"](#) on page 72

#### **INPut:DIQ:RANGe[:UPPer]:AUTO** <State>

If enabled, the digital input full scale 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 is installed.

**Parameters:**

<State>                    ON | OFF  
                               \*RST:            OFF

**Manual operation:** See ["Full Scale Level"](#) on page 71

#### **INPut:DIQ:RANGe:COUPling** <State>

If enabled, the reference level for digital input is adjusted to the full scale level automatically if the full scale level changes.

This command is only available if the optional Digital Baseband Interface is installed.

**Parameters:**

<State>                    ON | OFF  
                               \*RST:            OFF

**Manual operation:** See ["Adjust Reference Level to Full Scale Level"](#) on page 72

#### **INPut:DIQ:RANGe[:UPPer]** <Level>

Defines or queries the "Full Scale Level", i.e. the level that corresponds to an I/Q sample with the magnitude "1".

This command is only available if the optional Digital Baseband Interface is installed.

**Parameters:**

<Level>                    <numeric value>  
                               Range:            1  $\mu$ V to 7.071 V  
                               \*RST:            1 V

**Manual operation:** See ["Full Scale Level"](#) on page 71

#### **INPut:DIQ:RANGe[:UPPer]:UNIT** <Unit>

Defines the unit of the full scale level (see ["Full Scale Level"](#) on page 71). The availability of units depends on the measurement application you are using.

This command is only available if the optional Digital Baseband Interface is installed.

**Parameters:**

<Level>                    VOLT | DBM | DBPW | WATT | DBMV | DBUV | DBUA | AMPere  
                               \*RST:            Volt

**Manual operation:** See ["Full Scale Level"](#) on page 71

#### INPut:DIQ:SRATe <SampleRate>

This command specifies or queries the sample rate of the input signal from the optional Digital Baseband Interface (see ["Input Sample Rate"](#) on page 71).

**Parameters:**

<SampleRate>      Range:      1 Hz to 10 GHz  
                          \*RST:      32 MHz

**Example:**            INP:DIQ:SRAT 200 MHz

**Manual operation:** See ["Input Sample Rate"](#) on page 71

#### INPut:DIQ:SRATe:AUTO <State>

If enabled, the sample rate of the digital I/Q input signal is set automatically by the connected device.

This command is only available if the optional Digital Baseband Interface is installed.

**Parameters:**

<State>                ON | OFF  
                          \*RST:      OFF

**Manual operation:** See ["Input Sample Rate"](#) on page 71

#### OUTPut:DIQ <State>

This command turns continuous output of I/Q data to the optional Digital Baseband Interface on and off.

Using the digital input and digital output simultaneously is not possible.

If digital baseband output is active, the sample rate is restricted to 100 MHz (200 MHz if enhanced mode is possible; max. 160 MHz bandwidth).

**Parameters:**

<State>                ON | OFF  
                          \*RST:      OFF

**Example:**            OUTP:DIQ ON

**Manual operation:** See ["Digital Baseband Output"](#) on page 80

#### OUTPut:DIQ:CDEvice?

This command queries the current configuration and the status of the digital I/Q data output to the optional Digital Baseband Interface.

**Return values:**

<ConnState>	Defines whether a device is connected or not. <b>0</b> No device is connected. <b>1</b> 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
<NotUsed>	to be ignored
<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. <b>Not Started</b> <b>Has to be Started</b> <b>Started</b> <b>Passed</b> <b>Failed</b> <b>Done</b>
<PRBSTestState>	State of the PRBS test. <b>Not Started</b> <b>Has to be Started</b> <b>Started</b> <b>Passed</b> <b>Failed</b> <b>Done</b>
<NotUsed>	to be ignored
<Placeholder>	for future use; currently "0"
<b>Example:</b>	OUTP:DIQ:CDEV? Result: 1, SMW200A, 101190, CODER 1 IN, 0, 200000000, Passed, Done, 0, 0
<b>Usage:</b>	Query only
<b>Manual operation:</b>	See " <a href="#">Output Settings Information</a> " on page 80 See " <a href="#">Connected Instrument</a> " on page 80

**STATus:QUESTIONable:DIQ Register**

This register contains information about the state of the digital I/Q input and output. This register is used by the optional Digital Baseband Interface.

The status of the `STATUS:QUESTIONABLE:DIQ` register is indicated in bit 14 of the `STATUS:QUESTIONABLE` register.

You can read out the state of the register with `STATUS:QUESTIONABLE:DIQ:CONDITION?` on page 185 and `STATUS:QUESTIONABLE:DIQ[:EVENT]?` on page 186.

Bit No.	Meaning
0	<p><b>Digital I/Q Input Device connected</b></p> <p>This bit is set if a device is recognized and connected to the Digital Baseband Interface of the analyzer.</p>
1	<p><b>Digital I/Q Input Connection Protocol in progress</b></p> <p>This bit is set while the connection between analyzer and digital baseband data signal source (e.g. R&amp;S SMW, R&amp;S Ex-I/Q-Box) is established.</p>
2	<p><b>Digital I/Q Input Connection Protocol error</b></p> <p>This bit is set if an error occurred during establishing of the connect between analyzer and digital I/Q data signal source (e.g. R&amp;S SMW, R&amp;S Ex-I/Q-Box) is established.</p>
3	<p><b>Digital I/Q Input PLL unlocked</b></p> <p>This bit is set if the PLL of the Digital I/Q input is out of lock due to missing or unstable clock provided by the connected Digital I/Q TX device. To solve the problem the Digital I/Q connection has to be newly initialized after the clock has been restored.</p>
4	<p><b>Digital I/Q Input DATA Error</b></p> <p>This bit is set if the data from the Digital I/Q input module is erroneous. Possible reasons:</p> <ul style="list-style-type: none"> <li>• Bit errors in the data transmission. The bit will only be set if an error occurred at the current measurement.</li> <li>• Protocol or data header errors. May occur due to data synchronization problems or vast transmission errors. The bit will be set constantly and all data will be erroneous. To solve the problem the Digital I/Q connection has to be newly initialized.</li> </ul> <p>NOTE: If this error is indicated repeatedly either the Digital I/Q LVDS connection cable or the receiving or transmitting device might be defect.</p>
5	Not used
6	<p><b>Digital I/Q Input FIFO Overload</b></p> <p>This bit is set if the sample rate on the connected instrument is higher than the input sample rate setting on the R&amp;S FSW. Possible solution:</p> <ul style="list-style-type: none"> <li>• Reduce the sample rate on the connected instrument</li> <li>• Increase the input sample rate setting on the R&amp;S FSW</li> </ul>
7	Not used
8	<p><b>Digital I/Q Output Device connected</b></p> <p>This bit is set if a device is recognized and connected to the Digital I/Q Output.</p>
9	<p><b>Digital I/Q Output Connection Protocol in progress</b></p> <p>This bit is set while the connection between analyzer and digital I/Q data signal source (e.g. R&amp;S SMW, R&amp;S Ex-I/Q-Box) is established.</p>
10	<p><b>Digital I/Q Output Connection Protocol error</b></p> <p>This bit is set if an error occurred while the connection between analyzer and digital I/Q data signal source (e.g. R&amp;S SMW, R&amp;S Ex-I/Q-Box) is established.</p>



Bit No.	Meaning
11	<b>Digital I/Q Output FIFO Overload</b> This bit is set if an overload of the Digital I/Q Output FIFO occurred. This happens if the output data rate is higher than the maximal data rate of the connected instrument. Reduce the sample rate to solve the problem.
12-14	Not used
15	This bit is always set to 0.

STATus:QUESTionable:DIQ:CONDition?	185
STATus:QUESTionable:DIQ:ENABLE	185
STATus:QUESTionable:DIQ:NTRansition	186
STATus:QUESTionable:DIQ:PTRansition	186
STATus:QUESTionable:DIQ[:EVENT]?	186

---

### STATus:QUESTionable:DIQ:CONDition? <ChannelName>

This command reads out the CONDition section of the STATus:QUESTionable:DIQ:CONDition status register.

The command does not delete the contents of the EVENT section.

#### Query parameters:

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

**Example:** STAT:QUES:DIQ:COND?

**Usage:** Query only

---

### STATus:QUESTionable:DIQ:ENABLE <BitDefinition>, <ChannelName>

This command controls the ENABLE part of a register.

The ENABLE part allows true conditions in the EVENT part of the status register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit transitions to true, a positive transition will occur in the summary bit reported to the next higher level.

#### Parameters:

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

#### Setting parameters:

<SumBit> Range: 0 to 65535

**Usage:** SCPI confirmed

**STATus:QUESTIONable:DIQ:NTRansition** <BitDefinition>,<ChannelName>

This command controls the Negative TRansition part of a register.

Setting a bit causes a 1 to 0 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENT register.

**Parameters:**

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

**Setting parameters:**

<BitDefinition> Range: 0 to 65535

**STATus:QUESTIONable:DIQ:PTRansition** <BitDefinition>,<ChannelName>

This command controls the Positive TRansition part of a register.

Setting a bit causes a 0 to 1 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENT register.

**Parameters:**

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

**Setting parameters:**

<BitDefinition> Range: 0 to 65535

**STATus:QUESTIONable:DIQ[:EVENT]?** <ChannelName>

This command queries the contents of the "EVENT" section of the STATus:QUESTIONable:DIQ register for IQ measurements.

Readout deletes the contents of the "EVENT" section.

**Query parameters:**

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

**Example:** STAT:QUES:DIQ?

**Usage:** Query only

**11.5.2.3 Configuring Input via the Optional Analog Baseband Interface**

The following commands are required to control the optional Analog Baseband Interface in a remote environment. They are only available if this option is installed.

For more information on the Analog Baseband Interface see the R&S FSW I/Q Analyzer User Manual.

Useful commands for Analog Baseband data described elsewhere:

- `INP:SEL AIQ` (see `INPut:SElect` on page 178)
- `[SENSe:]FREQuency:CENTer` on page 193

Commands for the Analog Baseband calibration signal are described in the R&S FSW User Manual.

### Remote commands exclusive to Analog Baseband data input and output

<code>INPut:IQ:BALanced[:STATe]</code> .....	187
<code>INPut:IQ:FULLscale:AUTO</code> .....	187
<code>INPut:IQ:FULLscale[:LEVEl]</code> .....	188
<code>INPut:IQ:TYPE</code> .....	188
<code>CALibration:AIQ:HATiming[:STATe]</code> .....	188

---

#### `INPut:IQ:BALanced[:STATe]` <State>

This command defines whether the input is provided as a differential signal via all 4 Analog Baseband connectors or as a plain I/Q signal via 2 single-ended lines.

##### Parameters:

<State>

**ON**  
Differential

**OFF**  
Single ended

\*RST: ON

**Example:** `INP:IQ:BAL OFF`

**Manual operation:** See "[Input Configuration](#)" on page 74

---

#### `INPut:IQ:FULLscale:AUTO` <State>

This command defines whether the full scale level (i.e. the maximum input power on the Baseband Input connector) is defined automatically according to the reference level, or manually.

##### Parameters:

<State>

**ON**  
Automatic definition

**OFF**  
Manual definition according to `INPut:IQ:FULLscale[:LEVEl]` on page 188

\*RST: ON

**Example:** `INP:IQ:FULL:AUTO OFF`

**Manual operation:** See "[Full Scale Level Mode / Value](#)" on page 86

**INPut:IQ:FULLscale[:LEVel]** <PeakVoltage>

This command defines the peak voltage at the Baseband Input connector if the full scale level is set to manual mode (see [INPut:IQ:FULLscale:AUTO](#) on page 187).

**Parameters:**

<PeakVoltage> 0.25 V | 0.5 V | 1 V | 2 V

Peak voltage level at the connector.

For probes, the possible full scale values are adapted according to the probe's attenuation and maximum allowed power.

\*RST: 1V

**Example:** INP:IQ:FULL 0.5V

**Manual operation:** See "[Full Scale Level Mode / Value](#)" on page 86

**INPut:IQ:TYPE** <DataType>

This command defines the format of the input signal.

**Parameters:**

<DataType> IQ | I | Q

**IQ**

The input signal is filtered and resampled to the sample rate of the application.

Two input channels are required for each input signal, one for the in-phase component, and one for the quadrature component.

**I**

The in-phase component of the input signal is filtered and resampled to the sample rate of the application. If the center frequency is not 0, the in-phase component of the input signal is down-converted first (Low IF I).

**Q**

The quadrature component of the input signal is filtered and resampled to the sample rate of the application. If the center frequency is not 0, the quadrature component of the input signal is down-converted first (Low IF Q).

\*RST: IQ

**Example:** INP:IQ:TYPE Q

**Manual operation:** See "[I/Q Mode](#)" on page 73

**CALibration:AIQ:HATiming[:STATe]** <State>

Activates a mode with enhanced timing accuracy between analog baseband, RF and external trigger signals.

For more information see the R&S FSW I/Q Analyzer and I/Q Input User Manual.

**Parameters:**

<State> ON | OFF | 1 | 0

**ON | 1**  
The high accuracy timing function is switched on.  
The cable for high accuracy timing must be connected to trigger ports 1 and 2.

**OFF | 0**  
The high accuracy timing function is switched off.

\*RST: OFF

**Example:**

CAL:AIQ:HAT:STAT ON

**Manual operation:** See "[High Accuracy Timing Trigger - Baseband - RF](#)" on page 74

**11.5.2.4 Setting up Probes**

Probes can be connected to the optional BASEBAND INPUT connectors, if the Analog Baseband interface (option R&S FSW-B71) is installed.

[SENSe:]PROBe<p>:SETup:CMOffset.....	189
[SENSe:]PROBe<p>:ID:PARTnumber?.....	190
[SENSe:]PROBe<p>:ID:SRNumber?.....	190
[SENSe:]PROBe<p>:SETup:MODE.....	190
[SENSe:]PROBe<p>:SETup:NAME?.....	191
[SENSe:]PROBe<p>:SETup:STATe?.....	191
[SENSe:]PROBe<p>:SETup:TYPE?.....	191

**[SENSe:]PROBe<p>:SETup:CMOffset <CMOffset>**

Sets the common mode offset. The setting is only available if a differential probe is connected to the R&S FSW.

If the probe is disconnected, the common mode offset of the probe is reset to 0.0 V.

**Suffix:**

<p> 1 | 2 | 3  
Selects the connector:  
1 = Baseband Input I  
2 = Baseband Input Q  
3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

**Parameters:**

<CMOffset> Range: -100E+24 to 100E+24  
Increment: 1E-3  
\*RST: 0  
Default unit: V

**Manual operation:** See "[Common Mode Offset](#)" on page 76

---

**[SENSe:]PROBe<p>:ID:PARTnumber?**

Queries the R&S part number of the probe.

**Suffix:**

<p>                    1 | 2 | 3  
 Selects the connector:  
 1 = Baseband Input I  
 2 = Baseband Input Q  
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

**Return values:**

<PartNumber>        Part number in a string.

**Usage:**                Query only

---

**[SENSe:]PROBe<p>:ID:SRNumber?**

Queries the serial number of the probe.

**Suffix:**

<p>                    1 | 2 | 3  
 Selects the connector:  
 1 = Baseband Input I  
 2 = Baseband Input Q  
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

**Return values:**

<SerialNo>            Serial number in a string.

**Usage:**                Query only

---

**[SENSe:]PROBe<p>:SETup:MODE <Mode>**

Select the action that is started with the micro button on the probe head.

See also: "[Microbutton Action](#)" on page 76.

**Suffix:**

<p>                    1 | 2 | 3  
 Selects the connector:  
 1 = Baseband Input I  
 2 = Baseband Input Q  
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

**Parameters:**

<Mode>                    **RSINgle**  
 Run single: starts one data acquisition.

**NOAction**  
 Nothing is started on pressing the micro button.

\*RST:                    RSINgle

**Manual operation:** See "[Microbutton Action](#)" on page 76

**[SENSe:]PROBe<p>:SETup:NAME?**

Queries the name of the probe.

**Suffix:**

<p>                            1 | 2 | 3  
 Selects the connector:  
 1 = Baseband Input I  
 2 = Baseband Input Q  
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

**Return values:**

<Name>                    Name string

**Usage:**                    Query only

**[SENSe:]PROBe<p>:SETup:STATe?**

Queries if the probe at the specified connector is active (detected) or not active (not detected). To switch the probe on, i.e. activate input from the connector, use `INP:SEL:AIQ` (see [INPut:SElect](#) on page 178).

**Suffix:**

<p>                            1 | 2 | 3  
 Selects the connector:  
 1 = Baseband Input I  
 2 = Baseband Input Q  
 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")

**Return values:**

<State>                    DETected | NDETECTED  
 \*RST:                    NDETECTED

**Usage:**                    Query only

**[SENSe:]PROBe<p>:SETup:TYPE?**

Queries the type of the probe.

<b>Suffix:</b>	
<p>	1   2   3 Selects the connector: 1 = Baseband Input I 2 = Baseband Input Q 3 = RF (currently not supported; use "1" with RF Input Connector setting "Baseband Input I")
<b>Return values:</b>	
<Type>	String containing one of the following values: – None (no probe detected) – active differential – active single-ended
<b>Usage:</b>	Query only

### 11.5.2.5 Configuring the Outputs



Configuring trigger input/output is described in [Chapter 11.5.4.2, "Configuring the Trigger Output"](#), on page 206.

DIAGnostic:SERVice:NSource..... 192

#### DIAGnostic:SERVice:NSource <State>

This command turns the 28 V supply of the BNC connector labeled NOISE SOURCE CONTROL on the R&S FSW on and off.

#### Suffix:

<n> [Window](#)

#### Parameters:

<State> ON | OFF  
\*RST: OFF

**Example:** DIAG:SERV:NSO ON

**Manual operation:** See "[Noise Source](#)" on page 77

## 11.5.3 Frontend Configuration

The following commands configure frequency, amplitude and y-axis scaling settings, which represent the "frontend" of the measurement setup.

- [Frequency](#)..... 193
- [Amplitude Settings](#)..... 194
- [Configuring the Attenuation](#)..... 198



### 11.5.3.1 Frequency

[SENSe:]FREQUENCY:CENTer.....	193
[SENSe:]FREQUENCY:CENTer:STEP.....	193
[SENSe:]FREQUENCY:CENTer:STEP:AUTO.....	194
[SENSe:]FREQUENCY:OFFSet.....	194

---

#### [SENSe:]FREQUENCY:CENTer <Frequency>

This command defines the center frequency.

##### Parameters:

<Frequency>            The allowed range and  $f_{\max}$  is specified in the data sheet.

##### UP

Increases the center frequency by the step defined using the [SENSe:]FREQUENCY:CENTer:STEP command.

##### DOWN

Decreases the center frequency by the step defined using the [SENSe:]FREQUENCY:CENTer:STEP command.

\*RST:             $f_{\max}/2$

Default unit: Hz

##### Example:

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
Sets the center frequency to 110 MHz.
```

**Usage:**            SCPI confirmed

**Manual operation:**    See "Center Frequency" on page 75  
                               See "Center frequency" on page 87

---

#### [SENSe:]FREQUENCY:CENTer:STEP <StepSize>

This command defines the center frequency step size.

You can increase or decrease the center frequency quickly in fixed steps using the SENS:FREQ UP AND SENS:FREQ DOWN commands, see [SENSe:]FREQUENCY:CENTer on page 193.

##### Parameters:

<StepSize>             $f_{\max}$  is specified in the data sheet.

Range:            1 to  $f_{\max}$

\*RST:            0.1 x span

Default unit: Hz

##### Example:

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
Sets the center frequency to 110 MHz.
```

**Manual operation:**    See "Center Frequency Stepsize" on page 88

**[SENSe:]FREQuency:CENTer:STEP:AUTO <State>**

This command couples or decouples the center frequency step size to the span.

In time domain (zero span) measurements, the center frequency is coupled to the RBW.

**Parameters:**

<State> ON | OFF | 0 | 1  
\*RST: 1

**Example:**

FREQ:CENT:STEP:AUTO ON  
Activates the coupling of the step size to the span.

**[SENSe:]FREQuency:OFFSet <Offset>**

This command defines a frequency offset.

If this value is not 0 Hz, the application assumes that the input signal was frequency shifted outside the application. All results of type "frequency" will be corrected for this shift numerically by the application.

See also "[Frequency Offset](#)" on page 88.

**Note:** In MSRA mode, the setting command is only available for the MSRA Master. For MSRA slave applications, only the query command is available.

**Parameters:**

<Offset> Range: -100 GHz to 100 GHz  
\*RST: 0 Hz

**Example:**

FREQ:OFFS 1GHZ

**Usage:** SCPI confirmed

**Manual operation:** See "[Frequency Offset](#)" on page 88

**11.5.3.2 Amplitude Settings**

The following commands are required to configure the amplitude settings in a remote environment.

Useful commands for amplitude settings described elsewhere:

- [INPut:COUPling](#) on page 176
- [INPut:IMPedance](#) on page 178
- [\[SENSe:\]ADJust:LEVel](#) on page 229

**Remote commands exclusive to amplitude settings:**

<a href="#">DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALE]:AUTO ONCE</a> .....	195
<a href="#">DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALE]:MAXimum</a> .....	195
<a href="#">DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALE]:MINimum</a> .....	195
<a href="#">DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALE]:PDIVision</a> .....	196
<a href="#">DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALE]:RLEVel</a> .....	196

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet.....	196
INPut:GAIN:STATe.....	197
INPut:GAIN[:VALue].....	197

---

#### DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE

Automatic scaling of the y-axis is performed once, then switched off again (for all traces).

**Suffix:**

<n>                      Window

<t>                      irrelevant

**Usage:**                      SCPI confirmed

**Manual operation:**    See "Auto Scale Once" on page 87

---

#### DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum <Value>

This command defines the maximum value of the y-axis for all traces in the selected result display.

**Suffix:**

<n>                      Window

<t>                      irrelevant

**Parameters:**

<Value>                      <numeric value>

\*RST:                      depends on the result display  
The unit and range depend on the result display.

**Example:**

```
DISP:TRAC:Y:MIN -60
DISP:TRAC:Y:MAX 0
```

Defines the y-axis with a minimum value of -60 and maximum value of 0.

**Manual operation:**    See "Y-Maximum, Y-Minimum" on page 87

---

#### DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum <Value>

This command defines the minimum value of the y-axis for all traces in the selected result display.

**Suffix:**

<n>                      Window

<t>                      irrelevant

**Parameters:**

<Value>                      <numeric value>

\*RST:                      depends on the result display  
The unit and range depend on the result display.

**Example:**            `DISP:TRAC:Y:MIN -60`  
                       `DISP:TRAC:Y:MAX 0`  
 Defines the y-axis with a minimum value of -60 and maximum value of 0.

**Manual operation:** See "[Y-Maximum, Y-Minimum](#)" on page 87

#### **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>                    [Window](#)  
 <t>                    irrelevant

**Parameters:**

<Value>              numeric value WITHOUT UNIT (unit according to the result display)  
 Defines the range per division (total range = 10\*[Value](#))  
 \*RST:                depends on the result display

**Example:**            `DISP:TRAC:Y:PDIV 10`  
 Sets the grid spacing to 10 units (e.g. dB) per division  
 (For example 10 dB in the Code Domain Power result display.)

#### **DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel <ReferenceLevel>**

This command defines the reference level (for all traces in all windows).

With a reference level offset  $\neq 0$ , the value range of the reference level is modified by the offset.

**Suffix:**

<n>, <t>              irrelevant

**Parameters:**

<ReferenceLevel>    The unit is variable.  
 Range:              see datasheet  
 \*RST:                0 dBm

**Example:**            `DISP:TRAC:Y:RLEV -60dBm`

**Usage:**              SCPI confirmed

**Manual operation:** See "[Reference Level](#)" on page 81

#### **DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Offset>**

This command defines a reference level offset (for all traces in all windows).

**Suffix:**

<n>, <t>              irrelevant

**Parameters:**

<Offset>                    Range:        -200 dB to 200 dB  
                                  \*RST:        0dB

**Example:**                    `DISP:TRAC:Y:RLEV:OFFS -10dB`

**Manual operation:**    See "[Shifting the Display \(Offset\)](#)" on page 82

**INPut:GAIN:STATe** <State>

This command turns the preamplifier on and off. It requires the optional preamplifier hardware.

This function is not available for input from the optional Digital Baseband Interface.

For R&S FSW 26 or higher models, the input signal is amplified by 30 dB if the preamplifier is activated.

For R&S FSW 8 or 13 models, the preamplification is defined by `INPut:GAIN[:VALue]`.

**Parameters:**

<State>                    ON | OFF  
                                  \*RST:        OFF

**Example:**                    `INP:GAIN:STAT ON`  
 Switches on 30 dB preamplification.

**Usage:**                    SCPI confirmed

**Manual operation:**    See "[Preamplifier](#)" on page 84

**INPut:GAIN[:VALue]** <Gain>

This command selects the gain if the preamplifier is activated (`INP:GAIN:STAT ON`, see `INPut:GAIN:STATe` on page 197).

The command requires the additional preamplifier hardware option.

**Parameters:**

<Gain>                    15 dB | 30 dB  
                                  The availability of gain levels depends on the model of the R&S FSW.  
                                  R&S FSW8/13: 15dB and 30 dB  
                                  R&S FSW26 or higher: 30 dB  
                                  All other values are rounded to the nearest of these two.  
                                  \*RST:        OFF

**Example:**                    `INP:GAIN:STAT ON`  
                                  `INP:GAIN:VAL 30`  
 Switches on 30 dB preamplification.

**Usage:**                    SCPI confirmed

**Manual operation:**    See "[Preamplifier](#)" on page 84

### 11.5.3.3 Configuring the Attenuation

INPut:ATTenuation.....	198
INPut:ATTenuation:AUTO.....	198
INPut:EATT.....	199
INPut:EATT:AUTO.....	199
INPut:EATT:STATe.....	199

---

#### INPut:ATTenuation <Attenuation>

This command defines the total attenuation for RF input.

If an electronic attenuator is available and active, the command defines a mechanical attenuation (see [INPut:EATT:STATe](#) on page 199).

If you set the attenuation manually, it is no longer coupled to the reference level, but the reference level is coupled to the attenuation. Thus, if the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

This function is not available if the optional Digital Baseband Interface is active.

#### Parameters:

<Attenuation>	Range:	see data sheet
	Increment:	5 dB
	*RST:	10 dB (AUTO is set to ON)

**Example:** `INP:ATT 30dB`  
 Defines a 30 dB attenuation and decouples the attenuation from the reference level.

**Usage:** SCPI confirmed

**Manual operation:** See "[Attenuation Mode / Value](#)" on page 83

---

#### INPut:ATTenuation:AUTO <State>

This command couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S FSW determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

This function is not available if the optional Digital Baseband Interface is active.

#### Parameters:

<State>	ON   OFF   0   1
	*RST: 1

**Example:** `INP:ATT:AUTO ON`  
 Couples the attenuation to the reference level.

**Usage:** SCPI confirmed

**Manual operation:** See "[Attenuation Mode / Value](#)" on page 83

**INPut:EATT <Attenuation>**

This command defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see `INPut:EATT:AUTO` on page 199).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

This command requires the electronic attenuation hardware option.

It is not available if the optional Digital Baseband Interface is active.

**Parameters:**

<Attenuation>           attenuation in dB  
                               Range:        see data sheet  
                               Increment: 1 dB  
                               \*RST:        0 dB (OFF)

**Example:**                `INP:EATT:AUTO OFF`  
                               `INP:EATT 10 dB`

**Manual operation:**    See "[Using Electronic Attenuation](#)" on page 83

**INPut:EATT:AUTO <State>**

This command turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

This command requires the electronic attenuation hardware option.

It is not available if the optional Digital Baseband Interface is active.

**Parameters:**

<State>                   1 | 0 | ON | OFF  
                               **1 | ON**  
                               **0 | OFF**  
                               \*RST:        1

**Example:**                `INP:EATT:AUTO OFF`

**Manual operation:**    See "[Using Electronic Attenuation](#)" on page 83

**INPut:EATT:STATe <State>**

This command turns the electronic attenuator on and off.

This command requires the electronic attenuation hardware option.

It is not available if the optional Digital Baseband Interface is active.

**Parameters:**

<State>            1 | 0 | ON | OFF  
                       1 | ON  
                       0 | OFF  
 \*RST:            0

**Example:**

INP:EATT:STAT ON  
 Switches the electronic attenuator into the signal path.

**Manual operation:** See ["Using Electronic Attenuation"](#) on page 83

## 11.5.4 Configuring Triggered Measurements

The following commands are required to configure a triggered measurement in a remote environment.

The tasks for manual operation are described in [Chapter 5.2.5, "Trigger Settings"](#), on page 88



The \*OPC command should be used after commands that retrieve data so that subsequent commands to change the selected trigger source are held off until after the sweep is completed and the data has been returned.

- [Configuring the Triggering Conditions](#).....200
- [Configuring the Trigger Output](#).....206

### 11.5.4.1 Configuring the Triggering Conditions

The following commands are required to configure a triggered measurement.

TRIGger[:SEQuence]:BBPower:HOLDoff.....	200
TRIGger[:SEQuence]:DTIME.....	201
TRIGger[:SEQuence]:HOLDoff[:TIME].....	201
TRIGger[:SEQuence]:IFPower:HOLDoff.....	201
TRIGger[:SEQuence]:IFPower:HYSTeresis.....	202
TRIGger[:SEQuence]:LEVel:BBPower.....	202
TRIGger[:SEQuence]:LEVel[:EXTeRnal<port>].....	202
TRIGger[:SEQuence]:LEVel:IFPower.....	203
TRIGger[:SEQuence]:LEVel:IQPower.....	203
TRIGger[:SEQuence]:LEVel:RFPower.....	203
TRIGger[:SEQuence]:LEVel:VIDeo.....	204
TRIGger[:SEQuence]:SLOPe.....	204
TRIGger[:SEQuence]:SOURce.....	204
TRIGger[:SEQuence]:TIME:RINTerval.....	206

**TRIGger[:SEQuence]:BBPower:HOLDoff <Period>**

This command defines the holding time before the baseband power trigger event.



The command requires the optional Digital Baseband Interface or the optional Analog Baseband Interface.

Note that this command is maintained for compatibility reasons only. Use the `TRIGger[:SEquence]:IFPower:HOLDoff` on page 201 command for new remote control programs.

**Parameters:**

<Period>                   Range:       150 ns to 1000 s  
                              \*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.
```

**TRIGger[:SEquence]:DTIME <DropoutTime>**

Defines the time the input signal must stay below the trigger level before a trigger is detected again.

For input from the Analog Baseband Interface (R&S FSW-B71) using the baseband power trigger (BBP), the default drop out time is set to 100 ns to avoid unintentional trigger events (as no hysteresis can be configured in this case).

**Parameters:**

<DropoutTime>           Dropout time of the trigger.  
                              Range:       0 s to 10.0 s  
                              \*RST:        0 s

**Manual operation:** See "[Drop-Out Time](#)" on page 92

**TRIGger[:SEquence]:HOLDoff[:TIME] <Offset>**

Defines the time offset between the trigger event and the start of the measurement.

**Parameters:**

<Offset>                   \*RST:        0 s

**Example:**                TRIG:HOLD 500us

**Manual operation:** See "[Trigger Offset](#)" on page 92

**TRIGger[:SEquence]:IFPower:HOLDoff <Period>**

This command defines the holding time before the next trigger event.

Note that this command can be used for **any trigger source**, not just IF Power (despite the legacy keyword).

**Note:** If you perform gated measurements in combination with the IF Power trigger, the R&S FSW ignores the holding time for frequency sweep, FFT sweep, zero span and I/Q data measurements.

**Parameters:**

<Period>                   Range:     0 s to 10 s  
                               \*RST:     0 s

**Example:**

```
TRIG:SOUR EXT
Sets an external trigger source.
TRIG:IFP:HOLD 200 ns
Sets the holding time to 200 ns.
```

**Manual operation:** See "[Trigger Holdoff](#)" on page 92

**TRIGger[:SEquence]:IFPower:HYSTeresis <Hysteresis>**

This command defines the trigger hysteresis, which is only available for "IF Power" trigger sources.

**Parameters:**

<Hysteresis>               Range:     3 dB to 50 dB  
                               \*RST:     3 dB

**Example:**

```
TRIG:SOUR IFP
Sets the IF power trigger source.
TRIG:IFP:HYST 10DB
Sets the hysteresis limit value.
```

**Manual operation:** See "[Hysteresis](#)" on page 92

**TRIGger[:SEquence]:LEVel:BBPower <Level>**

This command sets the level of the baseband power trigger.

This command is available for the optional Digital Baseband Interface and the optional Analog Baseband Interface.

**Parameters:**

<Level>                    Range:     -50 dBm to +20 dBm  
                               \*RST:     -20 dBm

**Example:**

```
TRIG:LEV:BBP -30DBM
```

**Manual operation:** See "[Trigger Level](#)" on page 92

**TRIGger[:SEquence]:LEVel[:EXternal<port>] <TriggerLevel>**

This command defines the level the external signal must exceed to cause a trigger event.

Note that the variable INPUT/OUTPUT connectors (ports 2+3) must be set for use as input using the `OUTPut:TRIGger<port>:DIRection` command.

**Suffix:**

&lt;port&gt;

Selects the trigger port.

1 = trigger port 1 (TRIGGER INPUT connector on front panel)

2 = trigger port 2 (TRIGGER INPUT/OUTPUT connector on front panel)

3 = trigger port 3 (TRIGGER3 INPUT/OUTPUT connector on rear panel)

**Parameters:**

&lt;TriggerLevel&gt;

Range: 0.5 V to 3.5 V

\*RST: 1.4 V

**Example:**

TRIG:LEV 2V

**Manual operation:** See "[Trigger Level](#)" on page 92**TRIGger[:SEQuence]:LEVel:IFPower <TriggerLevel>**

This command defines the power level at the third intermediate frequency that must be exceeded to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

For compatibility reasons, this command is also available for the "baseband power" trigger source when using the Analog Baseband Interface (R&S FSW-B71).

**Parameters:**

&lt;TriggerLevel&gt;

For details on available trigger levels and trigger bandwidths see the data sheet.

\*RST: -10 dBm

**Example:**

TRIG:LEV:IFP -30DBM

**TRIGger[:SEQuence]:LEVel:IQPower <TriggerLevel>**

This command defines the magnitude the I/Q data must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed.

**Parameters:**

&lt;TriggerLevel&gt;

Range: -130 dBm to 30 dBm

\*RST: -20 dBm

**Example:**

TRIG:LEV:IQP -30DBM

**TRIGger[:SEQuence]:LEVel:RFPower <TriggerLevel>**

This command defines the power level the RF input must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

The input signal must be between 500 MHz and 8 GHz.

**Parameters:**

<TriggerLevel> For details on available trigger levels and trigger bandwidths see the data sheet.

\*RST: -20 dBm

**Example:**

TRIG:LEV:RFP -30dBm

**TRIGger[:SEQUence]:LEVel:VIDeo <Level>**

This command defines the level the video signal must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed.

**Parameters:**

<Level> Range: 0 PCT to 100 PCT

\*RST: 50 PCT

**Example:**

TRIG:LEV:VID 50PCT

**TRIGger[:SEQUence]:SLOPe <Type>**

For external and time domain trigger sources you can define whether triggering occurs when the signal rises to the trigger level or falls down to it.

**Parameters:**

<Type> POSitive | NEGative

**POSitive**

Triggers when the signal rises to the trigger level (rising edge).

**NEGative**

Triggers when the signal drops to the trigger level (falling edge).

\*RST: POSitive

**Example:**

TRIG:SLOP NEG

**Manual operation:** See "[Slope](#)" on page 92

**TRIGger[:SEQUence]:SOURce <Source>**

This command selects the trigger source.

**Note on external triggers:**

If a measurement is configured to wait for an external trigger signal in a remote control program, remote control is blocked until the trigger is received and the program can continue. Make sure this situation is avoided in your remote control programs.

**Parameters:**

&lt;Source&gt;

**IMMediate**

Free Run

**EXTernal**

Trigger signal from the TRIGGER INPUT connector.

**EXT2**

Trigger signal from the TRIGGER INPUT/OUTPUT connector.

Note: Connector must be configured for "Input".

**EXT3**

Trigger signal from the TRIGGER 3 INPUT/ OUTPUT connector.

Note: Connector must be configured for "Input".

**RFPower**

First intermediate frequency

(Frequency and time domain measurements only.)

Not available for input from the optional Digital Baseband Interface or the optional Analog Baseband Interface.

**IFPower**

Second intermediate frequency

(For frequency and time domain measurements only.)

Not available for input from the optional Digital Baseband Interface. For input from the optional Analog Baseband Interface, this parameter is interpreted as `BBPower` for compatibility reasons.**TIME**

Time interval

(For frequency and time domain measurements only.)

**PSEN**

External power sensor

(For frequency and time domain measurements only.)

**GP0 | GP1 | GP2 | GP3 | GP4 | GP5**

For applications that process I/Q data, such as the I/Q Analyzer or optional applications, and only if the optional Digital Baseband Interface is available.

Defines triggering of the measurement directly via the LVDS connector. The parameter specifies which general purpose bit (0 to 5) will provide the trigger data.

The assignment of the general purpose bits used by the Digital IQ trigger to the LVDS connector pins is provided in "[Digital I/Q](#)" on page 91.

\*RST:       IMMediate

**Example:**

TRIG:SOUR EXT

Selects the external trigger input as source of the trigger signal

**Manual operation:**See "[Trigger Source](#)" on page 90See "[Free Run](#)" on page 90See "[External Trigger 1/2/3](#)" on page 90See "[Digital I/Q](#)" on page 91See "[IF Power](#)" on page 91

**TRIGger[:SEQuence]:TIME:RINTerval <Interval>**

This command defines the repetition interval for the time trigger.

**Parameters:**

<Interval>                    2.0 ms to 5000  
 Range:                    2 ms to 5000 s  
 \*RST:                    1.0 s

**Example:**

```
TRIG:SOUR TIME
Selects the time trigger input for triggering.
TRIG:TIME:RINT 50
The measurement starts every 50 s.
```

**11.5.4.2 Configuring the Trigger Output**

The following commands are required to send the trigger signal to one of the variable TRIGGER INPUT/OUTPUT connectors on the R&S FSW.

OUTPut:TRIGger<port>:DIRection.....	206
OUTPut:TRIGger<port>:LEVel.....	206
OUTPut:TRIGger<port>:OTYPe.....	207
OUTPut:TRIGger<port>:PULSe:IMMediate.....	207
OUTPut:TRIGger<port>:PULSe:LENGth.....	208

**OUTPut:TRIGger<port>:DIRection <Direction>**

This command selects the trigger direction for trigger ports that serve as an input as well as an output.

**Suffix:**

<port>                    Selects the used trigger port.  
 2 = trigger port 2 (front panel)  
 3 = trigger port 3 (rear panel)

**Parameters:**

<Direction>                    **INPut**  
 Port works as an input.  
                                   **OUTPut**  
 Port works as an output.  
 \*RST:                    INPut

**Manual operation:** See "[Trigger 2/3](#)" on page 77

**OUTPut:TRIGger<port>:LEVel <Level>**

This command defines the level of the (TTL compatible) signal generated at the trigger output.

This command works only if you have selected a user defined output with `OUTPut:TRIGger<port>:OTYPe`.

**Suffix:**  
 <port> Selects the trigger port to which the output is sent.  
 2 = trigger port 2 (front)  
 3 = trigger port 3 (rear)

**Parameters:**  
 <Level> **HIGH**  
 5 V  
**LOW**  
 0 V  
 \*RST: LOW

**Example:** OUTP:TRIG2:LEV HIGH

**Manual operation:** See "Level" on page 78

### OUTPut:TRIGger<port>:OTYPe <OutputType>

This command selects the type of signal generated at the trigger output.

**Suffix:**  
 <port> Selects the trigger port to which the output is sent.  
 2 = trigger port 2 (front)  
 3 = trigger port 3 (rear)

**Parameters:**  
 <OutputType> **DEvice**  
 Sends a trigger signal when the R&S FSW has triggered internally.  
**TARMed**  
 Sends a trigger signal when the trigger is armed and ready for an external trigger event.  
**UDEfined**  
 Sends a user defined trigger signal. For more information see [OUTPut:TRIGger<port>:LEVel](#).  
 \*RST: DEvice

**Manual operation:** See "Output Type" on page 78

### OUTPut:TRIGger<port>:PULSe:IMMediate

This command generates a pulse at the trigger output.

**Suffix:**  
 <port> Selects the trigger port to which the output is sent.  
 2 = trigger port 2 (front)  
 3 = trigger port 3 (rear)

**Usage:** Event

**Manual operation:** See "Send Trigger" on page 78

---

**OUTPut:TRIGger<port>:PULSe:LENGth <Length>**

This command defines the length of the pulse generated at the trigger output.

**Suffix:**

<port>                      Selects the trigger port to which the output is sent.  
 2 = trigger port 2 (front)  
 3 = trigger port 3 (rear)

**Parameters:**

<Length>                    Pulse length in seconds.

**Example:**                    `OUTP:TRIG2:PULS:LENG 0.02`

**Manual operation:**    See "[Pulse Length](#)" on page 78

## 11.5.5 Signal Capturing

The following commands are required to configure how much and how data is captured from the input signal.



### MSRA operating mode

In MSRA operating mode, only the MSRA Master channel actually captures data from the input signal. The data acquisition settings for the 3GPP FDD application in MSRA mode define the **application data** (see [Chapter 11.12, "Configuring the Slave Application Data Range \(MSRA mode only\)"](#), on page 292).

For details on the MSRA operating mode see the R&S FSW MSRA User Manual.

Useful commands for configuring data acquisition described elsewhere:

- [\[SENSe:\]CDPower:FRAMe\[:VALue\]](#) on page 229

### Remote commands exclusive to signal capturing:

<a href="#">[SENSe:]CDPower:BASE</a> .....	208
<a href="#">[SENSe:]CDPower:FILTer[:STATe]</a> .....	209
<a href="#">[SENSe:]CDPower:IQLength</a> .....	209
<a href="#">[SENSe:]CDPower:QINVert</a> .....	209
<a href="#">[SENSe:]CDPower:SBANd</a> .....	210

---

**[SENSe:]CDPower:BASE <BaseValue>**

This command defines the base of the CDP analysis.



**Parameters:**

<BaseValue>            SLOT | FRAME  
**SLOT**  
 Only one slot of the signal is analyzed.  
**FRAME**  
 The complete 3GPP frame is analyzed.  
 \*RST:            FRAME

**Example:**            CDP:BASE SLOT

**Manual operation:** See "[Capture Mode](#)" on page 96

**[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 | 1**  
 If an unfiltered signal is received (normal case), the RRC filter should be used to get a correct signal demodulation.  
**OFF | 0**  
 If a filtered 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:            1

**Example:**            SENS:CDP:FILT:STAT OFF

**Manual operation:** See "[RRC Filter State](#)" on page 95

**[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

**Manual operation:** See "[Capture Length \(Frames\)](#)" on page 96

**[SENSe:]CDPower:QINVert <State>**

This command inverts the Q-branch of the signal.

**Parameters:**

ON | OFF            \*RST:        OFF

**Example:**            CDP:QINV ON  
 Activates inversion of Q-branch

**Manual operation:** See "Invert Q" on page 95

---

**[SENSe:]CDPower:SBANd** <NORMal | INVers>

This command is used to swap the left and right sideband.

**Parameters:**

<NORMal | INVers> \*RST: NORM

**Example:**

CDP:SBAN INV  
Switches the right and left sideband.

## 11.5.6 Synchronization

For BTS tests, the individual channels in the input signal need to be synchronized to detect timing offsets in the slot spacings. These commands are described here. they are only available in the 3GPP FDD BTS application

Useful commands for synchronization described elsewhere:

- [\[SENSe:\]CDPower:ANTenna](#) on page 170

**Remote commands exclusive to synchronization:**

<a href="#">[SENSe:]CDPower:UCPich:ANT&lt;antenna&gt;:CODE</a> .....	210
<a href="#">[SENSe:]CDPower:UCPich:ANT&lt;antenna&gt;:PATTern</a> .....	211
<a href="#">[SENSe:]CDPower:UCPich:ANT&lt;antenna&gt;[:STATE]</a> .....	211
<a href="#">[SENSe:]CDPower:STYPe</a> .....	212

---

**[SENSe:]CDPower:UCPich:ANT<antenna>:CODE** <CodeNumber>

This command sets the code number of the user defined CPICH used for signal analysis.

**Note:** this command is equivalent to the command [\[SENSe:\]CDPower:UCPich:CODE](#) on page 299 for antenna 1.

**Suffix:**

<antenna> 1 | 2  
Antenna to be configured

**Parameters:**

<CodeNumber> Range: 0 to 225  
\*RST: 0

**Example:**

SENS:CDP:UCP:ANT2:CODE 10

**Mode:**

BTS application only

**Manual operation:** See "S-CPICH Code Nr" on page 98

**[SENSe:]CDPower:UCPich:ANT<antenna>:PATTern <Pattern>**

This command defines which pattern is used for signal analysis for the user-defined CPICH (see [SENSe:]CDPower:UCPich:ANT<antenna>[:STATe] on page 211).

**Note:** this command is equivalent to the command [SENSe:]CDPower:UCPich:PATTern on page 300 for antenna 1.

**Suffix:**

<antenna>            1 | 2  
Antenna to be configured

**Parameters:**

<Pattern>            1 | 2  
**1**  
fixed usage of "Pattern 1" according to standard  
**2**  
fixed usage of "Pattern 2" according to standard  
\*RST:                2

**Example:**            SENS:CDP:UCP:ANT2:PATT 1

**Mode:**                BTS application only

**Manual operation:** See "S-CPICH Antenna Pattern" on page 98

**[SENSe:]CDPower:UCPich:ANT<antenna>[:STATe] <State>**

Defines whether the common pilot channel (CPICH) is defined by a user-defined position instead of its default position.

**Note:** this command is equivalent to the command [SENSe:]CDPower:UCPich[:STATe] on page 300 for antenna 1.

**Suffix:**

<antenna>            1 | 2  
Antenna to be configured

**Parameters:**

<State>                **0**  
Standard configuration (CPICH is always on channel 0)  
**1**  
User-defined configuration, position defined using [SENSe:]CDPower:UCPich:ANT<antenna>:CODE on page 210.  
\*RST:                0

**Example:**            SENS:CDP:CPIC:ANT2:STAT 1

**Mode:**                BTS application only

**Manual operation:** See "CPICH Mode" on page 98

**[SENSe:]CDPower:STYPe** <Type>

This command selects the type of synchronization.

**Parameters:**

<Type> CPICH | SCHannel

**CPICH**

Synchronization is carried out to CPICH. For this type of synchronization, the CPICH must be available in the input signal.

**SCHannel**

Synchronization is carried out without CPICH. This type of synchronization is required for test model 4 without CPICH.

\*RST: CPICH

**Example:** SENS:CDP:STYP SCH

**Mode:** BTS application only

**Manual operation:** See "[Synchronization Type](#)" on page 97

## 11.5.7 Channel Detection

The channel detection settings determine which channels are found in the input signal. The commands for working with channel tables are described here.

When the channel type is required as a parameter by a remote command or provided as a result for a remote query, the following abbreviations and assignments to a numeric value are used:

**Table 11-4: BTS channel types and their assignment to a numeric parameter value**

Param.	Channel type	Description
0	DPCH	Dedicated Physical Channel of a standard frame
1	PICH	Paging Indication Channel
2	CPICH	Common Pilot Channel
3	PSCH	Primary Synchronization Channel
4	SSCH	Secondary Synchronization Channel
5	PCCPCH	Primary Common Control Physical Channel
6	SCCPCH	Secondary Common Control Physical Channel
7	HS_SCCH	HSDPA: High Speed Shared Control Channel
8	HS_PDSCH	HSDPA: High Speed Physical Downlink Shared Channel
9	CHAN	Channel without any pilot symbols (QPSK modulated)
10	CPRSD	Dedicated Physical Channel in compressed mode
11	CPR-TPC	Dedicated Physical Channel in compressed mode TPC symbols are sent in the first slot of the gap.

Param.	Channel type	Description
12	CPR-SF/2	Dedicated Physical Channel in <b>compressed</b> mode using half spreading factor ( <b>SF/2</b> ).
13	CPR-SF/2-TPC	Dedicated Physical Channel in <b>compressed</b> mode using half spreading factor ( <b>SF/2</b> ). <b>TPC</b> symbols are sent in the first slot of the gap.
14	EHICH-ERGCH	HSUPA: <b>Enhanced HARQ Hybrid Acknowledgement Indicator Channel</b> HSUPA: <b>Enhanced Relative Grant Channel</b>
15	EAGCH	E-AGCH: <b>Enhanced Absolute Grant Channel</b>
16	SCPICH	<b>S</b> econdary <b>C</b> ommon <b>P</b> ilot <b>C</b> hannel

**Table 11-5: UE channel types and their assignment to a numeric parameter value**

Param.	Channel type	Description
0	DPDCH	Dedicated Physical Data Channel
1	DPCCH	Dedicated Physical Control Channel
2	HS-DPCCH	High-Speed Dedicated Physical Control Channel
3	E-DPCCH	Enhanced Dedicated Physical Control Channel
4	E_DPDCH	Enhanced Dedicated Physical Data Channel

- [General Channel Detection](#).....213
- [Managing Channel Tables](#)..... 215
- [Configuring Channel Tables](#).....219
- [Configuring Channel Details \(BTS Measurements\)](#)..... 221
- [Configuring Channel Details \(UE Measurements\)](#)..... 222

### 11.5.7.1 General Channel Detection

The following commands configure how channels are detected in general.

Useful commands for general channel detection described elsewhere:

- `CONFigure:WCDPower[:BTS]:CTABLE[:STATe]` on page 215
- `CONFigure:WCDPower[:BTS]:CTABLE:SElect` on page 217
- `CONFigure:WCDPower:MS:CTABLE[:STATe]` on page 218
- `CONFigure:WCDPower:MS:CTABLE:SElect` on page 219

**Remote commands exclusive to general channel detection:**

- `CONFigure:WCDPower[:BTS]:CTABLE:COMParE`.....214
- `CONFigure:WCDPower[:BTS]:CTABLE:TOFFset`..... 214
- `[SENSe:]CDPower:ICTReshold`..... 215

**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.

Comparison is a submode of predefined channel table measurement. It only influences the measurement if the "Channel Search Mode" is set to *Predefined* (see [CONFigure:WCDPower\[:BTS\]:CTABLE\[:STATe\]](#) on page 215). 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. The differences between the measured and the predefined values are visualized in the corresponding columns of the "CHANNEL TABLE" evaluation (see "[Channel Table](#)" on page 19). The following columns are displayed in the channel table:

- **PilotL** is the subtraction of PilotLengthMeasured - PilotLengthPredefined
- **PwrRel** is the subtraction of PowerRelMeasured - PowerRelPredefined
- **T Offs** is the subtraction 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:**                    BTS application only

**Manual operation:**    See "[Comparing the Measurement Signal with the Predefined Channel Table](#)" on page 100

**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 application. The channel configuration is specified via the predefined channel table.

**Example:**

CONF:WCDP:CTAB:TOFF MEAS

**Mode:**

BTS application only

**Manual operation:** See "[Timing Offset Reference](#)" on page 100**[SENSe:]CDPower:ICTReshold <ThresholdLevel>**

This command defines the minimum power that a single channel must have compared to the total signal in order to be regarded as an active channel. Channels below the specified threshold are regarded as "inactive".

**Parameters:**

**<ThresholdLevel>** Range: -100 dB to 0 dB  
\*RST: -60 dB

**Example:**

SENS:CDP:ICTR -100

**Mode:**

BTS application only

**Manual operation:** See "[Inactive Channel Threshold \(BTS measurements only\)](#)" on page 99**11.5.7.2 Managing Channel Tables**

CONFigure:WCDPower[:BTS]:CTABLE[:STATE].....	215
CONFigure:WCDPower[:BTS]:CTABLE:CAtalog?.....	216
CONFigure:WCDPower[:BTS]:CTABLE:COpy.....	217
CONFigure:WCDPower[:BTS]:CTABLE:DELeTe.....	217
CONFigure:WCDPower[:BTS]:CTABLE:SELeCt.....	217
CONFigure:WCDPower:MS:CTABLE[:STATE].....	218
CONFigure:WCDPower:MS:CTABLE:CAtalog?.....	218
CONFigure:WCDPower:MS:CTABLE:COpy.....	218
CONFigure:WCDPower:MS:CTABLE:DELeTe.....	219
CONFigure:WCDPower:MS:CTABLE:SELeCt.....	219

**CONFigure:WCDPower[:BTS]:CTABLE[:STATE] <State>**

This command switches the channel table on or off. When switched on, the measured channel table is stored under the name "RECENT" and is selected for use. After the "RECENT" channel table is switched on, another channel table can be selected with the command `CONFigure:WCDPower[:BTS]:CTABLE:SELeCt` on page 217.

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:** CONF:WCDP:CTAB ON

**Mode:** BTS application only

**Manual operation:** See ["Using Predefined Channel Tables"](#) on page 99

**CONFigure:WCDPower[:BTS]:CTABLE:CATalog?**

This command reads out the names of all channel tables stored in the instrument. The first two result values are global values for all channel tables, the subsequent values are listed for each individual table.

**Return values:**

<TotalSize> Sum of file sizes of all channel table files (in bytes)  
 <FreeMem> Available memory left on hard disk (in bytes)  
 <FileName> File name of individual channel table file  
 <FileSize> File size of individual channel table file (in bytes)

**Example:**

CONF:WCDP:CTAB:CAT?

Sample result (description see table below):

52853,2634403840,3GB\_1\_16.XML,  
 3469,3GB\_1\_32.XML,5853,3GB\_1\_64.XML,  
 10712,3GB\_2.XML,1428,3GB\_3\_16.XML,  
 3430,3GB\_3\_32.XML,5868,3GB\_4.XML,  
 678,3GB\_5\_2.XML,2554,3GB\_5\_4.XML,  
 4101,3GB\_5\_8.XML,7202,3GB\_6.XML,  
 7209,MYTABLE.XML,349

**Usage:** Query only

**Mode:** BTS application only

**Manual operation:** See ["Predefined Tables"](#) on page 100

*Table 11-6: Description of query results in example:*

Value	Description
52853	Total size of all channel table files: 52583 bytes
2634403840	Free memory on hard disk: 2.6 Gbytes
3GB_1_16.XML	Channel table 1: 3GB_1_16.XML
3469	File size for channel table 1: 3469 bytes
3GB_1_32.XML	Channel table 2: 3GB_1_32.XML
5853	File size for channel table 2: 5853 bytes
3GB_1_64.XML	Channel table 3: 3GB_1_64.XML



Value	Description
10712	File size for channel table 3: 10712 bytes
...	Channel table x: ...

---

### 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 220.

The name of the channel table may contain a maximum of 8 characters.

#### Parameters:

<FileName> 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:** BTS application only

**Manual operation:** See "[Copying a Table](#)" on page 101

---

### 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 220.

#### Example:

```
CONF:WCDP:CTAB:NAME 'NEW_TAB'
Defines the channel table name to be deleted.
CONF:WCDP:CTAB:DEL
Deletes the table.
```

**Mode:** BTS application only

**Manual operation:** See "[Deleting a Table](#)" on page 101

---

### CONFigure:WCDPower[:BTS]:CTABLE:SELEct <FileName>

This command selects a predefined channel table file for comparison during channel detection. Before using this command, the "RECENT" channel table must be switched on first with the command `CONFigure:WCDPower[:BTS]:CTABLE[:STATE]` on page 215.

#### 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:**                BTS application only

**Manual operation:** See ["Selecting a Table"](#) on page 101

#### **CONFigure:WCDPower:MS:CTABLE[:STATe] <State>**

This command switches the channel table on or off. When switched on, the measured channel table is stored under the name "RECENT" and is selected for use. After the "RECENT" channel table is switched on, another channel table can be selected with the command [CONFigure:WCDPower:MS:CTABLE:SElect](#) on page 219.

#### **Parameters:**

<State>                ON | OFF  
                          \*RST:            OFF

**Example:**            `CONF:WCDP:CTAB ON`

**Mode:**                UE application only

**Manual operation:** See ["Using Predefined Channel Tables"](#) on page 99

#### **CONFigure:WCDPower:MS:CTABLE:CATalog?**

This command reads out the names of all channel tables stored in the instrument. The first two result values are global values for all channel tables, the subsequent values are listed for each individual table.

#### **Return values:**

<TotalSize>            Sum of file sizes of all channel table files (in bytes)  
 <FreeMem>             Available memory left on hard disk (in bytes)  
 <FileName>            File name of individual channel table file  
 <FileSize>            File size of individual channel table file (in bytes)

**Usage:**                Query only

**Mode:**                UE application only

**Manual operation:** See ["Predefined Tables"](#) on page 100

#### **CONFigure:WCDPower:MS:CTABLE:COpy <FileName>**

This command copies one channel table onto another one. The channel table to be copied is selected with command [CONFigure:WCDPower:MS:CTABLE:NAME](#) on page 220.

The name of the channel table may contain a maximum of 8 characters.

**Parameters:**

<FileName> Name of the new channel table

**Example:**

```
CONF:WCDP:MS:CTAB:NAME 'NEW_TAB'
Defines the channel table name to be copied.
CONF:WCDP:MS:CTAB:COPY 'CTAB_2'
Copies channel table 'NEW_TAB' to 'CTAB_2'.
```

**Mode:** UE application only

**Manual operation:** See "[Copying a Table](#)" on page 101

**CONFigure:WCDPower:MS:CTABLE:DELeTe**

This command deletes the selected channel table. The channel table to be deleted is selected with the command `CONFigure:WCDPower:MS:CTABLE:NAME` on page 220.

**Example:**

```
CONF:WCDP:MS:CTAB:NAME 'NEW_TAB'
Defines the channel table name to be deleted.
CONF:WCDP:MS:CTAB:DEL
```

**Mode:** UE application only

**Manual operation:** See "[Deleting a Table](#)" on page 101

**CONFigure:WCDPower:MS:CTABLE:SElect** <FileName>

This command selects a predefined channel table file for comparison during channel detection. Before using this command, the "RECENT" channel table must be switched on first with the command `CONFigure:WCDPower:MS:CTABLE[:STATE]` on page 218.

**Parameters:**

<FileName> \*RST: RECENT

**Example:**

```
CONF:WCDP:MS:CTABL ON
Switches the channel table on.
CONF:WCDP:CTAB:MS:SEL 'CTAB_1'
Selects the predefined channel table 'CTAB_1'.
```

**Mode:** UE application only

**Manual operation:** See "[Selecting a Table](#)" on page 101

**11.5.7.3 Configuring Channel Tables**

Some general settings and functions are available when configuring a predefined channel table.

**Remote commands exclusive to configuring channel tables:**

CONFigure:WCDPower[:BTS]:CTABLE:NAME.....	220
CONFigure:WCDPower[:BTS]:CTABLE:COMMeNT.....	220
CONFigure:WCDPower:MS:CTABLE:NAME.....	220
CONFigure:WCDPower:MS:CTABLE:COMMeNT.....	221

**CONFigure:WCDPower[:BTS]:CTABLE:NAME <Name>**

This command creates a new channel table file or selects an existing channel table in order to copy or delete it.

**Parameters:**

<Name>                    <file name>  
                              \*RST:        RECENT

**Example:**                CONF:WCDP:CTAB:NAME 'NEW\_TAB'

**Mode:**                    BTS application only

**Manual operation:**    See "Name" on page 102

**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 220. The values of the table are defined with command [CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#) on page 221.

**Parameters:**

<Comment>

**Example:**                CONF:WCDP:CTAB:NAME 'NEW\_TAB'  
                              Defines the channel table name.  
                              CONF:WCDP:CTAB:COMM 'Comment for table 1'  
                              Defines a comment for the table.  
                              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.

**Mode:**                    BTS application only

**Manual operation:**    See "Comment" on page 102

**CONFigure:WCDPower:MS:CTABLE:NAME <FileName>**

This command creates a new channel table file or selects an existing channel table in order to copy or delete it.

**Parameters:**

<FileName> <file name>  
\*RST: RECENT

**Example:**

CONF:WCDP:CTAB:NAME 'NEW\_TAB'

**Mode:**

UE application only

**Manual operation:** See "Name" on page 102

**CONFigure:WCDPower:MS: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:MS:CTable:NAME](#) on page 220. The values of the table are defined with command [CONFigure:WCDPower:MS:CTable:DATA](#) on page 223.

**Parameters:**

<Comment>

**Example:**

CONF:WCDP:MS:CTAB:NAME 'NEW\_TAB'

Defines the channel table name.

CONF:WCDP:MS:CTAB:COMM 'Comment for table 1'

Defines a comment for the table.

**Mode:**

UE application only

**Manual operation:** See "Comment" on page 102

**11.5.7.4 Configuring Channel Details (BTS Measurements)**

The following commands are used to configure individual channels in a predefined channel table in BTS measurements.

[CONFigure:WCDPower\[:BTS\]:CTable:DATA](#)..... 221

**CONFigure:WCDPower[:BTS]:CTable:DATA** <CodeClass>, <CodeNumber>, <UseTFCl>, <TimingOffset>, <PilotLength>, <ChannelType>, <Status>, <CDP>

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 220.

**Parameters:**

<CodeClass> Range: 2 to 9

<CodeNumber> Range: 0 to 511

<UseTFCI>	0   1 <b>0</b> not used <b>1</b> 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>	For the assignment of channel types to parameters see <a href="#">Table 11-4</a> .
<Status>	<b>0</b> not active <b>1</b> active
<CDP>	for queries: CDP relative to total signal power; for settings: CDP absolute or relative
<b>Example:</b>	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
<b>Mode:</b>	BTS application only
<b>Manual operation:</b>	See " <a href="#">Channel Type</a> " on page 103 See " <a href="#">Channel Number (Ch. SF)</a> " on page 104 See " <a href="#">Use TFCI</a> " on page 104 See " <a href="#">Timing Offset</a> " on page 104 See " <a href="#">Pilot Bits</a> " on page 104 See " <a href="#">CDP Relative</a> " on page 104 See " <a href="#">Status</a> " on page 104

#### 11.5.7.5 Configuring Channel Details (UE Measurements)

The following commands are used to configure individual channels in a predefined channel table in UE measurements.

CONFfigure:WCDPower:MS:CTABLE:DATA.....	223
CONFfigure:WCDPower:MS:CTABLE:DATA:HSDPcch.....	224
CONFfigure:WCDPower:MS:CTABLE:EDATa.....	224
CONFfigure:WCDPower:MS:CTABLE:EDATa:EDPCc.....	224

**CONFigure:WCDPower:MS:CTABLE:DATA**

<CodeClass>,<NoActChan>,<PilotLength>

This command defines the values of the selected channel table.

The Channel DPCCH may only be defined once. If channel DPCCH is missing in the command data, 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:MS:CTABLE:NAME](#) on page 220.

**Setting parameters:**

<CodeClass> Code class of channel 1. I-mapped  
Range: 2 to 9

<NoActChan> Number of active channels  
Range: 1 to 7

<PilotLength> pilot length of channel DPCCH

**Return values:**

<CodeClass> Code class of channel 1. I-mapped  
Range: 2 to 9

<NoActChan> Number of active channels  
Range: 1 to 7

<PilotLength> pilot length of channel DPCCH

<CDP1> Measured relative code domain power values of channel 1

<CDP2> Measured relative code domain power values of channel 2

<CDP3> Measured relative code domain power values of channel 3

<CDP4> Measured relative code domain power values of channel 4

<CDP5> Measured relative code domain power values of channel 5

<CDP6> Measured relative code domain power values of channel 6

**Example:**

```
CONF:WCDP:MS:CTAB:DATA 8,0,0,5,1,0.00,
4,1,1,0,1,0.00, 4,1,0,0,1,0.00
```

The following channels are defined: DPCCH and two data channels with 960 ksps.

**Mode:** UE application only

**Manual operation:** See ["Channel Type"](#) on page 103  
See ["Channel Number \(Ch. SF\)"](#) on page 104  
See ["Pilot Bits"](#) on page 104  
See ["CDP Relative"](#) on page 104  
See ["Status"](#) on page 104

**CONFigure:WCDPower:MS:CTABLE:DATA:HSDPcch** <State>

This command activates or deactivates the HS-DPCCH entry in a predefined channel table.

**Parameters:**

<State> \*RST: ON

**Example:** CONF:WCDP:MS:CTAB:DATA:HSDP ON

**Mode:** UE application only

**CONFigure:WCDPower:MS:CTABLE:EDATa** <CodeClass>, <NoActChan>

This command defines the values for an E-DPCCH channel in the selected channel table. The channel table must be selected using the command [CONFigure:WCDPower:MS:CTABLE:NAME](#) on page 220.

**Setting parameters:**

<CodeClass> Code class of channel

Range: 2 to 9

<NoActChan> Number of active channels

Range: 0 to 4

**Return values:**

<CodeClass> Code class of channel

Range: 2 to 9

<NoActChan> Number of active channels

Range: 0 to 4

<ECDP1> Measured relative code domain power values of channel 1

<ECDP2> Measured relative code domain power values of channel 2

<ECDP3> Measured relative code domain power values of channel 3

<ECDP4> Measured relative code domain power values of channel 4

**Example:** CONF:WCDP:MS:CTAB:EDAT 8,3

**Mode:** UE application only

**CONFigure:WCDPower:MS:CTABLE:EDATa:EDPCc** <State>

This command activates or deactivates the E-DPCCH entry in a predefined channel table.

**Parameters:**

<State> \*RST: OFF

**Example:** CONF:WCDP:MS:CTAB:EDAT:EDPC ON

**Mode:** UE application only



## 11.5.8 Sweep Settings

[SENSe:]AVERage<n>:COUNT.....	225
[SENSe:]SWEep:COUNT.....	225

---

### [SENSe:]AVERage<n>:COUNT <AverageCount>

This command defines the number of measurements that the application uses to average traces.

In case of continuous sweep mode, the application calculates the moving average over the average count.

In case of single sweep mode, the application stops the measurement and calculates the average after the average count has been reached.

#### Suffix:

<n> irrelevant

#### Parameters:

<AverageCount> If you set an average count of 0 or 1, the application performs one single measurement in single sweep mode.  
In continuous sweep mode, if the average count is set to 0, a moving average over 10 measurements is performed.

Range: 0 to 200000  
\*RST: 0

**Usage:** SCPI confirmed

**Manual operation:** See "[Sweep / Average Count](#)" on page 108

---

### [SENSe:]SWEep:COUNT <SweepCount>

This command defines the number of measurements that the application uses to average traces.

In case of continuous measurement mode, the application calculates the moving average over the average count.

In case of single measurement mode, the application stops the measurement and calculates the average after the average count has been reached.

#### Suffix:

<n> [Window](#)

#### Parameters:

<SweepCount> When you set a sweep count of 0 or 1, the R&S FSW performs one single measurement in single measurement mode.  
In continuous measurement mode, if the sweep count is set to 0, a moving average over 10 measurements is performed.

Range: 0 to 200000  
\*RST: 0

<b>Example:</b>	<pre>SWE:COUN 64 Sets the number of measurements to 64. INIT:CONT OFF Switches to single measurement mode. INIT;*WAI Starts a measurement and waits for its end.</pre>
<b>Usage:</b>	SCPI confirmed
<b>Manual operation:</b>	See "Sweep / Average Count" on page 108

### 11.5.9 Automatic Settings



#### MSRA operating mode

In MSRA operating mode, the following commands are not available, as they require a new data acquisition. However, 3GPP FDD applications cannot perform data acquisition in MSRA operating mode.

Useful commands for adjusting settings automatically described elsewhere:

- `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE` on page 195
- `[SENSe:]CDPower:LCODE:SEARCh[:IMMediate]?` on page 171

#### Remote commands exclusive to adjusting settings automatically:

<code>CONFigure:WCDPower[:BTS]:ASCale[:STATe]</code> .....	226
<code>CONFigure:WCDPower[:BTS]:MCARrier:STATe</code> .....	227
<code>[SENSe:]ADJust:ALL</code> .....	227
<code>[SENSe:]ADJust:CONFigure:DURation</code> .....	227
<code>[SENSe:]ADJust:CONFigure:DURation:MODE</code> .....	228
<code>[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer</code> .....	228
<code>[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer</code> .....	228
<code>[SENSe:]ADJust:LEVel</code> .....	229

#### `CONFigure:WCDPower[:BTS]:ASCale[:STATe] <State>`

Activate this command if multiple carriers are used. In this case, the autoscaling function automatically changes the level settings if the center frequency is changed to another carrier.

#### Parameters:

<State>                    ON | OFF  
\*RST:                    ON

**Example:**                `CONF:WCDP:ASC:STAT ON`

**Mode:**                    BTS application only

**CONFigure:WCDPower[:BTS]:MCARrier:STATe <State>**

Activate this command if multiple carriers are used. In this case, the adjust reference level procedure ensures that the settings of RF attenuation and reference level are optimally adjusted for measuring a multicarrier signal.

**Parameters:**

<State> ON | OFF  
\*RST: OFF

**Example:** CONF:WCDP:MCAR:STAT ON

**Mode:** BTS application only

**[SENSe:]ADJust:ALL**

This command initiates a measurement to determine and set the ideal settings for the current task automatically (only once for the current measurement).

This includes:

- Reference level
- Scrambling code
- Scaling

**Example:** ADJ:ALL

**Usage:** Event

**Manual operation:** See "[Adjusting all Determinable Settings Automatically \(Auto All\)](#)" on page 109

**[SENSe:]ADJust:CONFigure:DURation <Duration>**

In order to determine the ideal reference level, the R&S FSW performs a measurement on the current input data. This command defines the length of the measurement if `[SENSe:]ADJust:CONFigure:DURation:MODE` is set to `MANual`.

**Parameters:**

<Duration> Numeric value in seconds  
Range: 0.001 to 16000.0  
\*RST: 0.001  
Default unit: s

**Example:** ADJ:CONF:DUR:MODE MAN  
Selects manual definition of the measurement length.  
ADJ:CONF:LEV:DUR 5ms  
Length of the measurement is 5 ms.

**Manual operation:** See "[Changing the Automatic Measurement Time \(Meastime Manual\)](#)" on page 110

**[SENSe:]ADJust:CONFigure:DURation:MODE <Mode>**

In order to determine the ideal reference level, the R&S FSW performs a measurement on the current input data. This command selects the way the R&S FSW determines the length of the measurement .

**Parameters:**

&lt;Mode&gt;

**AUTO**

The R&S FSW determines the measurement length automatically according to the current input data.

**MANual**

The R&S FSW uses the measurement length defined by [\[SENSe:\]ADJust:CONFigure:DURation](#) on page 227.

\*RST: AUTO

**Manual operation:** See ["Resetting the Automatic Measurement Time \(Meastime Auto\)"](#) on page 110  
See ["Changing the Automatic Measurement Time \(Meastime Manual\)"](#) on page 110

**[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer <Threshold>**

When the reference level is adjusted automatically using the [\[SENSe:\]ADJust:LEVEl](#) on page 229 command, the internal attenuators and the preamplifier are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

**Parameters:**

&lt;Threshold&gt;

Range: 0 dB to 200 dB

\*RST: +1 dB

Default unit: dB

**Example:**

```
SENS:ADJ:CONF:HYST:LOW 2
```

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 110

**[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer <Threshold>**

When the reference level is adjusted automatically using the [\[SENSe:\]ADJust:LEVEl](#) on page 229 command, the internal attenuators and the preamplifier are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines an upper threshold the signal must exceed (compared to the last measurement) before the reference level is adapted automatically.

**Parameters:**

<Threshold>            Range:     0 dB to 200 dB  
                              \*RST:     +1 dB  
                              Default unit: dB

**Example:**            SENS:ADJ:CONF:HYST:UPP 2

**Example:**            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 110

**[SENSe:]ADJust:LEVel**

This command initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. 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 FSW or limiting the dynamic range by an S/N ratio that is too small.

**Example:**            ADJ:LEV

**Usage:**                Event

**Manual operation:**   See ["Setting the Reference Level Automatically \(Auto Level\)"](#) on page 82

**11.5.10 Evaluation Range**

The evaluation range defines which data is evaluated in the result display.

<a href="#">[SENSe:]CDPower:CODE.....</a>	229
<a href="#">[SENSe:]CDPower:FRAMe[:VALue].....</a>	229
<a href="#">[SENSe:]CDPower:SLOT.....</a>	230
<a href="#">[SENSe:]CDPower:MAPPING.....</a>	230
<a href="#">CALCulate&lt;n&gt;:CDPower:Mapping.....</a>	230

**[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

**Manual operation:**   See ["Channel"](#) on page 123

**[SENSe:]CDPower:FRAMe[:VALue] <Frame>**

This command defines the frame to be analyzed within the captured data.

**Parameters:**

<Frame> <numeric value>  
 Range: [0 ... CAPTURE\_LENGTH – 1]  
 \*RST: 1

**Example:** CDP:FRAM:VAL 1

**Manual operation:** See "[Frame To Analyze](#)" on page 96

**[SENSe:]CDPower:SLOT <SlotNumber>**

This command selects the (CPICH) slot number to be evaluated.

**Parameters:**

<SlotNumber> <numeric value>  
 \*RST: 0

**Example:** SENS:CDP:SLOT 3

**Manual operation:** See "[Slot](#)" on page 124

**[SENSe:]CDPower:MAPPING <SignalBranch>**

This command switches between I and Q branches of the signal for all evaluations (if not specified otherwise using [CALCulate<n>:CDPower:Mapping](#) on page 230).

**Parameters:**

<SignalBranch> I | Q  
 \*RST: Q

**Example:** CDP:MAPP Q

**Mode:** UE application only

**CALCulate<n>:CDPower:Mapping <SignalBranch>**

This command adjusts the mapping for the evaluations Code Domain Power and Code Domain Error Power in a specific 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 [\[SENSe:\]CDPower:MAPPING](#) command will be used for evaluation.  
 \*RST: AUTO

**Example:** CALC:CDP:MAPPING AUTO

<b>Mode:</b>	UE application only
<b>Manual operation:</b>	See " <a href="#">Branch (UE measurements only)</a> " on page 124 See " <a href="#">Selecting a Different Branch for a Window</a> " on page 125

### 11.5.11 Code Domain Analysis Settings (BTS Measurements)

Some evaluations provide further settings for the results. The commands for BTS measurements are described here.

<a href="#">CALCulate:MARKer&lt;m&gt;:FUNCtion:ZOOM</a> .....	231
<a href="#">[SENSe:]CDPower:CPB</a> .....	231
<a href="#">[SENSe:]CDPower:NORMALize</a> .....	232
<a href="#">[SENSe:]CDPower:PDISplay</a> .....	232
<a href="#">[SENSe:]CDPower:PDIFf</a> .....	232
<a href="#">[SENSe:]CDPower:PREFerence</a> .....	233

---

#### **CALCulate:MARKer<m>:FUNCtion:ZOOM <State>**

If marker zoom is activated, the number of channels displayed on the screen in the 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:**

<m>                      [Marker](#)

#### **Parameters:**

<State>                      ON | OFF  
\*RST:                      OFF

**Example:**                      CALC:MARK:FUNC:ZOOM ON

---

#### **[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:CDP 1

**Manual operation:**        See "[Constellation Parameter B](#)" on page 127

**[SENSe:]CDPower:NORMalize <State>**

If enabled, the I/Q offset is eliminated from the measured signal. This is useful to deduct a DC offset to the baseband caused by the DUT, thus improving the EVM. Note, however, that for EVM measurements according to standard, compensation must be disabled.

**Parameters:**

<State> ON | OFF  
\*RST: OFF

**Example:** SENS:CDP:NORM ON  
Activates the elimination of the I/Q offset.

**Manual operation:** See "[Compensate IQ Offset](#)" on page 126

**[SENSe:]CDPower:PDISplay <Mode>**

This command switches between showing the absolute or relative power.

This parameter only affects the Code Domain Power evaluation.

**Parameters:**

<Mode> ABS | REL  
**ABSolute**  
Absolute power levels  
**RELative**  
Power levels relative to total signal power or (BTS application only) CPICH channel power (see [\[SENSe:\]CDPower:PREference](#) on page 233)  
\*RST: ABS

**Example:** SENS:CDP:PDIS ABS

**Manual operation:** See "[Code Power Display](#)" on page 126  
See "[Code Power Display](#)" on page 128

**[SENSe:]CDPower:PDIFf <State>**

This command defines which slot power difference is displayed in the Power vs Slot evaluation.

**Parameters:**

<State> ON | OFF  
**ON**  
The slot power difference to the previous slot is displayed.  
**OFF**  
The current slot power of each slot is displayed.  
\*RST: OFF

**Example:** SENS:CDP:PDIF ON



**Mode:** BTS application only

**Manual operation:** See ["Show Difference to Previous Slot"](#) on page 126

---

**[SENSe:]CDPower:PREFerence <Mode>**

This command defines the reference for the relative CDP measurement values.

**Parameters:**

<Mode>                   TOTAl | CPICh  
**TOTAl**  
 Total signal power  
**CPICh**  
 CPICH channel power  
 \*RST:           TOTAl

**Example:**               SENS:CDP:PREF CPIC

**Mode:**                   BTS application only

**Manual operation:** See ["Code Power Display"](#) on page 126

### 11.5.12 Code Domain Analysis Settings (UE Measurements)

Some evaluations provide further settings for the results. The commands for UE measurements are described here.

Useful commands for Code Domain Analysis described elsewhere:

- [CALCulate:MARKer<m>:FUNction:ZOOM](#) on page 231
- [\[SENSe:\]CDPower:NORMalize](#) on page 232
- [\[SENSe:\]CDPower:PDISplay](#) on page 232

**Remote commands exclusive to Code Domain Analysis in UE Measurements:**

<a href="#">[SENSe:]CDPower:ETCHips</a> .....	233
<a href="#">[SENSe:]CDPower:HSLot</a> .....	234

---

**[SENSe:]CDPower:ETCHips <State>**

This command selects length of the measurement interval for calculation of error vector magnitude (EVM). In accordance with 3GPP specification Release 5, the EVM measurement interval is one slot (4096 chips) minus 25  $\mu$ s (3904 chips) at each end of the burst if power changes are expected. If no power changes are expected, the evaluation length is one slot (4096 chips).

**Parameters:**

&lt;State&gt;

**ON**

Changes of power are expected. Therefore an EVM measurement interval of one slot minus 25 µs (3904 chips) is considered.

**OFF**

Changes of power are not expected. Therefore an EVM measurement interval of one slot (4096 chips) is considered

\*RST: OFF

**Example:**

SENS:CDP:ETCH ON

**Manual operation:** See "Eliminate Tail Chips" on page 128**[SENSe:]CDPower:HSLot <State>**

This command switches between the analysis of half slots and full slots.

**Parameters:**

&lt;State&gt;

ON | OFF

**ON**

30 (half) slots are evaluated

**OFF**

15 (full) slots are evaluated

\*RST: OFF

**Example:**

SENS:CDP:HSL ON

**Mode:**

UE application only

**Manual operation:** See "Measurement Interval" on page 127

### 11.5.13 Configuring Carrier Tables for Time Alignment Measurements

The following commands are required to configure carrier tables for TAE measurements (see Chapter 5.3.2, "Carrier Table Configuration", on page 112)

[SENSe:]TAERror:CARRier<c>:ANTenna<antenna>:CPICH.....	235
[SENSe:]TAERror:CARRier<c>:ANTenna<antenna>:PATTern.....	235
[SENSe:]TAERror:CARRier:COUNT?.....	236
[SENSe:]TAERror:CARRier<c>:DELeTe.....	236
[SENSe:]TAERror:CARRier<c>:INSert.....	236
[SENSe:]TAERror:CARRier<c>:OFFSet.....	237
[SENSe:]TAERror:CARRier<c>:SCODE.....	237
[SENSe:]TAERror:CATalog?.....	237
[SENSe:]TAERror:DELeTe.....	238
[SENSe:]TAERror:NEW.....	238
[SENSe:]TAERror:PRESet.....	238
[SENSe:]TAERror:SAVE.....	239

**[SENSe:]TAERror:CARRier<c>:ANTenna<antenna>:CPICH <CodeNumber>**

Defines or queries the CPICH of the specified antenna for the carrier specified by the CARRier<c> suffix in the currently selected carrier table for Time Alignment Error measurement.

For antenna 1, the value can be queried only, not defined.

**Suffix:**

<c> 1 to 4  
Carrier in carrier table  
The suffix must refer to a carrier already defined in the current table.

<antenna> 1 | 2  
Antenna to be configured or queried

**Parameters:**

<CodeNumber> <numeric value>  
Scrambling code in decimal format.  
Range: 0 to 225  
\*RST: 0

**Manual operation:** See "[Antenna 1: CPICH-Number](#)" on page 116  
See "[Antenna 2: CPICH-Number](#)" on page 116

**[SENSe:]TAERror:CARRier<c>:ANTenna<antenna>:PATTern <Pattern>**

Defines or queries the pattern of the specified antenna for the carrier specified by the CARRier<c> suffix in the currently selected carrier table for Time Alignment Error measurement.

For antenna 1, the value can be queried only, not defined.

**Suffix:**

<c> 1 to 4  
Carrier in carrier table  
The suffix must refer to a carrier already defined in the current table.

<antenna> 1 | 2  
Antenna to be configured or queried

**Parameters:**

<Pattern> PATTERN\_1 | PATTERN\_2 | NONE  
\*RST: antenna 1: PATTERN\_1; antenna 2: PATTERN\_2

**Manual operation:** See "[Antenna 1: CPICH-Pattern](#)" on page 116  
See "[Antenna 2: CPICH-Pattern](#)" on page 116

**[SENSe:]TAERror:CARRier:COUNT?**

Queries the number of carriers defined in the currently selected carrier table for Time Alignment Error measurement.

**Parameters:**

<NoCarriers>            Range:     1 to 24

**Usage:**                Query only

**Manual operation:**   See "[Carrier](#)" on page 115

**[SENSe:]TAERror:CARRier<c>:DELeTe [ALL]**

Deletes the carrier specified by the CARRier<c> suffix in the currently selected carrier table for Time Alignment Error measurement.

If the parameter ALL is used, the carrier suffix is ignored and all carriers except for the reference carrier are deleted.

**Suffix:**

<c>                        1 to 4  
Carrier in carrier table  
The suffix must refer to a carrier already defined in the current table, but not to the reference carrier.

**Parameters:**

ALL                      All carriers except for the reference carrier are deleted.

**Example:**            TAER:CARR2:DEL  
Deletes carrier 2.

**Example:**            TAER:CARR:DEL ALL  
Deletes all carriers except for the reference carrier.

**Usage:**                Event

**Manual operation:**   See "[Deleting a Carrier](#)" on page 114

**[SENSe:]TAERror:CARRier<c>:INSert**

Inserts a new carrier in the currently selected carrier table for Time Alignment Error measurement. The new carrier is inserted in the row specified by the CARRier<c> suffix.

**Suffix:**

<c>                        1 to 4  
Carrier in carrier table  
The suffix must refer to a carrier already defined in the current table, or to the first row after the last defined carrier.

**Usage:**                Event

**Manual operation:**   See "[Adding a Carrier](#)" on page 114

**[SENSe:]TAERror:CARRier<c>:OFFSet <Freq>**

Defines or queries the frequency offset of the carrier specified by the CARRier<c> suffix in the currently selected carrier table for Time Alignment Error measurement. The frequency offset is defined with respect to the reference carrier.

(The reference carrier is set to the current center frequency, thus the offset is always 0.)

**Suffix:**

<c> 1 to 4  
Carrier in carrier table  
The suffix must refer to a carrier already defined in the current table, but not to the reference carrier.

**Parameters:**

<Freq> The minimum spacing between two carriers is 2.5 MHz.  
The maximum positive and negative frequency offset which a carrier can have from the reference depends on the available analysis bandwidth (see "Frequency Offset" on page 115).  
Range: 2.5 MHz to +/- 61.5 MHz

**Manual operation:** See "Frequency Offset" on page 115

**[SENSe:]TAERror:CARRier<c>:SCODE <ScramblingCode>**

Defines or queries the scrambling code of the carrier specified by the CARRier<c> suffix in the currently selected carrier table for Time Alignment Error measurement.

(The scrambling code for the reference carrier is defined/queried using [SENSe:]CDPower:LCODE:DVALue on page 173.)

**Suffix:**

<c> 1 to 4  
Carrier in carrier table  
The suffix must refer to a carrier already defined in the current table, but not the reference carrier.

**Parameters:**

<ScramblingCode> <numeric value>  
Scrambling code in decimal format.  
\*RST: 00

**Manual operation:** See "Scrambling Code" on page 116

**[SENSe:]TAERror:CATalog?**

Lists the carrier table names of all carrier table files found in the default directory.

The default directory for carrier tables is

C:\R\_SInstr\user\chan\_tab\carrier\_table\.

**Return values:**

<Tablenames> Table names as a comma-separated list of strings

**Example:**

TAER:CAT?  
Result: 'COPIED TABLE','NEWTABLE'

**Usage:**

Query only

**Manual operation:** See ["Carrier Tables"](#) on page 112

**[SENSe:]TAERror:DELeTe <Filename>**

Deletes the specified carrier table for Time Alignment Error measurement.

**Parameters:**

<Filename> Filename of the carrier table to be deleted in the default directory.  
The default directory for carrier tables is  
C:\R\_SInstr\user\chan\_tab\carrier\_table\.

**Example:**

TAER:DEL 'MyCarrierTable'  
Deletes the file  
C:\R\_SInstr\user\chan\_tab\carrier\_table\  
MyCarrierTable.xml.

**Usage:**

Event

**Manual operation:** See ["Deleting a Table"](#) on page 113

**[SENSe:]TAERror:NEw <Filename>**

Creates a new carrier table for Time Alignment Error measurement.

**Parameters:**

<Filename> Filename of the new carrier table to be created in the default directory.  
The default directory for carrier tables is  
C:\R\_SInstr\user\chan\_tab\carrier\_table\.

**Example:**

TAER:NEW 'MyCarrierTable'  
Creates the file  
C:\R\_SInstr\user\chan\_tab\carrier\_table\  
MyCarrierTable.xml.

**Usage:**

Event

**Manual operation:** See ["Creating a New Table"](#) on page 112

**[SENSe:]TAERror:PRESet <Filename>**

Loads the specified carrier table as the default table ("RECENT") for Time Alignment Error measurement.

**Parameters:**

<Filename>           Filename of the stored carrier table.  
The default directory for carrier tables is  
C:\R\_SInstr\user\chan\_tab\carrier\_table\.

**Example:**

```
TAER:PRES 'MyCarrierTable'
```

Loads the carrier table from the file  
C:\R\_SInstr\user\chan\_tab\carrier\_table\  
MyCarrierTable.xml.

**Usage:**

Event

**[SENSe:]TAERror:SAVE <Filename>**

Saves the specified carrier table for Time Alignment Error measurement to an xml file in the default directory.

**Parameters:**

<Filename>           Filename of the new or edited carrier table.  
The default directory for carrier tables is  
C:\R\_SInstr\user\chan\_tab\carrier\_table\.

**Example:**

```
TAER:SAVE 'MyCarrierTable'
```

Stores the file  
C:\R\_SInstr\user\chan\_tab\carrier\_table\  
MyCarrierTable.xml.

**Usage:**

Event

**Manual operation:** See ["Saving the Table"](#) on page 114

## 11.6 Configuring RF Measurements

RF measurements are performed in the Spectrum application, with some predefined settings as described in [Chapter 3.3, "RF Measurements"](#), on page 35.

For details on configuring these RF measurements in a remote environment, see the Remote Commands chapter of the R&S FSW User Manual.

The 3GPP FDD RF measurements must be activated for a 3GPP FDD application, see [Chapter 11.3, "Activating 3GPP FDD Measurements"](#), on page 164.

The individual measurements are activated using the `CONFigure:WCDPower[:BTS]:MEASurement` on page 168 command (see [Chapter 11.4, "Selecting a Measurement"](#), on page 168).

- [Special RF Configuration Commands](#).....240
- [Analysis](#).....240

### 11.6.1 Special RF Configuration Commands

In addition to the common RF measurement configuration commands described for the base unit, the following special commands are available in 3GPP FDD applications:

[CONFigure:WCDPower\[:BTS\]:STD](#).....240

---

#### **CONFigure:WCDPower[:BTS]:STD <Type>**

Switches between Normal mode and Home BS (Home Base Station) mode for ACP and SEM measurements in the BTS application. 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:**                BTS application only

**Manual operation:** See "[BTS Standard](#)" on page 118

### 11.6.2 Analysis

General result analysis settings concerning the trace, markers, lines etc. for RF measurements are identical to the analysis functions in the Spectrum application except for some special marker functions and spectrograms, which are not available in the 3GPP FDD applications.

For details see the "General Measurement Analysis and Display" chapter in the R&S FSW User Manual.

## 11.7 Configuring the Result Display

The following commands are required to configure the screen display in a remote environment. The tasks for manual operation are described in [Chapter 3, "Measurements and Result Display"](#), on page 15.

11.7.1	General Window Commands.....	241
11.7.2	Working with Windows in the Display.....	241



### 11.7.1 General Window Commands

The following commands are required to configure general window layout, independent of the application.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel* (see [INSTrument\[:SElect\]](#) on page 167).

<a href="#">DISPlay:FORMat</a> .....	241
<a href="#">DISPlay:WINDow&lt;n&gt;:SIZE</a> .....	241

---

#### DISPlay:FORMat <Format>

This command determines which tab is displayed.

##### Parameters:

<Format>	<b>SPLit</b> Displays the MultiView tab with an overview of all active channels
	<b>SINGle</b> Displays the measurement channel that was previously focused.
*RST:	SING

**Example:** DISP:FORM SPL

---

#### DISPlay[:WINDow<n>]:SIZE <Size>

This command maximizes the size of the selected result display window *temporarily*. To change the size of several windows on the screen permanently, use the [LAYout:SPLitter](#) command (see [LAYout:SPLitter](#) on page 245).

##### Suffix:

<n> [Window](#)

##### Parameters:

<Size>	<b>LARGE</b> Maximizes the selected window to full screen. Other windows are still active in the background.
	<b>SMALI</b> Reduces the size of the selected window to its original size. If more than one measurement window was displayed originally, these are visible again.
*RST:	SMALI

**Example:** DISP:WIND2:SIZE LARG

### 11.7.2 Working with Windows in the Display

The following commands are required to change the evaluation type and rearrange the screen layout for a measurement channel as you do using the SmartGrid in manual operation. Since the available evaluation types depend on the selected application,

some parameters for the following commands also depend on the selected measurement channel.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel* (see `INSTRUMENT[:SELECT]` on page 167).

<code>LAYout:ADD[:WINDow]?</code> .....	242
<code>LAYout:CATalog[:WINDow]?</code> .....	244
<code>LAYout:IDENtify[:WINDow]?</code> .....	244
<code>LAYout:REMove[:WINDow]</code> .....	245
<code>LAYout:REPLace[:WINDow]</code> .....	245
<code>LAYout:SPLitter</code> .....	245
<code>LAYout:WINDow&lt;n&gt;:ADD?</code> .....	247
<code>LAYout:WINDow&lt;n&gt;:IDENtify?</code> .....	247
<code>LAYout:WINDow&lt;n&gt;:REMove</code> .....	248
<code>LAYout:WINDow&lt;n&gt;:REPLace</code> .....	248

---

### `LAYout:ADD[:WINDow]?` <WindowName>,<Direction>,<WindowType>

This command adds a window to the display in the active measurement channel.

This command is always used as a query so that you immediately obtain the name of the new window as a result.

To replace an existing window, use the `LAYout:REPLace[:WINDow]` command.

#### Parameters:

<WindowName>	String containing the name of the existing window the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the <code>LAYout:CATalog[:WINDow]?</code> query.
<Direction>	LEFT   RIGHT   ABOVE   BELOW Direction the new window is added relative to the existing window.
<WindowType>	text value Type of result display (evaluation method) you want to add. See the table below for available parameter values.

#### Return values:

<NewWindowName>	When adding a new window, the command returns its name (by default the same as its number) as a result.
-----------------	---

**Example:** `LAY:ADD? '1',BEL,'XPOW:CDP:ABSolute'`  
Adds a Code Domain Power display below window 1.

**Usage:** Query only

- Manual operation:**
- See "Bitstream" on page 18
  - See "Channel Table" on page 19
  - See "Code Domain Power" on page 21
  - See "Code Domain Error Power" on page 22
  - See "Composite Constellation" on page 22
  - See "Composite EVM" on page 23
  - See "EVM vs Chip" on page 24
  - See "Frequency Error vs Slot" on page 25
  - See "Mag Error vs Chip" on page 25
  - See "Marker Table" on page 26
  - See "Peak Code Domain Error" on page 27
  - See "Phase Discontinuity vs Slot" on page 27
  - See "Phase Error vs Chip" on page 28
  - See "Power vs Slot" on page 29
  - See "Power vs Symbol" on page 30
  - See "Result Summary" on page 30
  - See "Symbol Constellation" on page 31
  - See "Symbol EVM" on page 31
  - See "Symbol Magnitude Error" on page 32
  - See "Symbol Phase Error" on page 32
  - See "Diagram" on page 39
  - See "Result Summary" on page 40
  - See "Marker Peak List" on page 41

**Table 11-7:** <WindowType> parameter values for 3GPP FDD application

Parameter value	Window type
BITStream	Bitstream
CCONst	Composite Constellation
CDPower	Code Domain Power
CDEPower	Code Domain Error Power
CEVM	Composite EVM
CTABle	Channel Table
EVMChip	EVM vs. Chip
FESLot	Frequency Error vs. Slot
MECHip	Magnitude Error vs. Chip
MTABle	Marker table
PCDerror	Peak Code Domain Error
PDSLot	Phase Discontinuity vs. Slot
PECHip	Phase Error vs. Chip
PSLot	Power vs. Slot
PSYMBOL	Power vs. Symbol
RSUMmary	Result Summary

Parameter value	Window type
SCONst	Symbol Constellation
SEVM	Symbol EVM
SMERror	Symbol Magnitude Error
SPERror	Symbol Phase Error

---

### LAYout:CATalog[:WINDow]?

This command queries the name and index of all active windows in the active measurement channel from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName\_1>,<WindowIndex\_1>..<WindowName\_n>,<WindowIndex\_n>

#### Return values:

<WindowName>      string  
 Name of the window.  
 In the default state, the name of the window is its index.

<WindowIndex>    **numeric value**  
 Index of the window.

#### Example:

LAY:CAT?  
 Result:  
 '2',2,'1',1  
 Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).

**Usage:**            Query only

---

### LAYout:IDENTify[:WINDow]? <WindowName>

This command queries the **index** of a particular display window in the active measurement channel.

**Note:** to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENTify?` query.

#### Query parameters:

<WindowName>      String containing the name of a window.

#### Return values:

<WindowIndex>    Index number of the window.

#### Example:

LAY:WIND:IDEN? '2'  
 Queries the index of the result display named '2'.  
 Response:  
 2

**Usage:**            Query only

**LAYout:REMOve[:WINDow]** <WindowName>

This command removes a window from the display in the active measurement channel.

**Parameters:**

<WindowName> String containing the name of the window.  
In the default state, the name of the window is its index.

**Example:** `LAY:REM '2'`  
Removes the result display in the window named '2'.

**Usage:** Event

**LAYout:REPLace[:WINDow]** <WindowName>,<WindowType>

This command replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window in the active measurement channel while keeping its position, index and window name.

To add a new window, use the `LAYout:ADD[:WINDow]?` command.

**Parameters:**

<WindowName> String containing the name of the existing window.  
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active measurement channel, use the `LAYout:CATalog[:WINDow]?` query.

<WindowType> Type of result display you want to use in the existing window.  
See `LAYout:ADD[:WINDow]?` on page 242 for a list of available window types.

**Example:** `LAY:REPL:WIND '1',MTAB`  
Replaces the result display in window 1 with a marker table.

**LAYout:SPLitter** <Index1>,<Index2>,<Position>

This command changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

Compared to the `DISPlay[:WINDow<n>]:SIZE` on page 241 command, the `LAYout:SPLitter` changes the size of all windows to either side of the splitter permanently, it does not just maximize a single window temporarily.

Note that windows must have a certain minimum size. If the position you define conflicts with the minimum size of any of the affected windows, the command will not work, but does not return an error.

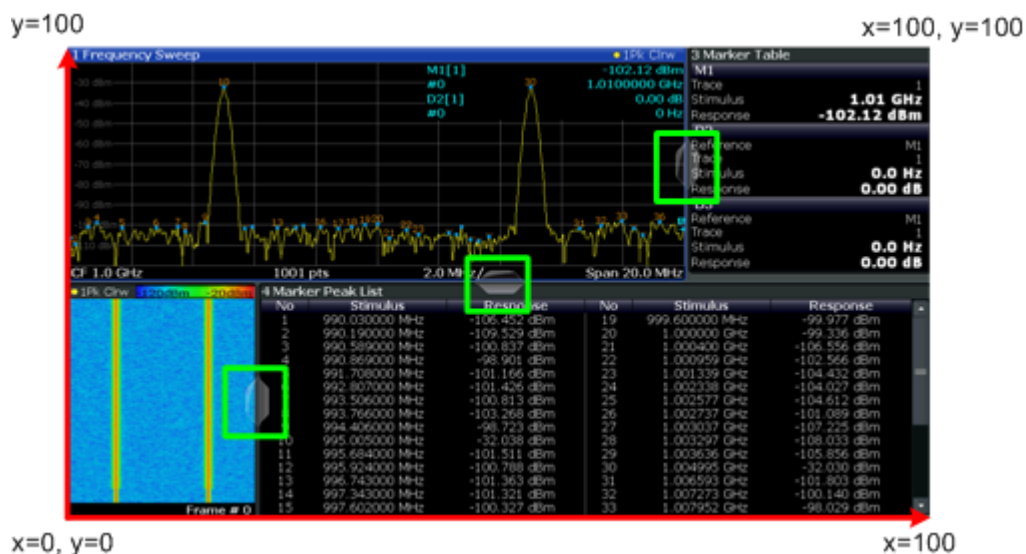


Figure 11-1: SmartGrid coordinates for remote control of the splitters

**Parameters:**

- <Index1> The index of one window the splitter controls.
- <Index2> The index of a window on the other side of the splitter.
- <Position> New vertical or horizontal position of the splitter as a fraction of the screen area (without channel and status bar and softkey menu).  
The point of origin ( $x = 0$ ,  $y = 0$ ) is in the lower left corner of the screen. The end point ( $x = 100$ ,  $y = 100$ ) is in the upper right corner of the screen. (See Figure 11-1.)  
The direction in which the splitter is moved depends on the screen layout. If the windows are positioned horizontally, the splitter also moves horizontally. If the windows are positioned vertically, the splitter also moves vertically.

Range: 0 to 100

**Example:** LAY:SPL 1, 3, 50  
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('Marker Table') to the center (50%) of the screen, i.e. in the figure above, to the left.

**Example:** LAY:SPL 1, 4, 70  
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('Marker Peak List') towards the top (70%) of the screen.  
The following commands have the exact same effect, as any combination of windows above and below the splitter moves the splitter vertically.

LAY:SPL 3, 2, 70

LAY:SPL 4, 1, 70

LAY:SPL 2, 1, 70

**LAYout:WINDow<n>:ADD?** <Direction>,<WindowType>

This command adds a measurement window to the display. Note that with this command, the suffix <n> determines the existing window next to which the new window is added, as opposed to [LAYout:ADD\[:WINDow\]?](#), for which the existing window is defined by a parameter.

To replace an existing window, use the [LAYout:WINDow<n>:REPLace](#) command.

This command is always used as a query so that you immediately obtain the name of the new window as a result.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Direction> LEFT | RIGHT | ABOVE | BELOW

<WindowType> Type of measurement window you want to add.  
See [LAYout:ADD\[:WINDow\]?](#) on page 242 for a list of available window types.

**Return values:**

<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

**Example:**

LAY:WIND1:ADD? LEFT,MTAB

Result:

'2'

Adds a new window named '2' with a marker table to the left of window 1.

**Usage:**

Query only

**LAYout:WINDow<n>:IDENTify?**

This command queries the **name** of a particular display window (indicated by the <n> suffix) in the active measurement channel.

**Note:** to query the **index** of a particular window, use the [LAYout:IDENTify\[:WINDow\]?](#) command.

**Suffix:**

<n> [Window](#)

**Return values:**

<WindowName> String containing the name of a window.  
In the default state, the name of the window is its index.

**Example:**

LAY:WIND2:IDEN?

Queries the name of the result display in window 2.

Response:

'2'

**Usage:**

Query only

**LAYout:WINDow<n>:REMOve**

This command removes the window specified by the suffix <n> from the display in the active measurement channel.

The result of this command is identical to the `LAYout:REMOve[:WINDow]` command.

**Suffix:**

<n> [Window](#)

**Example:**

LAY:WIND2:REM

Removes the result display in window 2.

**Usage:**

Event

**LAYout:WINDow<n>:REPLace <WindowType>**

This command changes the window type of an existing window (specified by the suffix <n>) in the active measurement channel.

The result of this command is identical to the `LAYout:REPLace[:WINDow]` command.

To add a new window, use the `LAYout:WINDow<n>:ADD?` command.

**Suffix:**

<n> [Window](#)

**Parameters:**

<WindowType>

Type of measurement window you want to replace another one with.

See `LAYout:ADD[:WINDow]?` on page 242 for a list of available window types.

**Example:**

LAY:WIND2:REPL MTAB

Replaces the result display in window 2 with a marker table.

## 11.8 Starting a Measurement

The measurement is started immediately when a 3GPP FDD application is activated, however, you can stop and start a new measurement any time.

<a href="#">ABORT</a> .....	249
<a href="#">INITiate&lt;n&gt;:CONMeas</a> .....	249
<a href="#">INITiate&lt;n&gt;:CONTinuous</a> .....	250
<a href="#">INITiate&lt;n&gt;:[IMMediate]</a> .....	250
<a href="#">INITiate&lt;n&gt;:SEQuencer:ABORt</a> .....	251
<a href="#">INITiate&lt;n&gt;:SEQuencer:IMMediate</a> .....	251
<a href="#">INITiate&lt;n&gt;:SEQuencer:MODE</a> .....	251
<a href="#">INITiate&lt;n&gt;:SEQuencer:REFRresh[:ALL]</a> .....	252
<a href="#">SYSTem:SEQuencer</a> .....	253



**ABORt**

This command aborts the measurement in the current measurement channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the `*OPC?` or `*WAI` command after `ABOR` and before the next command.

For details see the "Remote Basics" chapter in the R&S FSW User Manual.

To abort a sequence of measurements by the Sequencer, use the `INITiate<n>:SEQuencer:ABORt` command.

**Note on blocked remote control programs:**

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the R&S FSW is blocked for further commands. In this case, you must interrupt processing on the remote channel first in order to abort the measurement.

To do so, send a "Device Clear" command from the control instrument to the R&S FSW on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa:** `viClear()`
- **GPIB:** `ibclr()`
- **RSIB:** `RSDLLibclr()`

Now you can send the `ABORt` command on the remote channel performing the measurement.

**Example:** `ABOR; :INIT:IMM`  
Aborts the current measurement and immediately starts a new one.

**Example:** `ABOR; *WAI`  
`INIT:IMM`  
Aborts the current measurement and starts a new one once abortion has been completed.

**Usage:** Event  
SCPI confirmed

**INITiate<n>:CONMeas**

This command restarts a (single) measurement that has been stopped (using `ABORt`) or finished in single measurement mode.

The measurement is restarted at the beginning, not where the previous measurement was stopped.

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 maxhold or averaging functions.

**Suffix:**  
 <n> irrelevant

**Usage:** Event

**Manual operation:** See "[Continue Single Sweep](#)" on page 107

#### **INITiate<n>:CONTInuous <State>**

This command controls the measurement mode for an individual measurement channel.

Note that in single measurement mode, you can synchronize to the end of the measurement with \*OPC, \*OPC? or \*WAI. In continuous measurement mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous measurement mode in remote control, as results like trace data or markers are only valid after a single measurement end synchronization.

For details on synchronization see the "Remote Basics" chapter in the R&S FSW User Manual.

If the measurement mode is changed for a measurement channel while the Sequencer is active (see [INITiate<n>:SEQuencer:IMMEDIATE](#) on page 251) the mode is only considered the next time the measurement in that channel is activated by the Sequencer.

**Suffix:**  
 <n> irrelevant

**Parameters:**  
 <State> ON | OFF | 0 | 1  
**ON | 1**  
 Continuous measurement  
**OFF | 0**  
 Single measurement  
 \*RST: 1

**Example:**  
 INIT:CONT OFF  
 Switches the measurement mode to single measurement.  
 INIT:CONT ON  
 Switches the measurement mode to continuous measurement.

**Manual operation:** See "[Continuous Sweep/RUN CONT](#)" on page 107

#### **INITiate<n>:[IMMEDIATE]**

This command starts a (single) new measurement.

With measurement count or average count > 0, this means a restart of the corresponding number of measurements. With trace mode MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

You can synchronize to the end of the measurement with \*OPC, \*OPC? or \*WAI.

For details on synchronization see the "Remote Basics" chapter in the R&S FSW User Manual.

**Suffix:**

<n> irrelevant

**Usage:**

Event

**Manual operation:** See "[Single Sweep/ RUN SINGLE](#)" on page 107

**INITiate<n>:SEQuencer:ABORt**

This command stops the currently active sequence of measurements. The Sequencer itself is not deactivated, so you can start a new sequence immediately using [INITiate<n>:SEQuencer:IMMediate](#) on page 251.

To deactivate the Sequencer use [SYSTem:SEQuencer](#) on page 253.

**Suffix:**

<n> irrelevant

**Usage:**

Event

**INITiate<n>:SEQuencer:IMMediate**

This command starts a new sequence of measurements by the Sequencer.

Its effect is similar to the [INITiate<n>\[:IMMediate\]](#) command used for a single measurement.

Before this command can be executed, the Sequencer must be activated (see [SYSTem:SEQuencer](#) on page 253).

**Suffix:**

<n> irrelevant

**Example:**

```
SYST:SEQ ON
```

Activates the Sequencer.

```
INIT:SEQ:MODE SING
```

Sets single sequence mode so each active measurement will be performed once.

```
INIT:SEQ:IMM
```

Starts the sequential measurements.

**Usage:**

Event

**INITiate<n>:SEQuencer:MODE <Mode>**

This command selects the way the R&S FSW application performs measurements sequentially.

Before this command can be executed, the Sequencer must be activated (see [SYSTem:SEQuencer](#) on page 253).

A detailed programming example is provided in the "Operating Modes" chapter in the R&S FSW User Manual.

**Note:** In order to synchronize to the end of a sequential measurement using \*OPC, \*OPC? or \*WAI you must use `SINGLE` Sequence mode.

For details on synchronization see the "Remote Basics" chapter in the R&S FSW User Manual.

**Suffix:**

<n> irrelevant

**Parameters:**

<Mode>

**SINGLE**

Each measurement is performed once (regardless of the channel's sweep mode), considering each channels' sweep count, until all measurements in all active channels have been performed.

**CONTInuous**

The measurements in each active channel are performed one after the other, repeatedly (regardless of the channel's sweep mode), in the same order, until the Sequencer is stopped.

**CDEFIned**

First, a single sequence is performed. Then, only those channels in continuous sweep mode (`INIT:CONT ON`) are repeated.

\*RST: CONTInuous

**Example:**

`SYST:SEQ ON`

Activates the Sequencer.

`INIT:SEQ:MODE SING`

Sets single sequence mode so each active measurement will be performed once.

`INIT:SEQ:IMM`

Starts the sequential measurements.

---

**INITiate<n>:SEQuencer:REFResh[:ALL]**

This function is only available if the Sequencer is deactivated (`SYSTem:SEQuencer SYST:SEQ:OFF`) and only in MSRA mode.

The data in the capture buffer is re-evaluated by all active MSRA slave applications.

**Suffix:**

<n> irrelevant

**Example:**

```

SYST:SEQ:OFF
Deactivates the scheduler
INIT:CONT OFF
Switches to single sweep mode.
INIT;*WAI
Starts a new data measurement and waits for the end of the
sweep.
INIT:SEQ:REFR
Refreshes the display for all channels.

```

**Usage:** Event

---

### SYSTem:SEQuencer <State>

This command turns the Sequencer on and off. The Sequencer must be active before any other Sequencer commands (INIT:SEQ...) are executed, otherwise an error will occur.

A detailed programming example is provided in the "Operating Modes" chapter in the R&S FSW User Manual.

#### Parameters:

<State>

ON | OFF | 0 | 1

**ON | 1**  
The Sequencer is activated and a sequential measurement is started immediately.

**OFF | 0**  
The Sequencer is deactivated. Any running sequential measurements are stopped. Further Sequencer commands (INIT:SEQ...) are not available.

\*RST: 0

**Example:**

```

SYST:SEQ ON
Activates the Sequencer.
INIT:SEQ:MODE SING
Sets single Sequencer mode so each active measurement will
be performed once.
INIT:SEQ:IMM
Starts the sequential measurements.
SYST:SEQ OFF

```

## 11.9 Retrieving Results

The following commands are required to retrieve the results from a 3GPP FDD measurement in a remote environment.

When the channel type is required as a parameter by a remote command or provided as a result for a remote query, abbreviations or assignments to a numeric value are used as described in [Chapter 11.5.7, "Channel Detection"](#), on page 212.

**Specific commands:**

- [Retrieving Calculated Measurement Results](#).....254
- [Measurement Results for TRACe<n>\[:DATA\]? TRACE<n>](#).....258
- [Retrieving Trace Results](#).....265
- [Exporting Trace Results](#).....273
- [Retrieving RF Results](#).....275

**11.9.1 Retrieving Calculated Measurement Results**

The following commands describe how to retrieve the calculated results from the CDA and Time Alignment Error measurements.

- [CALCulate<n>:MARKer<m>:FUNction:TAERror:RESult?](#).....254
- [CALCulate<n>:MARKer<m>:FUNction:WCDPower\[:BTS\]:RESult?](#).....254
- [CALCulate<n>:MARKer<m>:FUNction:WCDPower:MS:RESult?](#).....256

**CALCulate<n>:MARKer<m>:FUNction:TAERror:RESult? <ResultType>**

This command queries the result of a time alignment measurement (see [Chapter 3.2, "Time Alignment Error Measurements"](#), on page 33).

**Suffix:**

<n>                    [Window](#)

<m>                    [Marker](#)

**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:**                BTS application only

**Manual operation:** See "[Result List](#)" on page 33

**CALCulate<n>:MARKer<m>:FUNction:WCDPower[:BTS]:RESult? <Measurement>**

This command queries the measured and calculated results of the 3GPP FDD BTS code domain power measurement.

**Suffix:**

<n>                    [Window](#)

<m>                    [Marker](#)

**Query parameters:**

<Measurement>	The parameter specifies the required evaluation method.
<b>ACHannels</b>	Number of active channels
<b>ARCDerror</b>	relative code domain error averaged over all channels with modulation type 64QAM
<b>CDPabsolute</b>	code domain power absolute
<b>CDPRelative</b>	code domain power relative
<b>CERror</b>	chip rate error
<b>CHANnel</b>	channel number
<b>CSLot</b>	channel slot number
<b>EVMPeak</b>	error vector magnitude peak
<b>EVMRms</b>	error vector magnitude RMS
<b>FERRor</b>	frequency error in Hz
<b>IOFFset</b>	imaginary part of the I/Q offset
<b>IQIMbalance</b>	I/Q imbalance
<b>IQOFFset</b>	I/Q offset
<b>MACCuracy</b>	composite EVM
<b>MPIC</b>	average power of inactive channels
<b>MTYPE</b>	modulation type: 2 – QPSK 4 – 16 QAM 5 – 64 QAM 15 – NONE
<b>PCDerror</b>	peak code domain error
<b>PSYMBOL</b>	number of pilot bits
<b>PTOTAL</b>	

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

<b>Example:</b>	<code>CALC:MARK:FUNC:WCDP:RES? PTOT</code>
<b>Usage:</b>	Query only
<b>Mode:</b>	BTS application only
<b>Manual operation:</b>	See " <a href="#">Code Domain Power</a> " on page 21 See " <a href="#">Result Summary</a> " on page 30

---

**CALCulate<n>:MARKer<m>:FUNCTion:WCDPower:MS:RESult? <Measurement>**

This command queries the measured and calculated results of the 3GPP FDD UE code domain power measurement.

**Suffix:**

<n>	<a href="#">Window</a>
<m>	<a href="#">Marker</a>



**Query parameters:**

<Measurement> The parameter specifies the required evaluation method.

**ACHannels**

Number of active channels

**CDPabsolute**

code domain power absolute

**CDPRelative**

code domain power relative

**CERRor**

chip rate error

**CHANnel**

channel number

**CMApping**

Channel branch

**CSLot**

channel slot number

**EVMPeak**

error vector magnitude peak

**EVMRms**

error vector magnitude RMS

**FERRor**

frequency error in Hz

**IQIMbalance**

I/Q imbalance

**IQOffset**

I/Q offset

**MACCuracy**

composite EVM

**MPIC**

average power of the inactive codes for the selected slot

**MTYPE**

modulation type:

BPSK-I: 0

BPSK-Q: 1

4PAM-I: 6

4PAM-Q: 7

NONE: 15

**PCDerror**

peak code domain error

**PSYMBOL**

Number of pilot bits

**PTOTAL**

total power

**RHO**

rho value for every slot

**SRATe**

symbol rate

**TFRame**

trigger to frame

**TOFFset**

timing offset

<b>Example:</b>	CALC:MARK:FUNC:WCDP:MS:RES? PTOT
<b>Usage:</b>	Query only
<b>Mode:</b>	UE application only
<b>Manual operation:</b>	See "Code Domain Power" on page 21

### 11.9.2 Measurement Results for TRACe<n>[:DATA]? TRACE<n>

The evaluation method selected by the LAY:ADD:WIND command also affects the results of the trace data query (TRACe<n>[:DATA]? TRACE<n>, see TRACe<n>[:DATA]? on page 266).

Details on the returned trace data depending on the evaluation method are provided here.

For details on the graphical results of these evaluation methods, see Chapter 3, "Measurements and Result Display", on page 15.

• Bitstream.....	259
• Channel Table.....	260
• Code Domain Error Power.....	260
• Code Domain Power.....	261
• Composite Constellation.....	261
• Composite EVM (RMS).....	261
• EVM vs Chip.....	261
• Frequency Error vs Slot.....	262
• Mag Error vs Chip.....	262
• Peak Code Domain Error.....	262
• Phase Discontinuity vs Slot.....	262
• Phase Error vs Chip.....	262
• Power vs Slot.....	262
• Power vs Symbol.....	262
• Result Summary.....	263
• Symbol Constellation.....	263
• Symbol EVM.....	264
• Symbol Magnitude Error.....	264
• Symbol Phase Error.....	264

### 11.9.2.1 Bitstream

When the trace data for this evaluation 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 one of the digits "6", "7" or "9".

The values and number of the bits are as follows (without HS-DPCCH channels, see [SENSe:]CDPower:HSDPamode on page 171) :

**Table 11-8: Bit values and numbers without HS-DPCCH channels**

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	$N_{\text{BitPerSymb}} = 2$
Number of symbols	$N_{\text{Symb}} = 10 \cdot 2^{(8-\text{Code Class})}$
Number of bits	$N_{\text{Bit}} = N_{\text{Symb}} \cdot N_{\text{BitPerSymb}}$
Format	Bit <sub>00</sub> , Bit <sub>01</sub> , Bit <sub>10</sub> , Bit <sub>11</sub> , Bit <sub>20</sub> , Bit <sub>21</sub> , ..., Bit <sub>N<sub>Symb</sub>0</sub> , Bit <sub>N<sub>Symb</sub>1</sub>

The values and number of the bits including HS-DPCCH channels (see [SENSe:]CDPower:HSDPamode on page 171) are as follows:

**Table 11-9: Bit values and numbers including HS-DPCCH channels**

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	$N_{\text{BitPerSymb}} = \{2, 4, 6\}$
Symbols per slot	$N_{\text{Symb\_Slot}} = 10 \cdot 2^{(8-\text{Code Class})}$
Symbols per frame	$N_{\text{Symb\_Frame}} = 15 \cdot N_{\text{Symb\_Slot}} = 150 \cdot 2^{(8-\text{Code Class})}$
Number of bits	$N_{\text{Bit}} = N_{\text{Symb\_Frame}} \cdot N_{\text{BitPerSymb\_MAX}}$

Format (16QAM)	Bit <sub>00</sub> , Bit <sub>01</sub> , Bit <sub>02</sub> , Bit <sub>03</sub> , Bit <sub>10</sub> , Bit <sub>11</sub> , Bit <sub>12</sub> , Bit <sub>13</sub> , ..., ..., Bit <sub>NSymb_Frame 0</sub> , Bit <sub>NSymb_Frame 1</sub> , Bit <sub>NSymb_Frame 2</sub> , Bit <sub>NSymb_Frame 3</sub>
Format (64QAM)	Bit <sub>00</sub> , Bit <sub>01</sub> , Bit <sub>02</sub> , Bit <sub>03</sub> , Bit <sub>04</sub> , Bit <sub>05</sub> , Bit <sub>10</sub> , Bit <sub>11</sub> , Bit <sub>12</sub> , Bit <sub>13</sub> , Bit <sub>14</sub> , Bit <sub>15</sub> , ..., Bit <sub>NSymb_Frame 0</sub> , Bit <sub>NSymb_Frame 1</sub> , Bit <sub>NSymb_Frame 2</sub> , Bit <sub>NSymb_Frame 3</sub> , Bit <sub>NSymb_Frame 4</sub> , Bit <sub>NSymb_Frame 5</sub>

### 11.9.2.2 Channel Table

When the trace data for this evaluation is queried, 5 (7) values are transmitted for each channel (depending on the query parameter):

- the class
- the channel number
- the absolute level
- the relative level
- the timing offset
- the pilot length \*)
- the active flag \*)

\*) for CTAB query parameter only

For details on these parameters see [TRAC:DATA? TRACE1](#) and [TRAC:DATA? CTAB](#).

#### Example:

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

Channel Pos.	Code class	Channel number	Abs. Level	Rel. level	Timing offset	Pilot Length	Active?
1	9	7	-40	-20	0	8	1
2	1	1	-40	-20	256 chips	2	1
3	7	255	-40	-20	2560 chips	6	1

TRAC:DATA? TRAC1 returns 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.

TRAC:DATA? CTAB returns the following result:

9, 7, -40, -20, 0, **8**, **1**, 1, 1, -40, -20, 256, **2**, **1**, 7, 255, -40, -20, 2560, **6**, **1**

### 11.9.2.3 Code Domain Error Power

When the trace data for this evaluation 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.

#### 11.9.2.4 Code Domain Power

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

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

For details on these parameters see [TRACe<n> \[ :DATA \] ?](#) on page 266.

#### 11.9.2.5 Composite Constellation

When the trace data for this evaluation is queried, the real and the imaginary branches 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.

#### 11.9.2.6 Composite EVM (RMS)

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

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

#### 11.9.2.7 EVM vs Chip

When the trace data for this evaluation is queried, a list of vector error values of all chips at the selected slot is returned (=2560 values). 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.

#### 11.9.2.8 Frequency Error vs Slot

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

<slot number>, <value in Hz>

#### 11.9.2.9 Mag Error vs Chip

When the trace data for this evaluation is queried, a list of magnitude error values of all chips at the selected slot is returned (=2560 values). 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.

#### 11.9.2.10 Peak Code Domain Error

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

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

#### 11.9.2.11 Phase Discontinuity vs Slot

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

<slot number>, <value in deg>

#### 11.9.2.12 Phase Error vs Chip

When the trace data for this evaluation is queried, a list of phase error values of all chips in the selected slot is returned (=2560 values). 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.

#### 11.9.2.13 Power vs Slot

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

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

#### 11.9.2.14 Power vs Symbol

When the trace data for this evaluation 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:

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

### 11.9.2.15 Result Summary

When the trace data for this evaluation 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 [ $\mu$ s]>,  
 <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]>,  
 <number of pilot bits>  
 <I/Q offset [%]>,  
 <I/Q imbalance [%]>

### 11.9.2.16 Symbol Constellation

When the trace data for this evaluation is queried, the real and the imaginary branches are transferred:

<Re<sub>0</sub>>, <Im<sub>0</sub>>, <Re<sub>1</sub>>, <Im<sub>1</sub>>, ..., <Re<sub>n</sub>>, <Im<sub>n</sub>>

The number of level values depends on the spreading factor:

Spreading factor	Number of level values
512	5
256	10
128	20
64	40

Spreading factor	Number of level values
32	80
16	160
8	320
4	640

#### 11.9.2.17 Symbol EVM

When the trace data for this evaluation is queried, the real and the imaginary branches are transferred:

<Re<sub>0</sub>>, <Im<sub>0</sub>>, <Re<sub>1</sub>>, <Im<sub>1</sub>>, ..., <Re<sub>n</sub>>, <Im<sub>n</sub>>

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

#### 11.9.2.18 Symbol Magnitude Error

When the trace data for this evaluation 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:

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

#### 11.9.2.19 Symbol Phase Error

When the trace data for this evaluation 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:

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



### 11.9.3 Retrieving Trace Results

The following commands describe how to retrieve the trace data from the CDA and Time Alignment Error measurements. Note that for these measurements, only 1 trace per window can be configured.

- `FORMat [ : DATA ]`
- `TRACe<n> [ : DATA ] ?` on page 266
- `TRACe<n>[:DATA]? TRACE1`
- `TRACe<n>[:DATA]? ABITstream`
- `TRACe<n>[:DATA]? ATRace1`
- `TRACe<n>[:DATA]? CTABle`
- `TRACe<n>[:DATA]? CWCDp`
- `TRACe<n>[:DATA]? FINal1`
- `TRACe<n>[:DATA]? LIST`
- `TRACe<n>[:DATA]? PWCDp`
- `TRACe<n>[:DATA]? TPVSlot`

---

#### **FORMat[:DATA] <Format>**

This command selects the data format that is used for transmission of trace data from the R&S FSW to the controlling computer.

Note that the command has no effect for data that you send to the R&S FSW. The R&S FSW automatically recognizes the data it receives, regardless of the format.

#### **Parameters:**

<Format>

#### **AScii**

AScii format, separated by commas.

This format is almost always suitable, regardless of the actual data format. However, the data is not as compact as other formats may be.

#### **REAL,32**

32-bit IEEE 754 floating-point numbers in the "definite length block format".

In the Spectrum application, the format setting `REAL` is used for the binary transmission of trace data.

For I/Q data, 8 bytes per sample are returned for this format setting.

\*RST:        ASCII

#### **Example:**

`FORM REAL,32`

#### **Usage:**

SCPI confirmed

**TRACe<n>[:DATA]? <MeasMode>**

This command queries the trace data from the measurement. Depending on the selected measurement mode, the results vary. For a detailed description of the results, see the individual commands.

**Suffix:**

<n> [Window](#)

**Query parameters:**

<MeasMode> ATRACE1 | ABITstream1 | CTABLE | CEVM | CWCDp | FINAL1 | LIST | PWCDp | TPVSlot | TRACE1

The data type defines which type of trace data is read.

**Example:**

TRAC:DATA? ATRACE

**Usage:**

Query only

**TRACe<n>[:DATA]? TRACE1**

This command returns the trace data. Depending on the evaluation, the trace data format varies.

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

For details see [Chapter 11.9.2, "Measurement Results for TRACe<n>\[:DATA\]? TRACE<n>"](#), on page 258.

**Suffix:**

<n> [Window](#)

**Return values:**

<CodeClass> **2 ... 9**

Code class of the channel

<ChannelNo> **0 ... 511**

Code number of the channel

<AbsLevel> **dBm**

Absolute level of the code channel at the selected channel slot.

<RelLevel> **%**

Relative level of the code channel at the selected channel slot referenced to CPICH or total power.

<TimingOffset> **0 ... 38400 [chips]**

Timing offset of the code channel to the CPICH 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.

**Example:**

TRAC2:DATA? TRACE1

Returns the trace data from trace 1 in window 2.

**Usage:**

Query only

- Manual operation:**
- See ["Code Domain Error Power"](#) on page 22
  - See ["Composite Constellation"](#) on page 22
  - See ["Composite EVM"](#) on page 23
  - See ["EVM vs Chip"](#) on page 24
  - See ["Mag Error vs Chip"](#) on page 25
  - See ["Peak Code Domain Error"](#) on page 27
  - See ["Phase Discontinuity vs Slot"](#) on page 27
  - See ["Phase Error vs Chip"](#) on page 28
  - See ["Power vs Symbol"](#) on page 30
  - See ["Result Summary"](#) on page 30
  - See ["Symbol Constellation"](#) on page 31
  - See ["Symbol EVM"](#) on page 31
  - See ["Symbol Magnitude Error"](#) on page 32
  - See ["Symbol Phase Error"](#) on page 32

---

### TRACe<n>[:DATA]? ABITstream

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 evaluation for the corresponding window is set to "Bitstream" using the `LAY:ADD:WIND "XTIM:CDP:BSTream"` command (see [LAYout:ADD\[:WINDow\] ?](#) on page 242).

The output format is identical to that of the `TRAC:DATA? TRAC` command for an activated Bitstream evaluation (see [Chapter 11.9.2, "Measurement Results for TRACe<n>\[:DATA\]? TRACE<n>"](#), on page 258). The only difference is the number of symbols which are evaluated. The `ABITstream` parameter evaluates all symbols of one entire frame (vs. only one slot for `TRAC:DATA? TRAC`).

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 (see examples below).

#### Suffix:

<n> [Window](#)

#### Example:

```
LAY:REPL 2, "XTIM:CDP:BSTream"
```

Sets the evaluation for window 2 to bit stream.

```
TRAC2:DATA? ABITstream
```

Returns the bit streams of all 15 slots in window 2, one after the other.

#### Usage:

Query only

**Manual operation:** See ["Bitstream"](#) on page 18

#### Examples for bits 7 and 8 for changing modulation types

**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 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 transmission. The bits of the suppressed slots are marked by the digit '6'. In this case, always 2 bits per symbol are transmitted.

---

**TRACe<n>[:DATA]? ATRace1**

This command returns a list of absolute Frequency Error vs Slot values for all 16 slots (based on CPICH slots). In contrast to the `TRACE1` parameter return value, absolute values are returned.

**Suffix:**

<n> [Window](#)

**Return values:**

<SlotNumber> Slot number  
 <FreqError> Absolute frequency error  
 Default unit: Hz

**Example:**

`TRAC2:DATA? ATR`  
 Returns a list of absolute frequency errors for all slots in window 2.

**Usage:** Query only

**Mode:** BTS application only

**Manual operation:** See "[Frequency Error vs Slot](#)" on page 25

---

**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>`.

This command is only available for Code Domain Power or Channel Table evaluations (see [Chapter 3.1.2, "Evaluation Methods for Code Domain Analysis"](#), on page 18).

<b>Suffix:</b>	
<n>	<a href="#">Window</a>
<b>Return values:</b>	
<CodeClass>	<b>2 ... 9</b> Code class of the channel
<ChannelNo>	<b>0 ... 511</b> Code number of the channel
<AbsLevel>	<b>dBm</b> Absolute level of the code channel at the selected channel slot.
<RelLevel>	<b>%</b> Relative level of the code channel at the selected channel slot referenced to CPICH or total power.
<TimingOffset>	<b>0 ... 38400 [chips]</b> Timing offset of the code channel to the CPICH 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.
<PilotLength>	The length of the pilot symbols. According to the 3GPP standard, the pilot length range depends on the code class. Range: 0,2,4,8,16 Default unit: symbols
<ActiveFlag>	0   1 Flag to indicate whether a channel is active (1) or not (0)
<b>Example:</b>	<code>TRAC:DATA? CTABle</code> Returns a list of channel information, including the pilot length and channel state.
<b>Usage:</b>	Query only
<b>Manual operation:</b>	See " <a href="#">Channel Table</a> " on page 19 See " <a href="#">Code Domain Power</a> " on page 21

---

#### TRACe<n>[:DATA]? CWCDp

This command returns additional results to the values returned for `TRACE<t>`.

The result is a 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.

This command is only available for Code Domain Power or Channel Table evaluations (see [Chapter 3.1.2, "Evaluation Methods for Code Domain Analysis"](#), on page 18).

**Suffix:**  
<n> [Window](#)

**Return values:**

<CodeClass>	<b>2 ... 9</b> Code class of the channel
<ChannelNo>	<b>0 ... 511</b> Code number of the channel
<AbsLevel>	<b>dBm</b> Absolute level of the code channel at the selected channel slot.
<RelLevel>	<b>%</b> Relative level of the code channel at the selected channel slot referenced to CPICH or total power.
<TimingOffset>	<b>0 ... 38400 [chips]</b> Timing offset of the code channel to the CPICH 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.
<PilotLength>	The length of the pilot symbols. According to the 3GPP standard, the pilot length range depends on the code class. Range: 0,2,4,8,16 Default unit: symbols
<ActiveFlag>	0   1 Flag to indicate whether a channel is active (1) or not (0)
<ChannelType>	Channel type. For details see <a href="#">Table 11-4</a> . Range: 0 ... 16
<ModType>	Modulation type of the code channel at the selected channel slot <b>2</b> QPSK <b>4</b> 16 QAM <b>15</b> NONE There is no power in the selected channel slot (slot is switched OFF). Range: 2,4,15
<Reserved>	for future use

**Example:**

```
TRAC:DATA? CWCDp
```

Returns a list of channel information for each channel in ascending order.

**Usage:**

Query only

**Manual operation:**

See "[Channel Table](#)" on page 19

See "[Code Domain Power](#)" on page 21

**TRACe<n>[:DATA]? FINal1**

This command returns the peak list. For each peak the following results are given:

**Suffix:**

<n> [Window](#)

**Return values:**

<Freq> Peak frequency  
 <Level> Peak level  
 <DeltaLevel> Delta between current peak level and next higher peak level

**Example:**

TRAC2:DATA? FINal1  
 Returns a list of peak values.

**Usage:**

Query only

**Mode:**

BTS application only

**TRACe<n>[:DATA]? LIST**

This command returns the peak list of the spectrum emission mask measurement list evaluation.

An array of values is returned for each range of the limit line:

<array of range 1>, <array of range 2>, ....., <array of range n>,

where each array consists of the following values:

<No>, <Start>, <Stop>, <RBW>, <Freq>, <Levelabs>, <Levelrel>, <Delta>, <Limit-check>, <Unused1>, <Unused2>

**Suffix:**

<n> [Window](#)

**Parameters:**

<No> Number of the limit line range  
 <Start> Start frequency of the limit line range  
 Default unit: Hz  
 <Stop> Stop frequency of the limit line range  
 Default unit: Hz  
 <RBW> Resolution bandwidth of the limit line range  
 Default unit: Hz  
 <Freq> Frequency of the peak power within the range  
 Default unit: Hz  
 <Levelabs> Absolute power of the peak within the range  
 Default unit: dBm

<Levelrel>	Relative power of the peak within the range related to channel power Default unit: dB
<Delta>	Power difference to margin power Default unit: dB
<Limitcheck>	0   1 Indicates whether the power is below [0] or above [1] the limit line
<Unused1>	for future use
<Unused2>	for future use
<b>Example:</b>	TRAC2:DATA? LIST Returns a list of SEM results for all slots in window 2.
<b>Usage:</b>	Query only

---

#### TRACe<n>[:DATA]? PWCDp

This command returns the pilot length in addition to the values returned for "TRACE<t>".

This command is only available for Code Domain Power or Channel Table evaluations (see [Chapter 3.1.2, "Evaluation Methods for Code Domain Analysis"](#), on page 18).

**Suffix:**

<n> [Window](#)

**Return values:**

<CodeClass>	<b>2 ... 9</b> Code class of the channel
<ChannelNo>	<b>0 ... 511</b> Code number of the channel
<AbsLevel>	<b>dBm</b> Absolute level of the code channel at the selected channel slot.
<RelLevel>	<b>%</b> Relative level of the code channel at the selected channel slot referenced to CPICH or total power.
<TimingOffset>	<b>0 ... 38400 [chips]</b> Timing offset of the code channel to the CPICH 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.
<PilotLength>	0,2,4,8,16 The length of the pilot symbols. According to the 3GPP standard, the pilot length range depends on the code class. Default unit: symbols



<b>Example:</b>	TRAC:DATA? PWCDp Returns a list of channel information, including the pilot length.
<b>Usage:</b>	Query only
<b>Mode:</b>	BTS application only
<b>Manual operation:</b>	See "Channel Table" on page 19 See "Code Domain Power" on page 21

**TRACe<n>[:DATA]? TPVSlot**

This command returns a comma-separated list of absolute Power vs Slot results for all 16 slots. In contrast to the TRACE<t> parameter result, absolute values are returned.

**Suffix:**

<n> [Window](#)

**Return values:**

<SlotNumber> **0...15**  
CPICH slot number

<Level> **dBm**  
Slot level value

**Example:**

```
CALC2:FEED 'XTIM:CDP:PVSlot:ABSolute'
```

Sets the evaluation for window 2 to POWER VS SLOT.

```
TRAC2:DATA? TPVSlot
```

Returns a list of absolute frequency errors for all slots in window 2.

**Usage:** Query only

**Manual operation:** See "Power vs Slot" on page 29

## 11.9.4 Exporting Trace Results

RF measurement trace results can be exported to a file.

For more commands concerning data and results storage see the R&S FSW User Manual.

<a href="#">MMEMory:STORe&lt;n&gt;:FINal</a> .....	273
<a href="#">MMEMory:STORe&lt;n&gt;:TRACe</a> .....	274
<a href="#">FORMat:DEXPort:DSEParator</a> .....	274

**MMEMory:STORe<n>:FINal <FileName>**

This command exports the marker peak list to a file.

The file format is \*.dat.

**Suffix:**

<n> [Window](#)

**Parameters:**

<FileName> String containing the path and name of the target file.

**Return values:**

<TraceNo> Always 1

<Frequency> Frequency of the peak in Hz

<Level> Absolute level of the peak in dBm

<DeltaLevel> Distance to the limit line in dB

**Example:**

```
MMEM:STOR:FIN 'C:\test'
```

Saves the current marker peak list in the file `test.dat`.

**MMEMory:STORe<n>:TRACe <Trace>, <FileName>**

This command exports trace data from the specified window to an ASCII file.

Trace export is only available for RF measurements.

For details on the file format see "Reference: ASCII File Export Format" in the R&S FSW User Manual.

**Secure User Mode**

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the R&S FSW User Manual.

**Suffix:**

<n> [Window](#)

**Parameters:**

<Trace> Number of the trace to be stored

<FileName> String containing the path and name of the target file.

**Example:**

```
MMEM:STOR1:TRAC 3, 'C:\TEST.ASC'
```

Stores trace 3 from window 1 in the file `TEST.ASC`.

**Usage:**

SCPI confirmed

**FORMat:DEXPort:DSEParator <Separator>**

This command selects the decimal separator for data exported in ASCII format.

**Parameters:**

&lt;Separator&gt;

**COMMa**

Uses a comma as decimal separator, e.g. 4,05.

**POINt**

Uses a point as decimal separator, e.g. 4.05.

\*RST:        \*RST has no effect on the decimal separator.  
 Default is POINt.

**Example:**

FORM:DEXP:DSEP POIN

Sets the decimal point as separator.

### 11.9.5 Retrieving RF Results

The following commands are required to retrieve the results of the 3GPP FDD RF measurements.

See also:

- [MMEMoRY:STORe<n>:FINAl](#) on page 273

<a href="#">CALCulate&lt;n&gt;:LIMit&lt;k&gt;:FAIL?</a> .....	275
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNcTION:POWer&lt;sb&gt;:RESult?</a> .....	276
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:Y?</a> .....	278
<a href="#">CALCulate&lt;n&gt;:STATistics:RESult&lt;t&gt;?</a> .....	278

**CALCulate<n>:LIMit<k>:FAIL?**

This command queries the result of a limit check in the specified window.

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 measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 250.

**Suffix:**<n>                      [Window](#)<k>                      [Limit line](#)**Return values:**

<Result>                **0**  
                               PASS  
                               **1**  
                               FAIL

**Example:**

INIT; \*WAI

Starts a new sweep and waits for its end.

CALC2:LIM3:FAIL?

Queries the result of the check for limit line 3 in window 2.

<b>Usage:</b>	Query only SCPI confirmed
<b>Manual operation:</b>	See " <a href="#">RF Combi</a> " on page 36 See " <a href="#">Spectrum Emission Mask</a> " on page 37

---

**CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult? <Measurement>**

This command queries the results of power measurements.

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 measurement mode.

See also [INITiate<n>:CONTInuous](#) on page 250.

**Suffix:**

<n>, <m>	irrelevant
<sb>	1   2   3 (4   5) Sub block in a Multi-standard radio measurement; MSR ACLR: 1 to 5 Multi-SEM: 1 to 3 for all other measurements: irrelevant

**Query parameters:**

&lt;Measurement&gt;

**ACPower | MCACpower**

ACLR measurements (also known as adjacent channel power or multicarrier adjacent channel measurements).

Returns the power for every active transmission and adjacent channel. The order is:

- power of the transmission channels
- power of adjacent channel (lower, upper)
- power of alternate channels (lower, upper)

**MSR ACLR results:**

For MSR ACLR measurements, the order of the returned results is slightly different:

- power of the transmission channels
- total power of the transmission channels for each sub block
- power of adjacent channels (lower, upper)
- power of alternate channels (lower, upper)
- power of gap channels (lower1, upper1, lower2, upper2)

The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

**GACLR**

For MSR ACLR measurements only: returns a list of ACLR values for each gap channel (lower1, upper1, lower2, upper2)

**MACM**

For MSR ACLR measurements only: returns a list of CACLR values for each gap channel (lower1, upper1, lower2, upper2)

**CN**

Carrier-to-noise measurements.

Returns the C/N ratio in dB.

**CNO**

Carrier-to-noise measurements.

Returns the C/N ratio referenced to a 1 Hz bandwidth in dBm/Hz.

**CPOWER**

Channel power measurements.

Returns the channel power. The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

For SEM measurements, the return value is the channel power of the reference range (in the specified sub block).

**PPOWER**

Peak power measurements.

Returns the peak power. The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

For SEM measurements, the return value is the peak power of the reference range (in the specified sub block).

#### **OBANdwidth | OBWidth**

Occupied bandwidth.

Returns the occupied bandwidth in Hz.

<b>Usage:</b>	Query only
<b>Manual operation:</b>	See " <a href="#">Channel Power ACLR</a> " on page 35 See " <a href="#">Occupied Bandwidth</a> " on page 35 See " <a href="#">Power</a> " on page 36 See " <a href="#">RF Combi</a> " on page 36 See " <a href="#">Spectrum Emission Mask</a> " on page 37 See " <a href="#">CCDF</a> " on page 38

#### **CALCulate<n>:MARKer<m>:Y?**

This command queries the position of a marker on the y-axis.

If necessary, the command activates the marker first.

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 measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 250.

#### **Suffix:**

<n>	<a href="#">Window</a>
<m>	<a href="#">Marker</a>

#### **Return values:**

<Result>	Result at the marker position.
----------	--------------------------------

#### **Example:**

```
INIT:CONT OFF
Switches to single measurement mode.
CALC:MARK2 ON
Switches marker 2.
INIT;*WAI
Starts a measurement and waits for the end.
CALC:MARK2:Y?
Outputs the measured value of marker 2.
```

<b>Usage:</b>	Query only
<b>Manual operation:</b>	See " <a href="#">Marker Table</a> " on page 26 See " <a href="#">CCDF</a> " on page 38 See " <a href="#">Marker Peak List</a> " on page 41

#### **CALCulate<n>:STATistics:RESult<t>? <ResultType>**

This command queries the results of a CCDF or ADP measurement for a specific trace.

<b>Suffix:</b>	
<n>	irrelevant
<t>	Trace
<b>Parameters:</b>	
<ResultType>	<p><b>MEAN</b> Average (=RMS) power in dBm measured during the measurement time.</p> <p><b>PEAK</b> Peak power in dBm measured during the measurement time.</p> <p><b>CFACTOR</b> Determined crest factor (= ratio of peak power to average power) in dB.</p> <p><b>ALL</b> Results of all three measurements mentioned before, separated by commas: &lt;mean power&gt;,&lt;peak power&gt;,&lt;crest factor&gt;</p>
<b>Example:</b>	<p>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</p>
<b>Usage:</b>	Query only
<b>Manual operation:</b>	See "CCDF" on page 38

## 11.10 Analysis

The following commands define general result analysis settings concerning the traces and markers.

- [Traces](#).....279
- [Markers](#).....281

### 11.10.1 Traces

The trace settings determine how the measured data is analyzed and displayed on the screen. In 3GPP FDD applications, only one trace per window can be configured for Code Domain Analysis.

- [DISPlay\[:WINDow<n>\]:TRACe<t>:MODE](#).....279
- [DISPlay\[:WINDow<n>\]:TRACe<t>\[:STATe\]](#).....280

---

**DISPlay[:WINDow<n>]:TRACe<t>:MODE <Mode>**

This command selects the trace mode.

In case of max hold, min hold or average trace mode, you can set the number of single measurements with `[SENSe:]SWEep:COUNT`. Note that synchronization to the end of the measurement is possible only in single sweep mode.

**Suffix:**

<n> [Window](#)

<t> [Trace](#)

**Parameters:**

<Mode>

**WRITE**

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

**AVERage**

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

**MAXHold**

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

**MINHold**

The minimum value is determined from several measurements and displayed. The R&S FSW saves the sweep result in the trace memory only if the new value is lower than the previous one.

**VIEW**

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

**BLANK**

Hides the selected trace.

\*RST: Trace 1: WRITE, Trace 2-6: BLANK

**Example:**

```
INIT:CONT OFF
```

Switching to single sweep mode.

```
SWE:COUN 16
```

Sets the number of measurements to 16.

```
DISP:TRAC3:MODE WRIT
```

Selects clear/write mode for trace 3.

```
INIT;*WAI
```

Starts the measurement and waits for the end of the measurement.

**Manual operation:** See "[Trace Mode](#)" on page 129

---

**DISPlay[:WINDow<n>]:TRACe<t>[:STATe] <State>**

This command turns a trace on and off.

The measurement continues in the background.



<b>Suffix:</b>	
<n>	Window
<t>	Trace
<b>Parameters:</b>	
<State>	ON   OFF   1   0
	*RST: 1 for TRACe1, 0 for TRACe 2 to 6
<b>Example:</b>	DISP:TRAC3 ON
<b>Usage:</b>	SCPI confirmed

## 11.10.2 Markers

Markers help you analyze your measurement results by determining particular values in the diagram. In 3GPP FDD applications, only 4 markers per window can be configured for Code Domain Analysis.

- [Individual Marker Settings](#).....281
- [General Marker Settings](#).....284
- [Positioning the Marker](#).....285

### 11.10.2.1 Individual Marker Settings

<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;[:STATE]</a> .....	281
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:X</a> .....	282
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:AOFF</a> .....	282
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;[:STATE]</a> .....	282
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:AOFF</a> .....	283
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:X</a> .....	283
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:X:RELative?</a> .....	283
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:Y?</a> .....	284

---

#### **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.

<b>Suffix:</b>	
<n>	Window
<m>	Marker
<b>Parameters:</b>	
<State>	ON   OFF
	*RST: OFF
<b>Example:</b>	CALC:MARK3 ON Switches on marker 3.
<b>Manual operation:</b>	See " <a href="#">Marker State</a> " on page 131 See " <a href="#">Marker Type</a> " on page 132

**CALCulate<n>:MARKer<m>:X <Position>**

This command moves a marker to a particular coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

**Suffix:**

<m> [Marker](#) (query: 1 to 16)

<n> [Window](#)

**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 Table"](#) on page 26  
See ["Marker Peak List"](#) on page 41  
See ["X-value"](#) on page 131

**CALCulate<n>:MARKer<m>:AOFF**

This command turns all markers off.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Example:**

`CALC:MARK:AOFF`

Switches off all markers.

**Usage:** Event

**Manual operation:** See ["All Markers Off"](#) on page 132

**CALCulate<n>:DELTamarker<m>[:STATE] <State>**

This command turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTmarker turns on delta marker 1.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:**

CALC:DELT2 ON  
 Turns on delta marker 2.

**Manual operation:**

See "[Marker State](#)" on page 131  
 See "[Marker Type](#)" on page 132

**CALCulate<n>:DELTamarker<m>:AOFF**

This command turns *all* delta markers off.

**Suffix:**

<n> [Window](#)  
 <m> irrelevant

**Example:**

CALC:DELT:AOff  
 Turns all delta markers off.

**Usage:**

Event

**CALCulate<n>:DELTamarker<m>:X <Position>**

This command moves a delta marker to a particular coordinate on the x-axis.

If necessary, the command activates the delta marker and positions a reference marker to the peak power.

**Suffix:**

<m> [Marker](#)  
 <n> [Window](#)

**Parameters:**

<Position> Numeric value that defines the marker position on the x-axis.  
 Range: The value range and unit depend on the measurement and scale of the x-axis.

**Example:**

CALC:DELT:X?  
 Outputs the absolute x-value of delta marker 1.

**Manual operation:**

See "[X-value](#)" on page 131

**CALCulate<n>:DELTamarker<m>:X:RELative?**

This command queries the relative position of a delta marker on the x-axis.

If necessary, the command activates the delta marker first.

**Suffix:**

<n> [Window](#)

<m>	Marker
<b>Return values:</b>	
<Position>	Position of the delta marker in relation to the reference marker.
<b>Example:</b>	<pre>CALC:DELT3:X:REL?</pre> <p>Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.</p>
<b>Usage:</b>	Query only

---

#### CALCulate<n>:DELTaMarker<m>:Y?

This command queries the relative position of a delta marker on the y-axis.

If necessary, the command activates the delta marker first.

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 measurement mode.

See also [INITiate<n>:CONTinuous](#) on page 250.

The unit depends on the application of the command.

<b>Suffix:</b>	
<m>	Marker
<n>	Window
<b>Return values:</b>	
<Position>	Position of the delta marker in relation to the reference marker or the fixed reference.
<b>Example:</b>	<pre>INIT:CONT OFF</pre> <p>Switches to single sweep mode.</p> <pre>INIT;*WAI</pre> <p>Starts a sweep and waits for its end.</p> <pre>CALC:DELT2 ON</pre> <p>Switches on delta marker 2.</p> <pre>CALC:DELT2:Y?</pre> <p>Outputs measurement value of delta marker 2.</p>
<b>Usage:</b>	Query only

#### 11.10.2.2 General Marker Settings

[DISPlay:MTABLE](#)..... 284

---

#### DISPlay:MTABLE <DisplayMode>

This command turns the marker table on and off.

**Parameters:**

<DisplayMode>      **ON**  
Turns the marker table on.

**OFF**  
Turns the marker table off.

**AUTO**  
Turns the marker table on if 3 or more markers are active.

\*RST:            AUTO

**Example:**

DISP:MTAB ON  
Activates the marker table.

**Manual operation:** See "Marker Table Display" on page 133

**11.10.2.3 Positioning the Marker**

This chapter contains remote commands necessary to position the marker on a trace.

- [Positioning Normal Markers](#) .....285
- [Positioning Delta Markers](#).....288

**Positioning Normal Markers**

The following commands position markers on the trace.

<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTion:CPICH</a> .....	285
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNCTion:PCCPch</a> .....	286
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum:LEFT</a> .....	286
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum:NEXT</a> .....	286
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum[:PEAK]</a> .....	286
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MAXimum:RIGHT</a> .....	287
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum:LEFT</a> .....	287
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum:NEXT</a> .....	287
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum[:PEAK]</a> .....	287
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:MINimum:RIGHT</a> .....	288

**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 evaluations.

**Suffix:**

<n>                    [Window](#)

<m>                    [Marker](#)

**Example:**

CALC:MARK:FUNC:CPIC

**Manual operation:** See "Marker To CPICH" on page 135

---

**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 evaluations.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Example:**

CALC:MARK:FUNC:PCCP

**Manual operation:** See "[Marker To PCCPCH](#)" on page 136

---

**CALCulate<n>:MARKer<m>:MAXimum:LEFT**

This command moves a marker to the next lower peak.

The search includes only measurement values to the left of the current marker position.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:**

Event

**Manual operation:** See "[Search Next Peak](#)" on page 135

---

**CALCulate<n>:MARKer<m>:MAXimum:NEXT**

This command moves a marker to the next lower peak.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:**

Event

**Manual operation:** See "[Search Next Peak](#)" on page 135

---

**CALCulate<n>:MARKer<m>:MAXimum[:PEAK]**

This command moves a marker to the highest level.

If the marker is not yet active, the command first activates the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:**

Event

**Manual operation:** See ["Peak Search"](#) on page 135

---

#### **CALCulate<n>:MARKer<m>:MAXimum:RIGHT**

This command moves a marker to the next lower peak.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See ["Search Next Peak"](#) on page 135

---

#### **CALCulate<n>:MARKer<m>:MINimum:LEFT**

This command moves a marker to the next minimum value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See ["Search Next Minimum"](#) on page 135

---

#### **CALCulate<n>:MARKer<m>:MINimum:NEXT**

This command moves a marker to the next minimum value.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See ["Search Next Minimum"](#) on page 135

---

#### **CALCulate<n>:MARKer<m>:MINimum[:PEAK]**

This command moves a marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

**Suffix:**

<n> [Window](#)

<m>                   Marker

**Usage:**               Event

**Manual operation:** See "[Search Minimum](#)" on page 135

#### **CALCulate<n>:MARKer<m>:MINimum:RIGHT**

This command moves a marker to the next minimum value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n>                   Window

<m>                   Marker

**Usage:**               Event

**Manual operation:** See "[Search Next Minimum](#)" on page 135

#### **Positioning Delta Markers**

The following commands position delta markers on the trace.

<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:FUNCTION:CPICH</a> .....	288
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:FUNCTION:PCCPch</a> .....	288
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MAXimum:LEFT</a> .....	289
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MAXimum:NEXT</a> .....	289
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MAXimum[:PEAK]</a> .....	289
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MAXimum:RIGHT</a> .....	290
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MINimum:LEFT</a> .....	290
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MINimum:NEXT</a> .....	290
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MINimum[:PEAK]</a> .....	290
<a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:MINimum:RIGHT</a> .....	291

#### **CALCulate<n>:DELTamarker<m>:FUNCTION:CPICH**

This command sets the delta marker to channel 0.

This command is only available in Code Domain Power and Code Domain Error Power evaluations.

**Suffix:**

<n>                   Window

<m>                   Marker

**Example:**           CALC:DELT2:FUNC:CPICH

#### **CALCulate<n>:DELTamarker<m>:FUNCTION:PCCPch**

This command sets the delta marker to the position of the PCCPCH.



This command is only available in code domain power and code domain error power evaluations.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Example:** `CALC:DELT2:FUNC:PCCP`

---

**CALCulate<n>:DELTamarker<m>:MAXimum:LEFT**

This command moves a delta marker to the next higher value.

The search includes only measurement values to the left of the current marker position.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See "[Search Next Peak](#)" on page 135

---

**CALCulate<n>:DELTamarker<m>:MAXimum:NEXT**

This command moves a marker to the next higher value.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See "[Search Next Peak](#)" on page 135

---

**CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]**

This command moves a delta marker to the highest level.

If the marker is not yet active, the command first activates the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See "[Peak Search](#)" on page 135

---

**CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT**

This command moves a delta marker to the next higher value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See "[Search Next Peak](#)" on page 135

---

**CALCulate<n>:DELTamarker<m>:MINimum:LEFT**

This command moves a delta marker to the next higher minimum value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See "[Search Next Minimum](#)" on page 135

---

**CALCulate<n>:DELTamarker<m>:MINimum:NEXT**

This command moves a marker to the next higher minimum value.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See "[Search Next Minimum](#)" on page 135

---

**CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]**

This command moves a delta marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See ["Search Minimum"](#) on page 135

---

#### **CALCulate<n>:DELTaMarker<m>:MINimum:RIGHT**

This command moves a delta marker to the next higher minimum value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n> [Window](#)

<m> [Marker](#)

**Usage:** Event

**Manual operation:** See ["Search Next Minimum"](#) on page 135

## 11.11 Importing and Exporting I/Q Data and Results

For details on importing and exporting I/Q data see [Chapter 7, "I/Q Data Import and Export"](#), on page 137.

<a href="#">MMEMory:LOAD:IQ:STATe</a> .....	291
<a href="#">MMEMory:STORe&lt;n&gt;:IQ:COMMeNt</a> .....	291
<a href="#">MMEMory:STORe&lt;n&gt;:IQ:STATe</a> .....	292

---

#### **MMEMory:LOAD:IQ:STATe 1,<FileName>**

This command restores I/Q data from a file.

The file extension is \*.iq.tar.

**Parameters:**

<FileName> String containing the path and name of the source file.

**Example:**

```
MMEM:LOAD:IQ:STAT 1, 'C:
\R_S\Instr\user\data.iq.tar'
Loads IQ data from the specified file.
```

**Usage:** Setting only

**Manual operation:** See ["I/Q Import"](#) on page 138

---

#### **MMEMory:STORe<n>:IQ:COMMeNt <Comment>**

This command adds a comment to a file that contains I/Q data.

**Suffix:**

<n> irrelevant

**Parameters:**

<Comment> String containing the comment.

## Configuring the Slave Application Data Range (MSRA mode only)

**Example:** `MMEM:STOR:IQ:COMM 'Device test 1b'`  
Creates a description for the export file.  
`MMEM:STOR:IQ:STAT 1, 'C:`  
`\R_S\Instr\user\data.iq.tar'`  
Stores I/Q data and the comment to the specified file.

**Manual operation:** See "[I/Q Export](#)" on page 138

**MMEMory:STORe<n>:IQ:STATe 1, <FileName>**

This command writes the captured I/Q data to a file.

The file extension is \*.iq.tar. By default, the contents of the file are in 32-bit floating point format.

**Secure User Mode**

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the R&S FSW User Manual.

**Suffix:**

<n> irrelevant

**Parameters:**

1

<FileName> String containing the path and name of the target file.

**Example:** `MMEM:STOR:IQ:STAT 1, 'C:`  
`\R_S\Instr\user\data.iq.tar'`  
Stores the captured I/Q data to the specified file.

**Manual operation:** See "[I/Q Export](#)" on page 138

## 11.12 Configuring the Slave Application Data Range (MSRA mode only)

In MSRA operating mode, only the MSRA Master actually captures data; the MSRA slave applications define an extract of the captured data for analysis, referred to as the **slave application data**.

For the 3GPP FDD BTS slave application, the slave application data range is defined by the same commands used to define the signal capture in Signal and Spectrum Analyzer mode (see [[SENSe:](#)] [CDPower:IQLength](#) on page 209). Be sure to select the correct measurement channel before executing this command.

In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the slave application data for the 3GPP FDD BTS measurement.

The **analysis interval** used by the individual result displays cannot be edited, but is determined automatically. However, you can query the currently used analysis interval for a specific window.

The **analysis line** is displayed by default but can be hidden or re-positioned.

### Remote commands exclusive to MSRA slave applications

The following commands are only available for MSRA slave application channels:

CALCulate<n>:MSRA:ALINE:SHOW.....	293
CALCulate<n>:MSRA:ALINE[:VALue].....	293
CALCulate<n>:MSRA:WINDow<n>:IVAL?.....	293
INITiate<n>:REFresh.....	294
[SENSe:]MSRA:CAPTure:OFFSet.....	294

---

#### CALCulate<n>:MSRA:ALINE:SHOW

This command defines whether or not the analysis line is displayed in all time-based windows in all MSRA slave applications and the MSRA Master.

**Note:** even if the analysis line display is off, the indication whether or not the currently defined line position lies within the analysis interval of the active slave application remains in the window title bars.

##### Suffix:

<n>                      irrelevant

##### Parameters:

<State>                      ON | OFF  
                                   \*RST:            ON

---

#### CALCulate<n>:MSRA:ALINE[:VALue] <Position>

This command defines the position of the analysis line for all time-based windows in all MSRA slave applications and the MSRA Master.

##### Suffix:

<n>                      irrelevant

##### Parameters:

<Position>                      Position of the analysis line in seconds. The position must lie within the measurement time of the MSRA measurement.  
                                   Default unit: s

---

#### CALCulate<n>:MSRA:WINDow<n>:IVAL?

This command queries the analysis interval for the window specified by the WINDow suffix <n> (the CALC suffix is irrelevant). This command is only available in slave application measurement channels, not the MSRA View or MSRA Master.

## Configuring the Slave Application Data Range (MSRA mode only)

<b>Suffix:</b>	
<n>	Window
<b>Return values:</b>	
<IntStart>	Start value of the analysis interval in seconds Default unit: s
<IntStop>	Stop value of the analysis interval in seconds
<b>Usage:</b>	Query only

**INITiate<n>:REFresh**

This function is only available if the Sequencer is deactivated (`SYSTem:SEQuencer SYST:SEQ:OFF`) and only for slave applications in MSRA mode, not the MSRA Master.

The data in the capture buffer is re-evaluated by the currently active slave application only. The results for any other slave applications remain unchanged.

<b>Suffix:</b>	
<n>	irrelevant
<b>Example:</b>	<pre>SYST:SEQ:OFF Deactivates the scheduler INIT:CONT OFF Switches to single sweep mode. INIT;*WAI Starts a new data measurement and waits for the end of the sweep. INST:SEL 'IQ ANALYZER' Selects the IQ Analyzer channel. INIT:REFR Refreshes the display for the I/Q Analyzer channel.</pre>
<b>Usage:</b>	Event
<b>Manual operation:</b>	See " <a href="#">Refresh ( MSRA only)</a> " on page 108

**[SENSe:]MSRA:CAPTure:OFFSet <Offset>**

This setting is only available for slave applications in MSRA mode, not for the MSRA Master. It has a similar effect as the trigger offset in other measurements.

<b>Parameters:</b>	
<Offset>	<p>This parameter defines the time offset between the capture buffer start and the start of the extracted slave application data. The offset must be a positive value, as the slave application can only analyze data that is contained in the capture buffer.</p> <p>Range: 0 to &lt;Record length&gt; *RST: 0</p>
<b>Manual operation:</b>	See " <a href="#">Capture Offset</a> " on page 93

## 11.13 Querying the Status Registers

The following commands are required for the status reporting system specific to the 3GPP FDD applications. In addition, the 3GPP FDD applications also use the standard status registers of the R&S FSW (depending on the measurement type).

For details on the common R&S FSW status registers refer to the description of remote control basics in the R&S FSW User Manual.



\*RST does not influence the status registers.



The `STATUS:QUESTIONABLE:DIQ` register is described in "[STATUS:QUESTIONABLE:DIQ Register](#)" on page 183.

The `STATUS:QUESTIONABLE:SYNC` register contains application-specific information about synchronization errors or errors during pilot symbol detection.

**Table 11-10: Status error bits in `STATUS:QUESTIONABLE:SYNC` register for 3GPP FDD applications**

Bit	Definition
0	Not used.
1	<p>Frame Sync failed</p> <p>This bit is set when synchronization is not possible within the application.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• Incorrectly set frequency</li> <li>• Incorrectly set level</li> <li>• Incorrectly set scrambling code</li> <li>• Incorrectly set values for Q-INVERT or SIDE BAND INVERT</li> <li>• Invalid signal at input</li> <li>• Antenna 1 synchronization is not possible (Time Alignment Error measurements, 3GPP FDD BTS only)</li> </ul>
2	<p>For Time Alignment Error measurements (3GPP FDD BTS only): bit is set if antenna 2 synchronization is not possible;</p> <p>Otherwise: not used.</p>
3 to 4	Not used.
5	<p>Incorrect Pilot Symbol</p> <p>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.</p> <p>Possible reasons:</p> <ul style="list-style-type: none"> <li>• Incorrectly sent pilot symbols in the received frame.</li> <li>• Low signal to noise ratio (SNR) of the W-CDMA signal.</li> <li>• 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.</li> <li>• 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).</li> </ul>

Bit	Definition
6 to 14	Not used.
15	This bit is always 0.

STATus:QUESTionable:SYNC[:EVENT]? .....	296
STATus:QUESTionable:SYNC:CONDition? .....	296
STATus:QUESTionable:SYNC:ENABle .....	296
STATus:QUESTionable:SYNC:NTRansition .....	297
STATus:QUESTionable:SYNC:PTRansition .....	297

---

### STATus:QUESTionable:SYNC[:EVENT]? <ChannelName>

This command reads out the EVENT section of the status register.

The command also deletes the contents of the EVENT section.

#### Suffix:

<n>                      Window

<m>                      Marker

#### Query parameters:

<ChannelName>      String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

**Usage:**                      Query only

---

### STATus:QUESTionable:SYNC:CONDition? <ChannelName>

This command reads out the CONDition section of the status register.

The command does not delete the contents of the EVENT section.

#### Suffix:

<n>                      Window

<m>                      Marker

#### Query parameters:

<ChannelName>      String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

**Usage:**                      Query only

---

### STATus:QUESTionable:SYNC:ENABle <BitDefinition>, <ChannelName>

This command controls the ENABle part of a register.



The ENABLE part allows true conditions in the EVENT part of the status register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit transitions to true, a positive transition will occur in the summary bit reported to the next higher level.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Parameters:**

&lt;BitDefinition&gt; Range: 0 to 65535

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

**STATus:QUESTionable:SYNC:NTRansition <BitDefinition>,<ChannelName>**

This command controls the Negative TRansition part of a register.

Setting a bit causes a 1 to 0 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENT register.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Parameters:**

&lt;BitDefinition&gt; Range: 0 to 65535

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

**STATus:QUESTionable:SYNC:PTRansition <BitDefinition>,<ChannelName>**

These commands control the Positive TRansition part of a register.

Setting a bit causes a 0 to 1 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENT register.

**Suffix:**<n> [Window](#)<m> [Marker](#)**Parameters:**

&lt;BitDefinition&gt; Range: 0 to 65535

<ChannelName> String containing the name of the channel.  
The parameter is optional. If you omit it, the command works for the currently active channel.

## 11.14 Deprecated Commands

The following commands are provided for compatibility to other signal analyzers only. For new remote control programs use the specified alternative commands.

CALCulate<n>:FEED.....	298
[SENSe:]CDPower:LEVel:ADJust.....	299
[SENSe:]CDPower:PRESet .....	299
[SENSe:]CDPower:UCPich:CODE.....	299
[SENSe:]CDPower:UCPich:PATTern.....	300
[SENSe:]CDPower:UCPich[:STATe].....	300

### CALCulate<n>:FEED <Evaluation>

This command selects the evaluation method of the measured data that is to be displayed in the specified window.

Note that this command is maintained for compatibility reasons only. Use the LAYout commands for new remote control programs (see [Chapter 11.7.2, "Working with Windows in the Display"](#), on page 241).

#### Suffix:

<n>                      Window

#### Parameters:

<Evaluation>            Type of evaluation you want to display.  
See the table below for available parameter values.

#### Example:

```
INST:SEL BWCD
Activates 3GPP FDD BTS mode.
CALC:FEED CDP
Selects the display of the code domain power.
```

**Table 11-11: <Evaluation> parameter values for 3GPP FDD applications**

String Parameter	Enum Parameter	Evaluation
'XTIM:CDP:BSTream'	BITStream	Bitstream
'XTIM:CDP:COMP:CONStellation'	CCONst	Composite Constellation
'XPOW:CDEPower'	CDEPower	Code Domain Error Power
'XPOW:CDP' 'XPOW:CDP:ABSolute'	CDPower	Code Domain Power (absolute scaling)
'XPOW:CDP:RATio'	CDPower	Code Domain Power (relative scaling) *)
'XTIM:CDP:MACCuracy'	CEVM	Composite EVM
'XTIM:CDP:ERR:CTable'	CTABLE	Channel Table
'XTIMe:CDP:CHIP:EVM'	EVMChip	EVM vs Chip
'XTIM:CDP:FVSLot'	FESLot	Frequency Error vs Slot
*) Use [SENS:]CDP:PDIS ABS   REL subsequently to change the scaling		

String Parameter	Enum Parameter	Evaluation
'XTIMe:CDP:CHIP:MAGNitude'	MECHip	Magnitude Error vs Chip
'XTIM:CDP:ERR:PCDomain'	PCDerror	Peak Code Domain Error
'XTIM:CDPower:PSVSlot'	PDSLot	Phase Discontinuity vs Slot
'XTIMe:CDPower:CHIP:PHASe'	PECHip	Phase Error vs Chip
'XTIM:CDP:PVSLot'	PSLot	Power vs Slot (absolute scaling)
'XTIM:CDP:PVSLot:ABSolute'		
'XTIM:CDP:PVSLot:RATio'	PSLot	Power vs Slot (relative scaling)*)
'XTIM:CDP:PVSYmbol'	PSYMBOL	Power vs Symbol
'XTIM:CDP:ERR:SUMMary'	RSUMmary	Result Summary
'XPOW:CDP:RATio'	SCONst	Symbol Constellation
'XTIM:CDP:SYMB:EVM'	SEVM	Symbol EVM
'XTIMe:CDPower:SYMBOL:EVM:MAGNitude'	SMERror	Symbol Magnitude Error
'XTIMe:CDPower:SYMBOL:EVM:PHASe'	SPError	Symbol Phase Error
*) Use [SENS:]CDP:PDIS ABS   REL subsequently to change the scaling		

#### [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 FSW or limiting the dynamic range by an S/N ratio that is too small.

Note that this command is retained for compatibility reasons only. For new R&S FSW programs use [\[SENSe:\]ADJust:LEVel](#) on page 229.

#### [SENSe:]CDPower:PRESet

This command resets the 3GPP FDD channel to its predefined settings. Any RF measurement is aborted and the measurement type is reset to Code Domain Analysis.

Note that this command is retained for compatibility reasons only. For new R&S FSW programs use [SYSTem:PRESet:CHANnel\[:EXECute\]](#) on page 167.

**Usage:** Event

#### [SENSe:]CDPower:UCPich:CODE <CodeNumber>

This command sets the code number of the user defined CPICH used for signal analysis.

This command only applies to antenna 1.

Note that this command is maintained for compatibility reasons only. Use [\[SENSe:\]CDPower:UCPich:ANT<antenna>:CODE](#) on page 210 for new remote control programs.

**Parameters:**

<CodeNumber>      Range:      0 to 225  
                          \*RST:        0

**Example:**                SENS:CDP:UCP:CODE 10

**Mode:**                    BTS application only

**[SENSe:]CDPower:UCPich:PATtern <Pattern>**

This command defines which pattern is used for signal analysis for the user-defined CPICH (see [\[SENSe:\]CDPower:UCPich\[:STATe\]](#) on page 300).

This command only applies to antenna 1.

Note that this command is maintained for compatibility reasons only. Use [\[SENSe:\]CDPower:UCPich:ANT<antenna>\[:STATe\]](#) on page 211 for new remote control programs.

**Parameters:**

<Pattern>                **1**  
                          fixed usage of "Pattern 1" according to standard  
                          **2**  
                          fixed usage of "Pattern 2" according to standard  
                          \*RST:        2

**Example:**                SENS:CDP:UCP:PATT 1

**Mode:**                    BTS application only

**[SENSe:]CDPower:UCPich[:STATe] <State>**

Defines whether the common pilot channel (CPICH) is defined by a user-defined position instead of its default position.

If enabled, the user-defined position must be defined using [\[SENSe:\]CDPower:UCPich:CODE](#) on page 299.

This command only applies to antenna 1.

Note that this command is maintained for compatibility reasons only. Use [\[SENSe:\]CDPower:UCPich:ANT<antenna>:CODE](#) on page 210 for new remote control programs.

**Parameters:**

<State>                    ON | OFF  
                          \*RST:        OFF

**Example:**                SENS:CDP:UCP ON

**Mode:** BTS application only

## 11.15 Programming Examples (R&S FSW-k72)

The following programming examples are based on the measurement examples described in [Chapter 10, "Measurement Examples"](#), on page 145 for manual operation.

The measurements are performed with an R&S FSW equipped with option R&S FSW-K72. Only the commands required to control the R&S FSW-K72 application are provided, not the signal generator.

The measurements are performed using the following devices and accessories:

- The R&S FSW with Application Firmware R&S FSW-K72: 3GPP FDD BTS base station test
- The Vector Signal Generator R&S SMW100A with option R&S SMW-K42: digital standard 3GPP FDD (requires options R&S SMW-B10, R&S SMW-B13 and R&S SMW-B103)
- 1 coaxial cable, 50Ω, approx. 1 m, N connector
- 1 coaxial cable, 50Ω, approx. 1 m, BNC connector

### Test setup

1. Connect the RF output of the R&S SMW200A to the input of the R&S FSW.
2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference input (REF OUT) on the rear panel of the R&S SMW200A (coaxial cable with BNC connectors).
3. Connect the external trigger input of the R&S FSW (TRIGGER INPUT) to the external trigger output of the R&S SMW200A (TRIGOUT1 of PAR DATA).

### Settings on the R&S SMW200A

Setting	value
Preset	
Frequency	2.1175 GHz
Level	0 dBm
Digital standard	3GPP FDD
Link direction	DOWN/FORWARD
Test model	Test_Model_1_16_channels
Base station	BTS 1
Digital standard - State	ON
Scrambling code	0000

The following measurements are described:

- [Measurement 1: Measuring the Signal Channel Power](#).....302
- [Measurement 2: Determining the Spectrum Emission Mask](#)..... 303
- [Measurement 3: Measuring the Relative Code Domain Power](#)..... 304
- [Measurement 4: Triggered Measurement of Relative Code Domain Power](#)..... 306
- [Measurement 5: Measuring the Composite EVM](#)..... 306
- [Measurement 6: Determining the Peak Code Domain Error](#).....307

### 11.15.1 Measurement 1: Measuring the Signal Channel Power

```
*RST
//Reset the instrument
INST:CRE:NEW BWCD, 'BTSMeasurement'
//Activate a 3GPP FDD BTS measurement channel named "BTSMeasurement"
DISP:TRAC:Y:SCAL:RLEV 0
//Set the reference level to 0 dBm
FREQ:CENT 2.1175 GHz
//Set the center Frequency to 2.1175 GHz
CONF:WCDP:BTS:MEAS POW
//Select the power measurement
DISP:TRAC:Y:SCAL:AUTO ONCE
//Optimize the scaling of the y-axis for the current measurement
INIT:CONT OFF
//Stops continuous sweep
SWE:COUN 100
//Sets the number of sweeps to be performed to 100
INIT;*WAI
//Start a new measurement with 100 sweeps and wait for the end
CALC:MARK:FUNC:POW:RES? CPOW
//Retrieves the calculated total power value of the signal channel
//Result: -1.02 [dB]
TRAC:DATA? TRACE1
//Retrieve the trace data of the power measurement
//Result: -1.201362252,-1.173495054,-1.187217355,-1.186594367,-1.171583891,
//-1.188250422,-1.204138160,-1.181404829,-1.186317205,-1.197872400, [...]
```

**Table 11-12: Trace results for power measurement**

Frequency	Power level
-1.201362252	-1.173495054
-1.187217355	-1.186594367
-1.171583891	-1.188250422
...	...

## 11.15.2 Measurement 2: Determining the Spectrum Emission Mask

```

*RST
//Reset the instrument
INST:CRE:NEW BWCD,'BTSMeasurement'
//Activate a 3GPP FDD BTS measurement channel named "BTSMeasurement"
DISP:TRAC:Y:SCAL:RLEV 0
//Set the reference level to 0 dBm
FREQ:CENT 2.1175 GHz
//Set the center Frequency to 2.1175 GHz
CONF:WCDP:BTS:MEAS ESP
//Select the spectrum emission mask measurement
DISP:TRAC:Y:SCAL:AUTO ONCE
//Optimize the scaling of the y-axis for the current measurement
INIT:CONT OFF
//Stops continuous sweep
SWE:COUN 100
//Sets the number of sweeps to be performed to 100
INIT;*WAI
//Start a new measurement with 100 sweeps and wait for the end
CALC:MARK:FUNC:POW:RES? CPOW
//Retrieves the calculated channel power value of the reference channel
//Result: -36.013 [dBm]
CALC:LIM:FAIL?
//QBTSries the result of the limit check
//Result: 0 [passed]
TRAC:DATA? LIST
//Retrieves the peak list of the spectrum emission mask measurement
//Result:
//+1.000000000,-1.275000000E+007,-8.500000000E+006,+1.000000000E+006,+2.108782336E+009,
//-8.057177734E+001,-7.882799530E+001,-2.982799530E+001,+0.000000000,+0.000000000,+0.000000000

//+2.000000000,-8.500000000E+006,-7.500000000E+006,+1.000000000E+006,+2.109000064E+009,
//-8.158547211E+001,-7.984169006E+001,-3.084169006E+001,+0.000000000,+0.000000000,+0.000000000

//+3.000000000,-7.500000000E+006,-3.500000000E+006,+1.000000000E+006,+2.113987200E+009,
//-4.202708435E+001,-4.028330231E+001,-5.270565033,+0.000000000,+0.000000000,+0.000000000,

[...]

```

Table 11-13: Trace results for SEM measurement

R an ge N o.	Start freq. [Hz]	Stop freq. [Hz]	RBW [Hz]	Freq. peak power [Hz]	Abs. peak power [dBm]	Rel. peak power [%]	Delta to margin [dB]	Limit check result	-	-	-
1	+1.00000 0000	-1.27500 0000E +007	-8.50000 0000E +006	+1.00000 0000E +006	+2.10878 2336E +009	-8.05717 7734E +001	-7.88279 9530E +001	-2.982 79953 0E +001	+	+	+0
2	+2.00000 0000	-8.50000 0000E +006	-7.50000 0000E +006	+1.00000 0000E +006	+2.10900 0064E +009	-8.15854 7211E +001	-7.98416 9006E +001	-3.084 16900 6E +001	+	+	+0
3	+3.00000 0000	-7.50000 0000E +006	-3.50000 0000E +006	+1.00000 0000E +006	+2.11398 7200E +009	-4.20270 8435E +001	-4.02833 0231E +001	-5.270 56503 3	+	+	+0
...	...										

### 11.15.3 Measurement 3: Measuring the Relative Code Domain Power

```

*RST
//Reset the instrument
INST:CRE:NEW BWCD, 'BTSMeasurement'
//Activate a 3GPP FDD BTS measurement channel named "BTSMeasurement"
DISP:TRAC:Y:SCAL:RLEV 10
//Set the reference level to 10 dBm
FREQ:CENT 2.1175 GHz
//Set the center Frequency to 2.1175 GHz
DISP:TRAC:Y:SCAL:AUTO ONCE
//Optimize the scaling of the y-axis for the current measurement
INIT:CONT OFF
//Stops continuous sweep
SWE:COUN 100
//Set the number of sweeps to be performed to 100
INIT;*WAI
//Start a new measurement with 100 sweeps and wait for the end
CALC:MARK:FUNC:WCDP:BTS:RES? CDPR
//Retrieve the relative code domain power
//Result: 0 [dB]
TRAC:DATA? TRACE1

```



```
//Retrieve the trace data of the code domain power measurement
//Result: +8.000000000,+0.000000000,-4.319848537,-3.011176586,+0.000000000,
//+2.000000000,+1.000000000,-4.318360806,-3.009688854,+1.000000000,
//+8.000000000,+0.000000000,-7.348078156E+001,-7.217211151E+001,+1.000000000,
// [...]
-----Synchronizing the Reference Frequencies-----

ROSC:SOUR EXT10
//Select the external Frequency from the REF INPUT 1.20 MHz connector as a reference

CALC:MARK:FUNC:WCDP:BTS:RES? FERR
//Query the carrier Frequency error
//Result: 0.1 [Hz]
```

-----Behaviour with Incorrect Scrambling Code-----

```
CDP:LCOD:DVAL 0001
//Change the scrambling code on the analyzer to 0001 (default is 0000)
TRAC:DATA? TRACE1
//Retrieve the trace data of the code domain power measurement
//Result: 1.000000000,+8.000000000,+7.700000000E+001,-2.991873932E+001,-2.861357307E+001,
//+0.000000000,+8.000000000,+7.800000000E+001,-2.892916107E+001,-2.762399483E+001,
//+1.000000000,+8.000000000,+7.800000000E+001,-2.856664085E+001,-2.726147461E+001,
// [...]
```

**Table 11-14: Trace results for Relative Code Domain Power measurement (correct scrambling code)**

Code class	Channel no.	Abs. power level [dBm]	Rel. power level [%]	Timing offset [chips]
+8.000000000	+0.000000000	-4.319848537	-3.011176586	+0.000000000
+2.000000000	+1.000000000	-4.318360806	-3.009688854	+1.000000000
+8.000000000	+0.000000000	-7.348078156E+001	-7.217211151E+001	+1.000000000
...	...			

**Table 11-15: Trace results for Relative Code Domain Power measurement (incorrect scrambling code)**

Code class	Channel no.	Abs. power level [dBm]	Rel. power level [%]	Timing offset [chips]
1.000000000	+8.000000000	+7.700000000E+001	-2.991873932E+001	-2.861357307E+001
+0.000000000	+8.000000000	+7.800000000E+001	-2.892916107E+001	-2.762399483E+001
+1.000000000	+8.000000000	+7.800000000E+001	-2.856664085E+001	-2.726147461E+001
...	...			

### 11.15.4 Measurement 4: Triggered Measurement of Relative Code Domain Power

```

*RST
//Reset the instrument
INST:CRE:NEW BWCD, 'BTSMeasurement'
//Activate a 3GPP FDD BTS measurement channel named "BTSMeasurement"
DISP:TRAC:Y:SCAL:RLEV 10
//Set the reference level to 10 dBm
FREQ:CENT 2.1175 GHz
//Set the center Frequency to 2.1175 GHz
CDP:LCOD:DVAL 0000
//Change the scrambling code on the analyzer to 0000
TRIG:SOUR EXT
//Set the trigger source to the external trigger
//(TRIGGER INPUT connector)
DISP:TRAC:Y:SCAL:AUTO ONCE
//Optimize the scaling of the y-axis for the current measurement
INIT:CONT OFF
//Stops continuous sweep
SWE:COUN 100
//Set the number of sweeps to be performed to 100
INIT;*WAI
//Start a new measurement with 100 sweeps and wait for the end
CALC:MARK:FUNC:WCDP:BTS:RES? TFR
//Retrieve the trigger to frame (the offset between trigger event and
// start of first captured frame)
//Result: 0.00599987013 [ms]

----- Compensating a delay of the trigger event to the first captured frame -----

TRIG:HOLD 100 us
//Change the trigger offset to 100 us (=trigger to frame value)
CALC:MARK:FUNC:WCDP:BTS:RES? TFR
//Retrieve the trigger to frame value
//Result: 0.00599987013 [ms]

```

### 11.15.5 Measurement 5: Measuring the Composite EVM

```

*RST
//Reset the instrument
INST:CRE:NEW BWCD, 'BTSMeasurement'
//Activate a 3GPP FDD BTS measurement channel named "BTSMeasurement"
DISP:TRAC:Y:SCAL:RLEV 10
//Set the reference level to 10 dBm
FREQ:CENT 2.1175 GHz
//Set the center Frequency to 2.1175 GHz
TRIG:SOUR EXT
//Set the trigger source to the external trigger

```

```
// (TRIGGER INPUT connector)
LAY:REPL '2','XTIM:CDP:MACC'
// Replace the second measurement window (Result Summary) by Composite EVM evaluation
DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE
// Optimize the scaling of the y-axis for the Composite EVM measurement
INIT:CONT OFF
// Stops continuous sweep
SWE:COUN 100
// Set the number of sweeps to be performed to 100
INIT;*WAI
// Start a new measurement with 100 sweeps and wait for the end
TRAC2:DATA? TRACE1
// Retrieve the trace data of the composite EVM measurement
// Result: +0.000000000,+5.876136422E-001,
// +1.000000000,+5.916179419E-001,
// +2.000000000,+5.949081182E-001,
// [...]
```

**Table 11-16: Trace results for Composite EVM measurement**

(CPICH) Slot number	EVM
0	+5.876136422E-001
1	+5.916179419E-001
2	+5.949081182E-001
...	...

### 11.15.6 Measurement 6: Determining the Peak Code Domain Error

```
*RST
// Reset the instrument
INST:CRE:NEW BWCD,'BTSMeasurement'
// Activate a 3GPP FDD BTS measurement channel named "BTSMeasurement"
DISP:TRAC:Y:SCAL:RLEV 10
// Set the reference level to 10 dBm
FREQ:CENT 2.1175 GHz
// Set the center Frequency to 2.1175 GHz
TRIG:SOUR EXT
// Set the trigger source to the external trigger
// (TRIGGER INPUT connector)
LAY:REPL '2','XTIM:CDP:ERR:PCD'
// Replace the second measurement window (Result Summary) by the
// Peak Code Domain Error evaluation
DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE
// Optimize the scaling of the y-axis for the Composite EVM measurement
INIT:CONT OFF
// Stops continuous sweep
SWE:COUN 100
// Set the number of sweeps to be performed to 100
```

```
INIT;*WAI
//Start a new measurement with 100 sweeps and wait for the end
TRAC2:DATA? TRACE1
//Retrieve the trace data of the Peak Code Domain Error measurement
//Result: +0.000000000,-6.730751038E+001,
//+1.000000000,-6.687619019E+001,
//+2.000000000,-6.728615570E+001,
// [...]
```

**Table 11-17: Trace results for Peak Code Domain Error measurement**

Slot number	Peak Error
0	-6.730751038E+001
1	-6.687619019E+001
2	-6.728615570E+001
...	...

## 12 I/Q Data File Format (iq-tar)

I/Q data is packed in a file with the extension `.iq.tar`. An iq-tar file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. the sample rate. The objective of the iq-tar file format is to separate I/Q data from the meta information while still having both inside one file. In addition, the file format allows you to preview the I/Q data in a web browser, and allows you to include user-specific data.

The iq-tar container packs several files into a single `.tar` archive file. Files in `.tar` format can be unpacked using standard archive tools (see [http://en.wikipedia.org/wiki/Comparison\\_of\\_file\\_archivers](http://en.wikipedia.org/wiki/Comparison_of_file_archivers)) available for most operating systems. The advantage of `.tar` files is that the archived files inside the `.tar` file are not changed (not compressed) and thus it is possible to read the I/Q data directly within the archive without the need to unpack (untar) the `.tar` file first.

### Contained files

An iq-tar file must contain the following files:

- **I/Q parameter XML file**, e.g. `xyz.xml`  
Contains meta information about the I/Q data (e.g. sample rate). The filename can be defined freely, but there must be only one single I/Q parameter XML file inside an iq-tar file.
- **I/Q data binary file**, e.g. `xyz.complex.float32`  
Contains the binary I/Q data of all channels. There must be only one single I/Q data binary file inside an iq-tar file.

Optionally, an iq-tar file can contain the following file:

- **I/Q preview XSLT file**, e.g. `open_IqTar_xml_file_in_web_browser.xslt`  
Contains a stylesheet to display the I/Q parameter XML file and a preview of the I/Q data in a web browser.  
A sample stylesheet is available at [http://www.rohde-schwarz.com/file/open\\_IqTar\\_xml\\_file\\_in\\_web\\_browser.xslt](http://www.rohde-schwarz.com/file/open_IqTar_xml_file_in_web_browser.xslt).

### 12.1 I/Q Parameter XML File Specification



The content of the I/Q parameter XML file must comply with the XML schema `RsIqTar.xsd` available at: <http://www.rohde-schwarz.com/file/RsIqTar.xsd>.

In particular, the order of the XML elements must be respected, i.e. iq-tar uses an "ordered XML schema". For your own implementation of the iq-tar file format make sure to validate your XML file against the given schema.

The following example shows an I/Q parameter XML file. The XML elements and attributes are explained in the following sections.

**Sample I/Q parameter XML file: xyz.xml**

```

<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl"
href="open_IqTar_xml_file_in_web_browser.xslt"?>
<RS_IQ_TAR_FileFormat fileFormatVersion="1"
xsi:noNamespaceSchemaLocation="RsIqTar.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <Name>R&S FSW</Name>
  <Comment>Here is a comment</Comment>
  <DateTime>2011-01-24T14:02:49</DateTime>
  <Samples>68751</Samples>
  <Clock unit="Hz">6.5e+006</Clock>
  <Format>complex</Format>
  <DataType>float32</DataType>
  <ScalingFactor unit="V">1</ScalingFactor>
  <NumberOfChannels>1</NumberOfChannels>
  <DataFilename>xyz.complex.float32</DataFilename>
  <UserData>
    <UserDefinedElement>Example</UserDefinedElement>
  </UserData>
  <PreviewData>...</PreviewData>
</RS_IQ_TAR_FileFormat>

```

Element	Description
RS_IQ_TAR_File-Format	The root element of the XML file. It must contain the attribute <code>fileFormatVersion</code> that contains the number of the file format definition. Currently, <code>fileFormatVersion "2"</code> is used.
Name	Optional: describes the device or application that created the file.
Comment	Optional: contains text that further describes the contents of the file.
DateTime	Contains the date and time of the creation of the file. Its type is <code>xs:dateTime</code> (see <code>RsIqTar.xsd</code> ).
Samples	Contains the number of samples of the I/Q data. For multi-channel signals all channels have the same number of samples. One sample can be: <ul style="list-style-type: none"> <li>• A complex number represented as a pair of I and Q values</li> <li>• A complex number represented as a pair of magnitude and phase values</li> <li>• A real number represented as a single real value</li> </ul> See also <code>Format</code> element.
Clock	Contains the clock frequency in Hz, i.e. the sample rate of the I/Q data. A signal generator typically outputs the I/Q data at a rate that equals the clock frequency. If the I/Q data was captured with a signal analyzer, the signal analyzer used the clock frequency as the sample rate. The attribute <code>unit</code> must be set to "Hz".
Format	Specifies how the binary data is saved in the I/Q data binary file (see <code>DataFilename</code> element). Every sample must be in the same format. The format can be one of the following: <ul style="list-style-type: none"> <li>• <code>complex</code>: Complex number in cartesian format, i.e. I and Q values interleaved. I and Q are unitless</li> <li>• <code>real</code>: Real number (unitless)</li> <li>• <code>polar</code>: Complex number in polar format, i.e. magnitude (unitless) and phase (rad) values interleaved. Requires <code>DataType = float32</code> or <code>float64</code></li> </ul>

Element	Description
DataType	<p>Specifies the binary format used for samples in the I/Q data binary file (see <code>DataFilename</code> element and <a href="#">Chapter 12.2, "I/Q Data Binary File"</a>, on page 313).</p> <p>The following data types are allowed:</p> <ul style="list-style-type: none"> <li>• <code>int8</code>: 8 bit signed integer data</li> <li>• <code>int16</code>: 16 bit signed integer data</li> <li>• <code>int32</code>: 32 bit signed integer data</li> <li>• <code>float32</code>: 32 bit floating point data (IEEE 754)</li> <li>• <code>float64</code>: 64 bit floating point data (IEEE 754)</li> </ul>
ScalingFactor	<p>Optional: describes how the binary data can be transformed into values in the unit Volt. The binary I/Q data itself has no unit. To get an I/Q sample in the unit Volt the saved samples have to be multiplied by the value of the <code>ScalingFactor</code>. For polar data only the magnitude value has to be multiplied. For multi-channel signals the <code>ScalingFactor</code> must be applied to all channels.</p> <p>The attribute <code>unit</code> must be set to "v".</p> <p>The <code>ScalingFactor</code> must be &gt; 0. If the <code>ScalingFactor</code> element is not defined, a value of 1 V is assumed.</p>
NumberOfChannels	<p>Optional: specifies the number of channels, e.g. of a MIMO signal, contained in the I/Q data binary file. For multi-channels, the I/Q samples of the channels are expected to be interleaved within the I/Q data file (see <a href="#">Chapter 12.2, "I/Q Data Binary File"</a>, on page 313). If the <code>NumberOfChannels</code> element is not defined, one channel is assumed.</p>
DataFilename	<p>Contains the filename of the I/Q data binary file that is part of the iq-tar file.</p> <p>It is recommended that the filename uses the following convention:  <code>&lt;xyz&gt;.&lt;Format&gt;.&lt;Channels&gt;ch.&lt;Type&gt;</code></p> <ul style="list-style-type: none"> <li>• <code>&lt;xyz&gt;</code> = a valid Windows file name</li> <li>• <code>&lt;Format&gt;</code> = complex, polar or real (see <code>Format</code> element)</li> <li>• <code>&lt;Channels&gt;</code> = Number of channels (see <code>NumberOfChannels</code> element)</li> <li>• <code>&lt;Type&gt;</code> = float32, float64, int8, int16, int32 or int64 (see <code>DataType</code> element)</li> </ul> <p>Examples:</p> <ul style="list-style-type: none"> <li>• xyz.complex.1ch.float32</li> <li>• xyz.polar.1ch.float64</li> <li>• xyz.real.1ch.int16</li> <li>• xyz.complex.16ch.int8</li> </ul>
UserData	<p>Optional: contains user, application or device-specific XML data which is not part of the iq-tar specification. This element can be used to store additional information, e.g. the hardware configuration. User data must be valid XML content.</p>
PreviewData	<p>Optional: contains further XML elements that provide a preview of the I/Q data. The preview data is determined by the routine that saves an iq-tar file (e.g. R&amp;S FSW). For the definition of this element refer to the <code>RsIqTar.xsd</code> schema. Note that the preview can be only displayed by current web browsers that have JavaScript enabled and if the XSLT stylesheet <code>open_IqTar_xml_file_in_web_browser.xslt</code> is available.</p>

### Example: ScalingFactor

Data stored as `int16` and a desired full scale voltage of 1 V

$$\text{ScalingFactor} = 1 \text{ V} / \text{maximum int16 value} = 1 \text{ V} / 2^{15} = 3.0517578125\text{e-}5 \text{ V}$$

Scaling Factor	Numerical value	Numerical value x ScalingFactor
Minimum (negative) int16 value	$-2^{15} = -32768$	-1 V
Maximum (positive) int16 value	$2^{15}-1 = 32767$	0.999969482421875 V

**Example: PreviewData in XML**

```

<PreviewData>
  <ArrayOfChannel length="1">
    <Channel>
      <PowerVsTime>
        <Min>
          <ArrayOfFloat length="256">
            <float>-134</float>
            <float>-142</float>
            ...
            <float>-140</float>
          </ArrayOfFloat>
        </Min>
        <Max>
          <ArrayOfFloat length="256">
            <float>-70</float>
            <float>-71</float>
            ...
            <float>-69</float>
          </ArrayOfFloat>
        </Max>
      </PowerVsTime>
      <Spectrum>
        <Min>
          <ArrayOfFloat length="256">
            <float>-133</float>
            <float>-111</float>
            ...
            <float>-111</float>
          </ArrayOfFloat>
        </Min>
        <Max>
          <ArrayOfFloat length="256">
            <float>-67</float>
            <float>-69</float>
            ...
            <float>-70</float>
            <float>-69</float>
          </ArrayOfFloat>
        </Max>
      </Spectrum>
      <IQ>
        <Histogram width="64" height="64">0123456789...0</Histogram>
      </IQ>
    </Channel>
  </ArrayOfChannel>
</PreviewData>

```



## 12.2 I/Q Data Binary File

The I/Q data is saved in binary format according to the format and data type specified in the XML file (see `Format` element and `DataType` element). To allow reading and writing of streamed I/Q data, all data is interleaved, i.e. complex values are interleaved pairs of I and Q values and multi-channel signals contain interleaved (complex) samples for channel 0, channel 1, channel 2 etc. If the `NumberOfChannels` element is not defined, one channel is presumed.

### Example: Element order for real data (1 channel)

```
I[0],           // Real sample 0
I[1],           // Real sample 1
I[2],           // Real sample 2
...
```

### Example: Element order for complex cartesian data (1 channel)

```
I[0], Q[0],     // Real and imaginary part of complex sample 0
I[1], Q[1],     // Real and imaginary part of complex sample 1
I[2], Q[2],     // Real and imaginary part of complex sample 2
...
```

### Example: Element order for complex polar data (1 channel)

```
Mag[0], Phi[0], // Magnitude and phase part of complex sample 0
Mag[1], Phi[1], // Magnitude and phase part of complex sample 1
Mag[2], Phi[2], // Magnitude and phase part of complex sample 2
...
```

### Example: Element order for complex cartesian data (3 channels)

Complex data: I[channel no][time index], Q[channel no][time index]

```
I[0][0], Q[0][0], // Channel 0, Complex sample 0
I[1][0], Q[1][0], // Channel 1, Complex sample 0
I[2][0], Q[2][0], // Channel 2, Complex sample 0

I[0][1], Q[0][1], // Channel 0, Complex sample 1
I[1][1], Q[1][1], // Channel 1, Complex sample 1
I[2][1], Q[2][1], // Channel 2, Complex sample 1

I[0][2], Q[0][2], // Channel 0, Complex sample 2
I[1][2], Q[1][2], // Channel 1, Complex sample 2
I[2][2], Q[2][2], // Channel 2, Complex sample 2
...
```

### Example: Element order for complex cartesian data (1 channel)

This example demonstrates how to store complex cartesian data in float32 format using MATLAB®.

```
% Save vector of complex cartesian I/Q data, i.e. iqiqiq...
N = 100
iq = randn(1,N)+1j*randn(1,N)
fid = fopen('xyz.complex.float32','w');
for k=1:length(iq)
    fwrite(fid, single(real(iq(k))), 'float32');
    fwrite(fid, single(imag(iq(k))), 'float32');
end
fclose(fid)
```

## List of Remote Commands (3GPP FDD)

[SENSe:]ADJust:ALL.....	227
[SENSe:]ADJust:CONFigure:DURation.....	227
[SENSe:]ADJust:CONFigure:DURation:MODE.....	228
[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer.....	228
[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer.....	228
[SENSe:]ADJust:LEVel.....	229
[SENSe:]AVERage<n>:COUNT.....	225
[SENSe:]CDPower:ANTenna.....	170
[SENSe:]CDPower:BASE.....	208
[SENSe:]CDPower:CODE.....	229
[SENSe:]CDPower:CPB.....	231
[SENSe:]CDPower:ETChips.....	233
[SENSe:]CDPower:FILTer[:STATe].....	209
[SENSe:]CDPower:FRAMe[:VALue].....	229
[SENSe:]CDPower:HSDPamode.....	171
[SENSe:]CDPower:HSLot.....	234
[SENSe:]CDPower:ICTReshold.....	215
[SENSe:]CDPower:IQLength.....	209
[SENSe:]CDPower:LCODE:DVALue.....	173
[SENSe:]CDPower:LCODE:SEARch:LIST?.....	172
[SENSe:]CDPower:LCODE:SEARch[:IMMEDIATE]?.....	171
[SENSe:]CDPower:LCODE:TYPE.....	174
[SENSe:]CDPower:LCODE[:VALue].....	174
[SENSe:]CDPower:LEVel:ADJust.....	299
[SENSe:]CDPower:MAPPing.....	230
[SENSe:]CDPower:MIMO.....	172
[SENSe:]CDPower:NORMAlize.....	232
[SENSe:]CDPower:PCONTrol.....	173
[SENSe:]CDPower:PDIFf.....	232
[SENSe:]CDPower:PDISplay.....	232
[SENSe:]CDPower:PREFerence.....	233
[SENSe:]CDPower:PRESet.....	299
[SENSe:]CDPower:QINVert.....	209
[SENSe:]CDPower:QPSK.....	174
[SENSe:]CDPower:SBANd.....	210
[SENSe:]CDPower:SFACTor.....	175
[SENSe:]CDPower:SLOT.....	230
[SENSe:]CDPower:STYPe.....	212
[SENSe:]CDPower:UCPich:ANT<antenna>:CODE.....	210
[SENSe:]CDPower:UCPich:ANT<antenna>:PATTern.....	211
[SENSe:]CDPower:UCPich:ANT<antenna>[:STATe].....	211
[SENSe:]CDPower:UCPich:CODE.....	299
[SENSe:]CDPower:UCPich:PATTern.....	300
[SENSe:]CDPower:UCPich[:STATe].....	300
[SENSe:]FREQuency:CENTer.....	193
[SENSe:]FREQuency:CENTer:STEP.....	193
[SENSe:]FREQuency:CENTer:STEP:AUTO.....	194

[SENSe:]FREQUency:OFFSet.....	194
[SENSe:]MSRA:CAPTure:OFFSet.....	294
[SENSe:]PROBe<p>:ID:PARTnumber?.....	190
[SENSe:]PROBe<p>:ID:SRNumber?.....	190
[SENSe:]PROBe<p>:SETup:CMOffset.....	189
[SENSe:]PROBe<p>:SETup:MODE.....	190
[SENSe:]PROBe<p>:SETup:NAME?.....	191
[SENSe:]PROBe<p>:SETup:STATe?.....	191
[SENSe:]PROBe<p>:SETup:TYPE?.....	191
[SENSe:]SWEep:COUNT.....	225
[SENSe:]TAERror:CARRier:COUNT?.....	236
[SENSe:]TAERror:CARRier<c>:ANTenna<antenna>:CPICH.....	235
[SENSe:]TAERror:CARRier<c>:ANTenna<antenna>:PATTern.....	235
[SENSe:]TAERror:CARRier<c>:DELete.....	236
[SENSe:]TAERror:CARRier<c>:INSert.....	236
[SENSe:]TAERror:CARRier<c>:OFFSet.....	237
[SENSe:]TAERror:CARRier<c>:SCODE.....	237
[SENSe:]TAERror:CATalog?.....	237
[SENSe:]TAERror:DELete.....	238
[SENSe:]TAERror:NEW.....	238
[SENSe:]TAERror:PRESet.....	238
[SENSe:]TAERror:SAVE.....	239
ABORT.....	249
CALCulate:MARKer<m>:FUNctioN:ZOOM.....	231
CALCulate<n>:CDPower:Mapping.....	230
CALCulate<n>:DELTamarker<m>:AOFF.....	283
CALCulate<n>:DELTamarker<m>:FUNctioN:CPICH.....	288
CALCulate<n>:DELTamarker<m>:FUNctioN:PCCPch.....	288
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT.....	289
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT.....	289
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT.....	290
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK].....	289
CALCulate<n>:DELTamarker<m>:MINimum:LEFT.....	290
CALCulate<n>:DELTamarker<m>:MINimum:NEXT.....	290
CALCulate<n>:DELTamarker<m>:MINimum:RIGHT.....	291
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK].....	290
CALCulate<n>:DELTamarker<m>:X.....	283
CALCulate<n>:DELTamarker<m>:X:RELative?.....	283
CALCulate<n>:DELTamarker<m>:Y?.....	284
CALCulate<n>:DELTamarker<m>[:STATe].....	282
CALCulate<n>:FEED.....	298
CALCulate<n>:LIMit<k>:FAIL?.....	275
CALCulate<n>:MARKer<m>:AOFF.....	282
CALCulate<n>:MARKer<m>:FUNctioN:CPICH.....	285
CALCulate<n>:MARKer<m>:FUNctioN:PCCPch.....	286
CALCulate<n>:MARKer<m>:FUNctioN:POWer<sb>:RESult?.....	276
CALCulate<n>:MARKer<m>:FUNctioN:TAERror:RESult?.....	254
CALCulate<n>:MARKer<m>:FUNctioN:WCDPower:MS:RESult?.....	256
CALCulate<n>:MARKer<m>:FUNctioN:WCDPower[:BTS]:RESult?.....	254
CALCulate<n>:MARKer<m>:MAXimum:LEFT.....	286

CALCulate<n>:MARKer<m>:MAXimum:NEXT.....	286
CALCulate<n>:MARKer<m>:MAXimum:RIGHT.....	287
CALCulate<n>:MARKer<m>:MAXimum[:PEAK].....	286
CALCulate<n>:MARKer<m>:MINimum:LEFT.....	287
CALCulate<n>:MARKer<m>:MINimum:NEXT.....	287
CALCulate<n>:MARKer<m>:MINimum:RIGHT.....	288
CALCulate<n>:MARKer<m>:MINimum[:PEAK].....	287
CALCulate<n>:MARKer<m>:X.....	282
CALCulate<n>:MARKer<m>:Y?.....	278
CALCulate<n>:MARKer<m>[:STATe].....	281
CALCulate<n>:MSRA:ALINe:SHOW.....	293
CALCulate<n>:MSRA:ALINe[:VALue].....	293
CALCulate<n>:MSRA:WINDow<n>:IVAL?.....	293
CALCulate<n>:STATistics:RESult<t>?.....	278
CALibration:AIQ:HATiming[:STATe].....	188
CONFigure:WCDPower:MS:CTABle:CATalog?.....	218
CONFigure:WCDPower:MS:CTABle:COMMeNt.....	221
CONFigure:WCDPower:MS:CTABle:COpy.....	218
CONFigure:WCDPower:MS:CTABle:DATA.....	223
CONFigure:WCDPower:MS:CTABle:DATA:HSDPcch.....	224
CONFigure:WCDPower:MS:CTABle:DELeTe.....	219
CONFigure:WCDPower:MS:CTABle:EDATa.....	224
CONFigure:WCDPower:MS:CTABle:EDATa:EDPCc.....	224
CONFigure:WCDPower:MS:CTABle:NAME.....	220
CONFigure:WCDPower:MS:CTABle:SELeCt.....	219
CONFigure:WCDPower:MS:CTABle[:STATe].....	218
CONFigure:WCDPower:MS:MEASurement.....	169
CONFigure:WCDPower[:BTS]:ASCale[:STATe].....	226
CONFigure:WCDPower[:BTS]:CTABle:CATalog?.....	216
CONFigure:WCDPower[:BTS]:CTABle:COMMeNt.....	220
CONFigure:WCDPower[:BTS]:CTABle:COMParE.....	214
CONFigure:WCDPower[:BTS]:CTABle:COpy.....	217
CONFigure:WCDPower[:BTS]:CTABle:DATA.....	221
CONFigure:WCDPower[:BTS]:CTABle:DELeTe.....	217
CONFigure:WCDPower[:BTS]:CTABle:NAME.....	220
CONFigure:WCDPower[:BTS]:CTABle:SELeCt.....	217
CONFigure:WCDPower[:BTS]:CTABle:TOFFset.....	214
CONFigure:WCDPower[:BTS]:CTABle[:STATe].....	215
CONFigure:WCDPower[:BTS]:MCARrier:STATe.....	227
CONFigure:WCDPower[:BTS]:MEASurement.....	168
CONFigure:WCDPower[:BTS]:STD.....	240
DIAGnostic:SERVice:NSourCe.....	192
DISPlay:FORMat.....	241
DISPlay:MTABle.....	284
DISPlay[:WINDow<n>]:SIZE.....	241
DISPlay[:WINDow<n>]:TRACe<t>:MODE.....	279
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE.....	195
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum.....	195
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum.....	195
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:PDIVision.....	196

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel.....	196
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet.....	196
DISPlay[:WINDow<n>]:TRACe<t>[:STATe].....	280
FORMat:DEXPort:DSEParator.....	274
FORMat[:DATA].....	265
INITiate<n>:CONMeas.....	249
INITiate<n>:CONTinuous.....	250
INITiate<n>:REFResh.....	294
INITiate<n>:SEQuencer:ABORt.....	251
INITiate<n>:SEQuencer:IMMediate.....	251
INITiate<n>:SEQuencer:MODE.....	251
INITiate<n>:SEQuencer:REFResh[:ALL].....	252
INITiate<n>[:IMMediate].....	250
INPut:ATTenuation.....	198
INPut:ATTenuation:AUTO.....	198
INPut:ATTenuation:PROTection:RESet.....	175
INPut:CONNector.....	176
INPut:COUPling.....	176
INPut:DIQ:CDEvice.....	179
INPut:DIQ:RANGe:COUPling.....	181
INPut:DIQ:RANGe[:UPPer].....	181
INPut:DIQ:RANGe[:UPPer]:AUTO.....	181
INPut:DIQ:RANGe[:UPPer]:UNIT.....	181
INPut:DIQ:SRATe.....	182
INPut:DIQ:SRATe:AUTO.....	182
INPut:DPATH.....	176
INPut:EATT.....	199
INPut:EATT:AUTO.....	199
INPut:EATT:STATe.....	199
INPut:FILTer:HPASs[:STATe].....	177
INPut:FILTer:YIG[:STATe].....	177
INPut:GAIN:STATe.....	197
INPut:GAIN[:VALue].....	197
INPut:IMPedance.....	178
INPut:IQ:BALanced[:STATe].....	187
INPut:IQ:FULLscale:AUTO.....	187
INPut:IQ:FULLscale[:LEVel].....	188
INPut:IQ:TYPE.....	188
INPut:SElect.....	178
INSTRument:CREate:DUPLicate.....	164
INSTRument:CREate:REPLace.....	165
INSTRument:CREate[:NEW].....	164
INSTRument:DELeTe.....	165
INSTRument:LIST?.....	165
INSTRument:REName.....	167
INSTRument[:SElect].....	167
LAYout:ADD[:WINDow]?.....	242
LAYout:CATalog[:WINDow]?.....	244
LAYout:IDENtify[:WINDow]?.....	244
LAYout:REMOve[:WINDow].....	245

LAYout:REPLace[:WINDow].....	245
LAYout:SPLitter.....	245
LAYout:WINDow<n>:ADD?.....	247
LAYout:WINDow<n>:IDENtify?.....	247
LAYout:WINDow<n>:REMOve.....	248
LAYout:WINDow<n>:REPLace.....	248
MMEMory:LOAD:IQ:STATe.....	291
MMEMory:STORe<n>:FINAl.....	273
MMEMory:STORe<n>:IQ:COMMeNt.....	291
MMEMory:STORe<n>:IQ:STATe.....	292
MMEMory:STORe<n>:TRACe.....	274
OUTPut:DIQ.....	182
OUTPut:DIQ:CDEVice?.....	182
OUTPut:TRIGger<port>:DIRectioN.....	206
OUTPut:TRIGger<port>:LEVel.....	206
OUTPut:TRIGger<port>:OTYPe.....	207
OUTPut:TRIGger<port>:PULSe:IMMediate.....	207
OUTPut:TRIGger<port>:PULSe:LENGth.....	208
STATus:QUEStionable:DIQ:CONDitioN?.....	185
STATus:QUEStionable:DIQ:ENABle.....	185
STATus:QUEStionable:DIQ:NTRansitioN.....	186
STATus:QUEStionable:DIQ:PTRansitioN.....	186
STATus:QUEStionable:DIQ[:EVENT]?.....	186
STATus:QUEStionable:SYNC:CONDitioN?.....	296
STATus:QUEStionable:SYNC:ENABle.....	296
STATus:QUEStionable:SYNC:NTRansitioN.....	297
STATus:QUEStionable:SYNC:PTRansitioN.....	297
STATus:QUEStionable:SYNC[:EVENT]?.....	296
SYSTem:PRESet:CHANnel[:EXECute].....	167
SYSTem:SEQuencer.....	253
TRACe<n>[:DATA]?.....	266
TRACe<n>[:DATA]?.....	266
TRACe<n>[:DATA]?.....	267
TRACe<n>[:DATA]?.....	268
TRACe<n>[:DATA]?.....	268
TRACe<n>[:DATA]?.....	269
TRACe<n>[:DATA]?.....	271
TRACe<n>[:DATA]?.....	271
TRACe<n>[:DATA]?.....	272
TRACe<n>[:DATA]?.....	273
TRIGger[:SEQuence]:BBPower:HOLDoff.....	200
TRIGger[:SEQuence]:DTIME.....	201
TRIGger[:SEQuence]:HOLDoff[:TIME].....	201
TRIGger[:SEQuence]:IFPower:HOLDoff.....	201
TRIGger[:SEQuence]:IFPower:HYSTeresis.....	202
TRIGger[:SEQuence]:LEVel:BBPower.....	202
TRIGger[:SEQuence]:LEVel:IFPower.....	203
TRIGger[:SEQuence]:LEVel:IQPower.....	203
TRIGger[:SEQuence]:LEVel:RFPower.....	203
TRIGger[:SEQuence]:LEVel:VIDeo.....	204

TRIGger[:SEQuence]:LEVel[:EXTernal<port>].....	202
TRIGger[:SEQuence]:SLOPe.....	204
TRIGger[:SEQuence]:SOURce.....	204
TRIGger[:SEQuence]:TIME:RINTerval.....	206



# Index

## Symbols

3GPP FDD	
Basics .....	42
Measurement examples .....	145
Measurements .....	15
Programming examples .....	301
Remote control .....	158
RF measurements .....	35

## A

Aborting	
Sweep .....	107
AC/DC coupling .....	69
ACLR	
3GPP FDD results .....	35
Configuration (3GPP FDD) .....	117
Results (remote) .....	276
RF Combi .....	36
Activating	
3GPP FDD measurements (remote) .....	164
Active probe	
Microbutton .....	76
Adjacent channel leakage ratio	
see ACLR .....	35
Amplitude	
Analog Baseband Interface (B71) settings .....	84
Configuration .....	81
Configuration (remote) .....	194
Settings .....	81
Analog Baseband	
Amplitude settings .....	84
Input .....	70
Input settings .....	72
Analog Baseband (B71)	
Full scale level .....	86
I/Q mode .....	73
Input type (remote control) .....	188
Analog Baseband Interface (B71)	
Amplitude settings .....	84
Input settings .....	72
Analysis	
BTS Code Domain Settings .....	125, 127
Mode .....	96
Remote control .....	279
RF (remote) .....	240
RF measurements .....	122
Settings .....	122
Analysis interval	
MSRA .....	95, 97, 208
Analysis line .....	57
Antenna	
Diversity .....	64
Number .....	64
Synchronization .....	98
Application cards .....	9
Application notes .....	9
Attenuation .....	82
Auto .....	83
Configuration (remote) .....	198
Displayed .....	13
Electronic .....	83

Manual .....	83
Option .....	83
Protective (remote) .....	175
Auto all .....	109
Auto level	
Hysteresis .....	110
Reference level .....	82, 85, 109
Softkey .....	82, 85, 109
Auto scaling .....	87
Auto scrambling code	
Softkey .....	65, 109
Auto settings .....	108
MeasTime Auto .....	110
MeasTime Manual .....	110
Remote control .....	226
Autosearch	
Channel detection .....	45
Scrambling code .....	65, 109
Average count .....	108
Avg Power Inact Chan .....	16
Avg. RCDE .....	16

## B

Bandwidth	
Coverage, MSRA mode .....	57
Menu .....	60
Base station	
see BTS .....	11
Base transceiver station	
see BTS .....	11
Bitstream	
Evaluation .....	18
Parameter .....	127
Trace results .....	259
Branch	
Evaluation range .....	124, 125
Brochures .....	9
BTS .....	11
Standard (ACLR) .....	118

## C

Capture Length .....	96
Capture offset	
MSRA applications .....	97
MSRA slave applications .....	93, 96
Remote .....	294
Softkey .....	93, 96
Carrier frequency error .....	16
Relationship to synchronization mode .....	17
Carrier tables	
Copying .....	113
Creating .....	112
Deleting .....	113
Editing .....	113
Predefined .....	112
Selecting .....	112
CCDF	
3GPP FDD results .....	38
Configuration (3GPP FDD) .....	121

- CDA ..... 15
  - Analysis settings (BTS) ..... 125
  - Analysis settings (UE) ..... 127
  - Channel results ..... 17
  - Configuring ..... 60
  - Configuring (remote) ..... 170
  - Evaluation settings BTS (remote) ..... 231
  - Evaluation settings UE (remote) ..... 233
  - Parameters ..... 16
  - Performing ..... 140
  - Results ..... 16
- CDEP ..... 16
  - Evaluation ..... 22
  - Trace results ..... 260
- CDP
  - Channel parameter ..... 47
  - Channel table ..... 104, 106
  - Evaluation ..... 21
  - Measurement example ..... 148
  - Programming example ..... 304
  - Trace results ..... 261
- Center frequency ..... 87
  - Analog Baseband (B71) ..... 75
  - Measurement example ..... 150
  - Softkey ..... 87
  - Step size ..... 88
- Ch. SF ..... 21
- Channel bandwidth
  - MSRA mode ..... 57
- Channel detection
  - Autosearch ..... 45
  - Configuring ..... 99
  - Methods ..... 45
  - Predefined tables ..... 45
  - Remote control ..... 212, 213
  - Search mode ..... 99
  - Softkey ..... 98
- Channel number ..... 104, 106
- Channel power ..... 17
  - ACLR, see ACLR ..... 35
  - Measurement example ..... 145
  - Programming example ..... 302
- Channel table
  - Configuration ..... 20
- Channel tables
  - Comparison ..... 45, 100
  - Configuring ..... 141
  - Configuring (remote) ..... 219
  - Configuring channels (remote) ..... 221, 222
  - Copying ..... 101
  - Creating ..... 101
  - Creating from input ..... 102
  - Deleting ..... 101
  - Details (BTS) ..... 103
  - Details (UE) ..... 105
  - Editing ..... 101
  - Evaluation ..... 19
  - Managing ..... 100
  - Managing (remote) ..... 215
  - Predefined ..... 100
  - Restoring ..... 101
  - Selecting ..... 101
  - Settings ..... 101
  - Sorting ..... 102
  - Trace results ..... 260
- Channel types ..... 47
  - BTS ..... 45
  - Compressed ..... 47
  - Configuring in table ..... 103, 105
  - Control ..... 45, 49
  - CPICH ..... 44, 46
  - CPRSD ..... 47
  - DPCCCH ..... 49
  - DPCH ..... 44, 47
  - DPDCH ..... 49
  - EDPCCH ..... 49
  - EDPDCH ..... 49
  - HSDPCCH ..... 49
  - MIMO ..... 48
  - Parameter values (remote) ..... 212, 213
  - PCCPCH ..... 44, 46
  - PICH ..... 47
  - PSCH ..... 46
  - SCCPCH ..... 46
  - SCH ..... 44, 46
  - Special ..... 44
  - SSCH ..... 46
  - Synchronization ..... 45
  - UE ..... 49
- Channels ..... 42
  - Active ..... 99, 104, 106
  - Bandwidth ..... 42
  - Displayed ..... 13
  - Evaluation range ..... 123
  - Inactive, showing ..... 20
  - Mapping ..... 17
  - No of Active ..... 16
  - Number ..... 42
  - Status ..... 104, 106
- Chip rate error ..... 16
- Chips ..... 44
- Closing
  - Channels (remote) ..... 165
  - Windows (remote) ..... 245, 248
- Code class
  - Relationship to spreading factor ..... 43
  - Relationship to symbol rate ..... 43
- Code domain ..... 42
- Code Domain Analysis
  - see CDA ..... 15
- Code domain error power
  - see CDEP ..... 16
- Code Domain Power
  - see CDP ..... 21
- Code domain settings
  - Softkey ..... 125, 127
- Code number
  - see Channel number ..... 42
- Code Power Display ..... 126, 128
- Codes ..... 42
  - Number per channel ..... 43
- Complementary cumulative distribution function
  - see CCDF ..... 38
- Composite Constellation
  - Evaluation ..... 22
  - Trace results ..... 261
- Composite EVM ..... 16
  - Evaluation ..... 23
  - Measurement example ..... 154
  - Programming example ..... 306
  - Trace results ..... 261
- Compressed Mode ..... 64

- Conflict
  - Channel table ..... 105
- Constellation
  - Parameter B ..... 127
- Constellation points
  - Mapping in MIMO channels ..... 48
- Continue single sweep
  - Softkey ..... 107
- Continuous sweep
  - Softkey ..... 107
- Conventions
  - SCPI commands ..... 159
- Copying
  - Measurement channel (remote) ..... 164
- Coupling
  - Input (remote) ..... 176
- CPICH ..... 46
  - Mode ..... 98
  - Power reference ..... 126
  - Slot, displayed ..... 13
  - Softkey ..... 135
- CPRSD ..... 47
- D**
- Data acquisition
  - MSRA ..... 95, 97, 208
  - see Signal capturing ..... 94
- Data format
  - Remote ..... 265
- Data sheet ..... 9
- DC offset
  - Analog Baseband (B71, remote control) ..... 188
  - see IQ offset ..... 126, 127
- Delta markers
  - Defining ..... 132
- Diagram footer information ..... 14
- Diagrams
  - Evaluation method ..... 39
  - Footer information ..... 14
- Differential input
  - Analog Baseband (B71, remote control) ..... 187
  - Analog Baseband (B71) ..... 74
- DigIConf
  - see also R&S DigIConf ..... 72
- Digital Baseband Interface ..... 80
  - Connected instrument ..... 80
  - Input settings ..... 70
  - Input status (remote) ..... 179
  - Output connection status (remote) ..... 182
  - Output settings ..... 79, 80
  - Status registers ..... 183
- Digital I/Q
  - Connection information ..... 80
  - Enhanced mode ..... 91
  - Input connection information ..... 72
  - Input settings ..... 70
  - Output settings ..... 79
  - Output settings information ..... 80
  - Triggering ..... 91
- Digital input
  - Connection information ..... 72
- Digital output
  - Enabling ..... 80
- Direct path
  - Input configuration ..... 69
  - Remote ..... 176
- Display Config
  - Softkey ..... 15, 59
- DPCH ..... 47
- Drop-out time
  - Trigger ..... 92
- Duplicating
  - Measurement channel (remote) ..... 164
- E**
- Electronic input attenuation ..... 83
- Eliminating
  - IQ offset ..... 126, 127, 232
  - Tail chips ..... 128
- Enhanced mode
  - Digital I/Q ..... 91
- Errors
  - Device connections ..... 183
  - IF OVLN ..... 81, 85
- Evaluation methods
  - Remote ..... 242
- Evaluation range
  - Branch ..... 124, 125
  - Channel ..... 123
  - Remote control ..... 229
  - Settings ..... 122
  - Slot ..... 124
  - Softkey ..... 122
- Evaluations
  - Bitstream ..... 127
  - CDA ..... 18
  - RF ..... 39
  - Selecting ..... 15
  - TAE ..... 33
- EVM
  - Symbol ..... 17
- EVM vs Chip
  - Evaluation ..... 24
  - Trace results ..... 261
- Exporting
  - I/Q data ..... 60, 137, 138, 313
  - I/Q data (remote) ..... 291
  - Scrambling codes ..... 66
  - Softkey ..... 138
  - Trace results (remote) ..... 273
- External trigger ..... 90
  - Level (remote) ..... 202
- F**
- Files
  - Format, I/Q data ..... 309
  - I/Q data binary XML ..... 313
  - I/Q parameter XML ..... 309
- Filters
  - High-pass (remote) ..... 177
  - High-pass (RF input) ..... 70
  - YIG (remote) ..... 177
- Format
  - Data (remote) ..... 265
  - Scrambling codes (BTS) ..... 65
  - Scrambling codes (UE) ..... 67
- Frames
  - Capture mode ..... 96
  - Evaluation range ..... 96, 124
  - Number to capture ..... 96
  - Selected ..... 96, 124

- Free Run
  - Trigger ..... 90
- Frequency
  - Configuration ..... 87
  - Configuration (remote) ..... 193
  - Offset ..... 88
- Frequency Error vs Slot
  - Evaluation ..... 25
  - Trace results ..... 262
- Frontend
  - Configuration ..... 80
  - Configuration (remote) ..... 192
- Full scale level
  - Analog Baseband (B71, remote control) ..... 187, 188
  - Analog Baseband (B71) ..... 86
  - Digital I/Q ..... 71
  - Digital I/Q (remote) ..... 181
  - Unit, digital I/Q (remote) ..... 181
- Full slot
  - Evaluation ..... 127
- H**
- Half slot
  - Evaluation ..... 127
- Hardware settings
  - CDA, Displayed ..... 13
- High-pass filter
  - Remote ..... 177
  - RF input ..... 70
- HS-DPA/JPA ..... 63, 67
- HS-PDSCH ..... 47
- HS-SSCH ..... 47
- Hysteresis
  - Lower (Auto level) ..... 110
  - Trigger ..... 92
  - Upper (Auto level) ..... 110
- I**
- I/Q data
  - Export file binary data description ..... 313
  - Export file parameter description ..... 309
  - Exporting ..... 60, 138
  - Exporting (remote) ..... 291
  - Importing ..... 60, 138
  - Importing (remote) ..... 291
  - Importing/Exporting ..... 137
- I/Q imbalance ..... 16
- I/Q offset ..... 16
- I/Q Power
  - Trigger level (remote) ..... 203
- IF Power
  - Trigger ..... 91
  - Trigger level (remote) ..... 203
- Impedance
  - Remote ..... 178
  - Setting ..... 69
- Importing
  - I/Q data ..... 60, 137, 138, 309
  - I/Q data (remote) ..... 291
  - Softkey ..... 137
- Inactive Channel Threshold ..... 99
- Input
  - Analog Baseband Interface (B71) settings ..... 72
  - Connector (remote) ..... 176
  - Coupling ..... 69
  - Coupling (remote) ..... 176
  - Digital Baseband Interface settings ..... 70
  - Overload (remote) ..... 175
  - RF ..... 68
  - Settings ..... 68, 83
  - Source Configuration (softkey) ..... 68
  - Source, connection errors ..... 183
  - Source, Radio frequency (RF) ..... 68
- Input sample rate (ISR)
  - Digital I/Q ..... 71
- Input sources
  - Analog Baseband ..... 73
  - Digital I/Q ..... 71
- Installation ..... 11
- Invert Q ..... 95
- IQ offset
  - Eliminating ..... 126, 127, 232
- K**
- Keys
  - MKR -> ..... 134
  - Peak Search ..... 135
  - RUN CONT ..... 107
  - RUN SINGLE ..... 107
- L**
- Lines
  - Menu ..... 60
- LO feedthrough ..... 69
- Lower Level Hysteresis ..... 110
- M**
- Mag Error vs Chip
  - Evaluation ..... 25
  - Trace results ..... 262
- Mapping
  - Channel ..... 17
  - Channel table ..... 106
  - I/Q branches ..... 106
- Marker Functions
  - Menu ..... 60
- Marker table
  - Configuring ..... 132
  - Evaluation method ..... 26, 40
- Markers
  - Configuration (remote) ..... 281, 284
  - Configuring ..... 130
  - Configuring (softkey) ..... 130
  - Deactivating ..... 132
  - Delta markers ..... 132
  - Minimum ..... 135
  - Minimum (remote control) ..... 285
  - Next minimum ..... 135
  - Next minimum (remote control) ..... 285
  - Next peak ..... 135
  - Next peak (remote control) ..... 285
  - Peak ..... 135
  - Peak (remote control) ..... 285
  - Positioning ..... 134
  - Querying position (remote) ..... 278
  - Search settings ..... 133
  - Setting to CPICH ..... 135
  - Setting to PCCPCH ..... 136
  - Settings (remote) ..... 281

- State ..... 131
  - Table ..... 133
  - Table (evaluation method) ..... 26, 40
  - Type ..... 132
  - Maximizing
    - Windows (remote) ..... 241
  - Maximum
    - Y-axis ..... 87
  - Measurement channel
    - Creating (remote) ..... 164, 165
    - Deleting (remote) ..... 165
    - Duplicating (remote) ..... 164
    - Querying (remote) ..... 165
    - Renaming (remote) ..... 167
    - Replacing (remote) ..... 165
  - Measurement examples
    - 3GPP FDD ..... 145
    - Composite EVM ..... 154
    - Incorrect center frequency ..... 150
    - Incorrect scrambling code ..... 151
    - PCDE ..... 155
    - Reference frequency ..... 149
    - Relative code domain power ..... 148
    - SEM ..... 146
    - Signal channel power ..... 145
    - Triggered CDP ..... 152
  - Measurement time
    - Auto settings ..... 110
  - Measurement types
    - CDA ..... 15
    - RF ..... 35
    - TAE ..... 33
  - Measurements
    - Interval ..... 127
    - Selecting ..... 62
    - Selecting (remote) ..... 168
    - Starting (remote) ..... 248
  - Microbutton
    - Probes ..... 76
  - MIMO
    - Channel types ..... 48
    - Mapping to constellation points ..... 48
    - Measurement mode ..... 64
    - Remote control ..... 172
  - Minimum ..... 135
    - Marker positioning ..... 135
    - Next ..... 135
    - Y-axis ..... 87
  - MKR ->
    - Key ..... 134
  - Mobile station
    - see UE (user equipment) ..... 11
  - Modulation type ..... 17
  - MSR ACLR
    - Results (remote) ..... 276
  - MSRA
    - Analysis interval ..... 95, 97, 208
    - Operating mode ..... 33, 57
    - RF measurements ..... 35
  - MSRA applications
    - Capture offset ..... 97
  - MSRA Master
    - Data coverage ..... 57
  - MSRA slave applications
    - Capture offset (remote) ..... 294
  - Multiple
    - Measurement channels ..... 12, 59
- N**
- Next Minimum ..... 135
    - Marker positioning ..... 135
  - Next Peak ..... 135
    - Marker positioning ..... 135
  - Noise
    - Source ..... 77
- O**
- OBW
    - 3GPP FDD results ..... 35
    - Configuration (3GPP FDD) ..... 118
    - RF Combi ..... 36
  - Occupied bandwidth
    - see OBW ..... 35
  - Offset
    - Analysis interval ..... 93, 96
    - Frequency ..... 88
    - Reference level ..... 82, 85
    - Timing ..... 16, 17, 100, 104
  - Online help ..... 8
  - Options
    - Electronic attenuation ..... 83
    - High-pass filter ..... 70, 177
    - Preamplifier ..... 84
  - Output
    - Configuration ..... 76
    - Configuration (remote) ..... 192
    - Digital Baseband Interface settings ..... 79, 80
    - Digital Baseband Interface status ..... 182
    - Digital I/Q (remote) ..... 182
    - Noise source ..... 77
    - Power measurement, Configuration ..... 119
    - Settings ..... 76
    - Trigger ..... 77, 93
  - Overload
    - RF input (remote) ..... 175
  - Overview
    - Configuration 3GPP FDD ..... 61
- P**
- P-CPICH
    - Synchronization mode ..... 98
  - PCCPCH ..... 46
    - Softkey ..... 136
  - PCDE
    - Evaluation ..... 27
    - Measurement example ..... 155
    - Programming example ..... 307
    - Trace results ..... 262
  - Peak Code Domain Error
    - see PCDE ..... 27
  - Peak list
    - Evaluation method ..... 41
  - Peak search
    - Key ..... 135
    - Mode ..... 134
  - Peaks
    - Marker positioning ..... 135
    - Next ..... 135
    - Softkey ..... 135
  - Performing
    - 3G FDD measurement ..... 140

- Phase Discontinuity vs Slot
  - Evaluation ..... 27
  - Trace results ..... 262
- Phase Error vs Chip
  - Evaluation ..... 28
  - Trace results ..... 262
- PICH ..... 47
- Pilot bits ..... 44, 45
  - Channel table ..... 104, 106
  - Number of ..... 17
- PilotL ..... 21
- Pk CDE ..... 16
- Power
  - Channel (Meas example) ..... 145, 302
  - Channels ..... 17, 36, 119
  - Control ..... 45
  - Difference to previous slot ..... 126
  - Displayed ..... 13
  - Inactive channels ..... 16
  - Reference ..... 126, 128
- Power vs Slot
  - Evaluation ..... 29
  - Trace results ..... 262
- Power vs Symbol
  - Evaluation ..... 30
  - Trace results ..... 262
- Preamplifier
  - Setting ..... 84
  - Softkey ..... 84
- Predefined tables
  - Channel detection ..... 45
- Presetting
  - Channels ..... 62, 299
- Pretrigger ..... 92
- Probes
  - Microbutton ..... 76
  - Settings ..... 75
- Programming examples
  - 3GPP FDD ..... 301
  - Composite EVM ..... 306
  - Incorrect scrambling code ..... 304
  - PCDE ..... 307
  - Reference Frequency ..... 304
  - Relative code domain power ..... 304
  - SEM ..... 303
  - Signal channel power ..... 302
  - Triggered CDP ..... 306
- Protection
  - RF input (remote) ..... 175
- PSCH ..... 46
- Pwr Abs/Pwr Rel ..... 21
- R**
- R&S DiglConf ..... 72
- R&S EX-IQ-BOX
  - DiglConf ..... 72
- Range
  - Scaling ..... 87
- RCDE ..... 17
  - Average ..... 16
- Reference frequency
  - Measurement example ..... 149
- Reference Frequency
  - Programming example ..... 304
- Reference level ..... 81, 85
  - Auto level ..... 82, 85, 109
  - Digital I/Q ..... 72
  - Displayed ..... 13
  - Offset ..... 82, 85
  - Unit ..... 81, 85
  - Value ..... 81, 85
- Reference power ..... 126
- Refreshing
  - MSRA slave applications ..... 108
  - MSRA slave applications (remote) ..... 294
  - MSRT slave applications (remote) ..... 294
  - Softkey ..... 108
- Release notes ..... 9
- Remote commands
  - Basics on syntax ..... 158
  - Boolean values ..... 162
  - Capitalization ..... 160
  - Character data ..... 163
  - Data blocks ..... 163
  - Deprecated ..... 298
  - Numeric values ..... 161
  - Optional keywords ..... 160
  - Parameters ..... 161
  - Strings ..... 163
  - Suffixes ..... 160
- Resetting
  - RF input protection ..... 175
- Restoring
  - Channel settings ..... 62, 299
- Result display
  - Configuration ..... 59
  - Configuration (remote) ..... 240
- Result Display ..... 12
- Result displays
  - Diagram ..... 39
  - Marker table ..... 26, 40
  - Peak list ..... 41
  - Result Summary ..... 40
- Result list
  - Evaluation ..... 33
- Result summary
  - Channel results ..... 17
  - Evaluation ..... 30
  - General results ..... 16
  - Trace results ..... 263
- Result Summary
  - Evaluation method ..... 40
  - Result display ..... 40
- Results ..... 15
  - Calculated (remote) ..... 254
  - Data format (remote) ..... 265
  - Evaluating ..... 122
  - Exporting (remote) ..... 273
  - Retrieving (remote) ..... 253
  - RF (remote) ..... 275
  - Trace (remote) ..... 265
  - Trace data query (remote) ..... 258
  - Updating the display ..... 108
  - Updating the display (remote) ..... 294
- Retrieving
  - Calculated results (remote) ..... 254
  - Results (remote) ..... 253
  - RF Results (remote) ..... 275
  - Trace results (remote) ..... 265

- RF attenuation
  - Auto ..... 83
  - Manual ..... 83
- RF Combi
  - Configuration (3GPP FDD) ..... 120
  - Measurement ..... 36
- RF input ..... 68
  - Connector (remote) ..... 176
  - Overload protection (remote) ..... 175
  - Remote ..... 175, 178
- RF measurements
  - 3GPP FDD ..... 35
  - Analysis ..... 122
  - Analysis (remote) ..... 240
  - Configuration ..... 117
  - Configuration (remote) ..... 239
  - MSRA ..... 35
  - Performing ..... 142
  - Results ..... 35
  - Results (remote) ..... 275
  - RF Combi ..... 120
  - Selecting ..... 117
  - Types ..... 35
- RF Power
  - Trigger level (remote) ..... 203
- RF signal power ..... 36, 119
- RHO ..... 16
- RRC Filter ..... 95, 209
- RUN CONT
  - Key ..... 107
- RUN SINGLE
  - Key ..... 107
- S**
- S-CPICH
  - Antenna pattern ..... 98
  - Code number ..... 98
  - Synchronization mode ..... 98
- Sample rate ..... 95
  - Configuring in channel table ..... 104, 106
  - Digital I/Q ..... 71
  - Digital I/Q (remote) ..... 182
- Scaling
  - Amplitude range, automatically ..... 87
  - Configuration, softkey ..... 86
  - Y-axis ..... 87
- SCCPCH ..... 46
- Scrambling code ..... 42
  - Autosearch ..... 65, 109
  - BTS ..... 64, 65
  - BTS (remote) ..... 173
  - Measurement example ..... 151
  - Programming example ..... 304
  - Softkey ..... 64
  - UE ..... 66
- Screen layout ..... 12
- Select meas
  - Softkey ..... 59
- SEM
  - 3GPP FDD results ..... 37
  - Configuration (3GPP FDD) ..... 119
  - Measurement example ..... 146
  - Programming example ..... 303
  - RF Combi ..... 36
- Sequencer ..... 12, 59
  - Aborting (remote) ..... 251
  - Activating (remote) ..... 251
  - Mode (remote) ..... 251
  - Remote ..... 250
- Settings
  - Overview ..... 61
- Show inactive channels ..... 20
- Signal capturing
  - Remote control ..... 208
  - Softkey ..... 94
- Signal description
  - BTS (remote) ..... 170
  - BTS Configuration ..... 63
  - Configuration ..... 62
  - Remote control ..... 170
  - Softkey ..... 62
  - UE (remote) ..... 174
  - UE Configuration ..... 66
- Signal source
  - Remote ..... 178
- Single sweep
  - Softkey ..... 107
- Slope
  - Trigger ..... 92, 204
- Slots ..... 44
  - Capture mode ..... 96
  - Channel ..... 44
  - CPICH ..... 44
  - Evaluation ..... 127
  - Evaluation range ..... 124
  - Number ..... 17
  - Power difference ..... 126
- Softkeys
  - Amplitude Config ..... 81
  - Auto All ..... 109
  - Auto Level ..... 82, 85, 109
  - Auto Scrambling Code ..... 65, 109
  - Capture Offset ..... 93, 96
  - Center ..... 87
  - Channel Detection ..... 98
  - Code Domain Settings ..... 125, 127
  - Continue Single Sweep ..... 107
  - Continuous Sweep ..... 107
  - CPICH ..... 135
  - DigiConf ..... 72
  - Digital I/Q ..... 91
  - Display Config ..... 15, 59
  - Evaluation Range ..... 122
  - Export ..... 138
  - External ..... 90
  - Free Run ..... 90
  - Frequency Config ..... 87
  - I/Q Export ..... 138
  - I/Q Import ..... 138
  - IF Power ..... 91
  - Import ..... 137
  - Input Source Config ..... 68
  - Lower Level Hysteresis ..... 110
  - Marker Config ..... 130
  - Meastime Auto ..... 110
  - Meastime Manual ..... 110
  - Min ..... 135
  - Next Min ..... 135
  - Next Peak ..... 135
  - Norm/Delta ..... 132
  - Outputs Config ..... 76

- PCCPCH ..... 136
- Peak ..... 135
- Preamp ..... 84
- Ref Level ..... 81, 85
- Ref Level Offset ..... 82, 85
- Refresh ..... 108
- RF Atten Auto ..... 83
- RF Atten Manual ..... 83
- Scale Config ..... 86
- Scrambling Code ..... 64
- Select Meas ..... 59
- Signal Capture ..... 94
- Signal Description ..... 62
- Single Sweep ..... 107
- Sweep Config ..... 106
- Sweep count ..... 108
- Synchronization ..... 97
- Trace Config ..... 128
- Trigger Config ..... 88
- Trigger Offset ..... 92
- Upper Level Hysteresis ..... 110
- Span
  - Menu ..... 60
- Specifics for
  - Configuration ..... 62
- Spectrum Emission Mask
  - see SEM ..... 37
- Spreading factor ..... 42
  - Relationship to code class ..... 43
  - Relationship to symbol rate ..... 43
- SSCH ..... 46
- Standard
  - BTS (ACLR) ..... 118
- Status
  - Channels ..... 104, 106
  - Display ..... 21
- Status registers
  - 3GPP FDD ..... 295
  - Contents ..... 295
  - Querying ..... 295
  - STAT:QUES:POW ..... 175
  - STATus:QUEStionable:DIQ ..... 183
- Suffixes
  - Common ..... 163
  - Remote commands ..... 160
- Sweep
  - Aborting ..... 107
  - Configuration (remote) ..... 225
  - Configuration (softkey) ..... 106
  - Count ..... 108
- Symbol Constellation
  - Evaluation ..... 31
  - Trace results ..... 263
- Symbol EVM ..... 17
  - Evaluation ..... 31
  - Trace results ..... 264
- Symbol Magnitude Error
  - Evaluation ..... 32
  - Trace results ..... 264
- Symbol Phase Error
  - Evaluation ..... 32
  - Trace results ..... 264
- Symbol rate ..... 21, 42
  - Displayed ..... 13
  - Relationship to code class ..... 43
  - Relationship to spreading factor ..... 43
- Synchronization
  - Check (TAE) ..... 55
  - Configuring ..... 97
  - Remote control ..... 210
  - Softkey ..... 97
  - Type ..... 97
- T**
- T Offs ..... 21
- TAE
  - Configuration (remote) ..... 170
  - Configuring ..... 111
  - Determining ..... 142
  - Measurement ..... 33
  - Results (remote control) ..... 254
- Tail chips
  - Eliminating ..... 128
- Test models
  - BTS ..... 50
  - UE ..... 52
- Test setup
  - BTS ..... 51
  - UE ..... 53
- TFCI ..... 21
  - Channel detection ..... 104
- Time Alignment Error
  - see TAE ..... 33
- Timing offset ..... 16, 17
  - Configuring ..... 104
  - Reference ..... 100
- Traces
  - Configuration (remote) ..... 279
  - Configuration (softkey) ..... 128
  - Exporting (remote) ..... 273
  - Mode ..... 129
  - Mode (remote) ..... 279
  - Results (remote) ..... 265
- Trigger
  - Configuration (remote) ..... 200
  - Configuration (softkey) ..... 88
  - Drop-out time ..... 92
  - External (remote) ..... 204
  - Holdoff ..... 92
  - Hysteresis ..... 92
  - Measurement example ..... 152
  - Offset ..... 92
  - Output ..... 77, 93
  - Programming example ..... 306
  - Slope ..... 92, 204
  - to frame ..... 16
- Trigger level ..... 92
  - External trigger (remote) ..... 202
  - I/Q Power (remote) ..... 203
  - IF Power (remote) ..... 203
  - RF Power (remote) ..... 203
- Trigger source ..... 90
  - Digital I/Q ..... 91
  - External ..... 90
  - Free Run ..... 90
  - IF Power ..... 91
- Troubleshooting
  - Input overload ..... 175
- Type
  - Scrambling codes (UE) ..... 67



**U**

UE (User equipment) .....	11
Units	
Reference level .....	81, 85
Updating	
Result display .....	108
Result display (remote) .....	294
Upper Level Hysteresis .....	110
Use TFCI	
Channel table .....	104

**W**

W-CDMA .....	11
White papers .....	9
Window title bar information .....	14
Windows	
Adding (remote) .....	242
Closing (remote) .....	245, 248
Configuring .....	62
Layout (remote) .....	245
Maximizing (remote) .....	241
Querying (remote) .....	244
Replacing (remote) .....	245
Splitting (remote) .....	241
Types (remote) .....	242

**X**

X-value	
Marker .....	131

**Y**

Y-maximum, Y-minimum	
Scaling .....	87
YIG-preselector	
Activating/Deactivating .....	70
Activating/Deactivating (remote) .....	177