# R&S®VSE-K72
# 3GPP FDD Measurements Application
# User Manual


1176896802
Version 11

ROHDE&SCHWARZ
Make ideas real

This manual applies to the following software, version 2.31 and later:

- R&S®VSE Enterprise Edition base software (1345.1105.06)
- R&S®VSE Basic Edition base software (1345.1011.06)

The following firmware options are described:

- R&S VSE-K72 (1320.7580.02)
- R&S VSE-K72 (1345.1857.02)
- R&S VSE-KP72 (1345.2518.xx)


Muehldorfstr. 15, 81671 Muenchen, Germany
Phone: +49 89 41 29 - 0
Email: info@rohde-schwarz.com
Internet: www.rohde-schwarz.com


1176.8968.02 | Version 11 | R&S®VSE-K72

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

# Contents

# 1 Preface

## 1.1 About this manual

This R&S VSE 3GPP FDD User Manual provides all the information **specific to the application**. All general software functions and settings common to all applications and operating modes are described in the R&S VSE Base Software 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 R&S VSE 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
- **How to Perform Measurements in the R&S VSE 3GPP FDD Measurements application**
  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
- **Optimizing and Troubleshooting the Measurement**
  Hints and tips on how to handle errors and optimize the measurement configuration
- **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 in the software are provided in the R&S VSE Base Software 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 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 and knob names are enclosed by square brackets. |
| `Filenames, commands, program code` | Filenames, commands, coding samples and screen output are distinguished by their font. |
| *Input* | Input to be entered by the user is displayed in italics. |
| Links | Links that you can click are displayed in blue font. |
| "References" | References to other parts of the documentation are enclosed by quotation marks. |

# 2 Welcome to the 3GPP FDD applications

The R&S VSE 3GPP FDD Measurements application applications add functionality to the R&S VSE 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.

R&S VSE-K72 performs **B**ase **T**ransceiver **S**tation (**BTS**) measurements (for downlink signals), as well as **U**ser **E**quipment (UE) measurements (for uplink signals).

In particular, the R&S VSE 3GPP FDD Measurements application features:

- Code domain analysis, providing results like code domain power, EVM, peak code domain error etc.
- Time alignment error determination

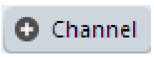
This user manual contains a description of the functionality that the application provides, including remote control operation.

Functions that are not discussed in this manual are the same as in the I/Q Analyzer application and are described in the R&S VSE Base Software User Manual. The latest version is available for download at the product homepage (http://www.rohde-schwarz.com/product/VSE.html).

## 2.1 Starting the 3GPP FDD application

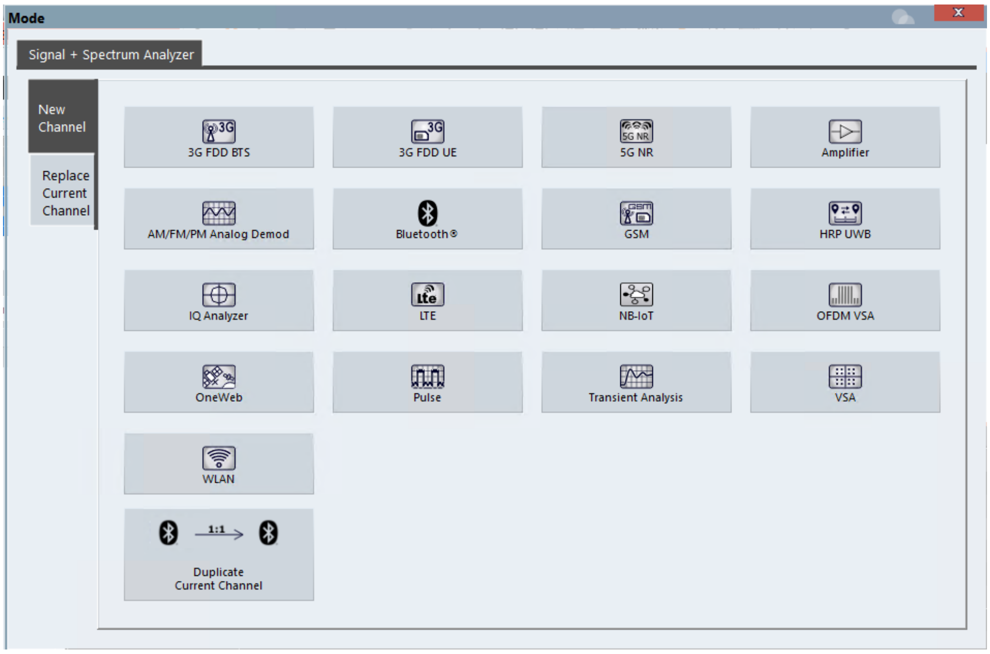
The 3GPP FDD measurements require a special application on the R&S VSE. It is activated by creating a new measurement channel in 3GPP FDD mode.

**To activate the 3GPP FDD application**

1. 


   Select the "Add Channel" function in the Sequence tool window.

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




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

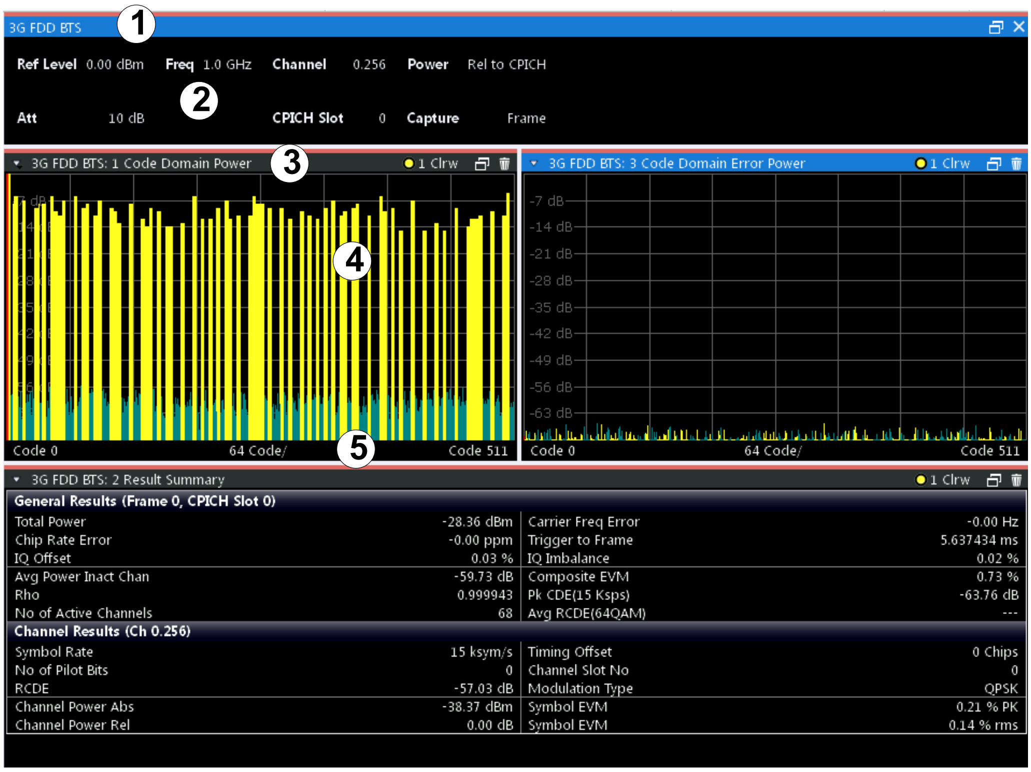


The R&S VSE opens a new measurement channel for the 3GPP FDD application.

## 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 = Color coding for windows of same channel
2 = Channel bar with measurement settings
3 = Window title bar with diagram-specific (trace) information
4 = Diagram area
5 = Diagram footer with diagram-specific information, depending on result display

### Channel bar information

In 3GPP FDD applications, when performing Code Domain Analysis, the R&S VSE screen display shows the following settings:

*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**<br>/ **Slot** (UE) | Slot of the (CPICH) channel |
| **Power** | Power result mode:<br>● Absolute<br>● Relative to CPICH (BTS application only)<br>● Relative to total power |

| | |
|---|---|
| **SymbRate** | Symbol rate of the current channel |
| **Capture** | **(UE application only):** 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*

0 = Color coding for windows of same channel
1 = Edit result display function
2 = Channel name
3 = Window number
4 = Window type
5 = Trace color, trace number, trace mode
6 = Dock/undock window function
7 = Close window function

#### Diagram area

The diagram area displays the results according to the selected result displays (see Chapter 3.1.2, "Evaluation methods for code domain analysis", on page 18).

#### 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

The software status, errors and warnings and any irregularities in the software are indicated in the status bar at the bottom of the R&S VSE window.

# 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.

#### Result display windows

For each measurement, a separate measurement channel is activated. Each measurement channel can provide multiple result displays, which are displayed in individual windows. The measurement windows can be rearranged and configured in the R&S VSE to meet your requirements. All windows that belong to the same measurement (including the channel bar) are indicated by a colored line at the top of the window title bar.

► To add further result displays for the 3GPP FDD channel, select the "Add Window" icon from the toolbar, or select the "Window > New Window" menu item.

For details on working with channels and windows, see the "Operating Basics" chapter in the R&S VSE base software user manual.

#### 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 95.



## 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 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 can 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 is possibly not correct. If channels with a timing offset contain a power control circuit, the channel-power-versus-time display can possibly 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 130

### 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 "Carrier Frequency Error" 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. |

| Parameter | Description |
|---|---|
| Trigger to Frame: | The time difference between the beginning of the recorded signal section to the start of the analyzed frame. For triggered data collection, this difference is identical to 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 % |
| 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 %.<br>See also "Composite EVM" 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 "Peak Code Domain Error" 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: | **(BTS measurements only):**<br>Channel slot number; determined by combining the value of the selected CPICH and the channel's timing offset |
| Channel Mapping | **(UE measurements only):**<br>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:<br>Modulation type of an HSDPA channel. High-speed physical data channels can be modulated with QPSK, 16 QAM or 64 QAM modulation.<br>UE measurements: the modulation type of the selected channel. Valid entries are:<br>● BPSK I for channels on I-branch<br>● BPSK Q for channels on Q-branch<br>● NONE for inactive channels |

### 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 10.8.2, "Measurement results for TRACe<n>[:DATA]? TRACE<n>", on page 230).

### 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).

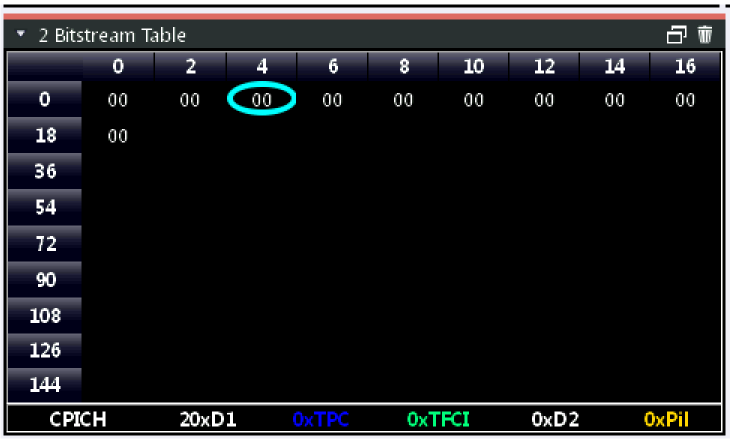



*Figure 3-1: Bitstream display for 3GPP FDD BTS measurements*

**TIP:** Select a specific symbol using a marker for the display. Enter the symbol number as the x-value. The marker is moved 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 218
`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 number corresponds to the 512 codes that can be assigned within the class of spreading factor 512.

In UE measurements, this number 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 38 and Chapter 4.3, "UE channel types", on page 42).

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.

3G FDD BTS: 2 Channel Table   1 Clrw

| Chan Type | Ch.SF | PwrAbs [dBm] | PwrRel [dB] | State | Mod Type | SymRate [ksps] | Toffs [Chips] | TFCI | PilotL [Bits] |
|---|---|---|---|---|---|---|---|---|---|
| CPICH | 0.256 | -38.37 | 0.00 | ON | QPSK | 15 | 0.00 | OFF | 0 |
| PSCH | | -41.36 | -2.99 | ON | NONE | 0 | 0.00 | OFF | 0 |
| SSCH | | -41.35 | -2.98 | ON | NONE | 0 | 0.00 | OFF | 0 |
| PCCPCH | 1.256 | -38.37 | 0.00 | ON | QPSK | 15 | 0.00 | OFF | 0 |
| SCCPCH | 3.256 | -46.37 | -8.00 | ON | QPSK | 15 | 0.00 | OFF | 0 |
| PICH | 16.256 | -46.38 | -8.00 | ON | QPSK | 15 | 30720.0 | OFF | 0 |
| DPCH | 2.128 | -44.37 | -5.99 | ON | QPSK | 30 | 22016.0 | OFF | 8 |
| DPCH | 4.128 | -45.37 | -7.00 | ON | QPSK | 30 | 23296.0 | OFF | 8 |
| DPCH | 7.128 | -47.36 | -8.99 | ON | QPSK | 30 | 21248.0 | OFF | 8 |
| DPCH | 9.128 | -46.38 | -8.00 | ON | QPSK | 30 | 1792.00 | OFF | 8 |
| DPCH | 11.128 | -44.37 | -5.99 | ON | QPSK | 30 | 34304.0 | OFF | 8 |
| DPCH | 12.128 | -48.38 | -10.01 | ON | QPSK | 30 | 8192.00 | OFF | 8 |
| DPCH | 13.128 | -49.39 | -11.01 | ON | QPSK | 30 | 6400.00 | OFF | 8 |

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

Remote command:

`LAY:ADD? '1',RIGH, CTABle`, see `LAYout:ADD[:WINDow]?` on page 218

`TRACe<n>[:DATA]? CTABle`

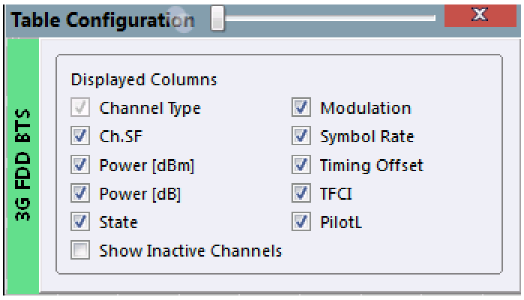
`TRACe<n>[:DATA]? PWCDp`

`TRACe<n>[:DATA]? CWCDp`

**Table Configuration ← Channel Table**

You can configure which parameters are displayed in the "Channel Table" by clicking (**not double-clicking**!) a column 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. 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<br>In BTS measurements: always |
| **State** | Active: channel is active and all pilot symbols are correct<br>Inactive: channel is not active<br>Pilotf: channel is active, but pilot symbols incomplete or missing |
| **TFCI** | **(BTS measurements only):**<br>Data channel uses TFCI symbols |
| **Mapping** | **(UE measurements only):**<br>Branch the channel is mapped to (I or Q) |
| **PilotL [Bits]** | Number of pilot bits in the channel<br>(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]** | **(BTS measurements only):**<br>Timing offset |

### Code Domain Power

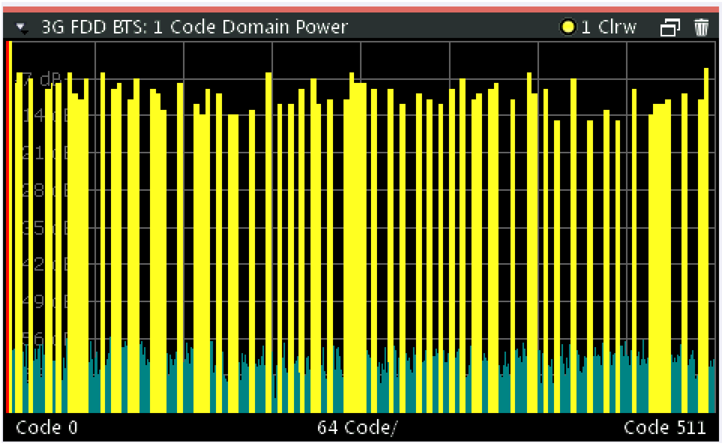



*Figure 3-3: Code Domain Power Display for 3GPP FDD BTS measurements*

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 can 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 sym-

bols 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. Furthermore, 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 53).

Remote command:
`LAY:ADD? '1',RIGH, CDPower`, see `LAYout:ADD[:WINDow]?` on page 218
`CALC:MARK:FUNC:WCDP:RES? CDP`, see`CALCulate<n>:MARKer<m>:FUNCtion:WCDPower[:BTS]:RESult` on page 228
`CALC:MARK:FUNC:WCDP:MS:RES? CDP`, see `CALCulate<n>:MARKer<m>:FUNCtion:WCDPower:MS:RESult?` on page 227
`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.

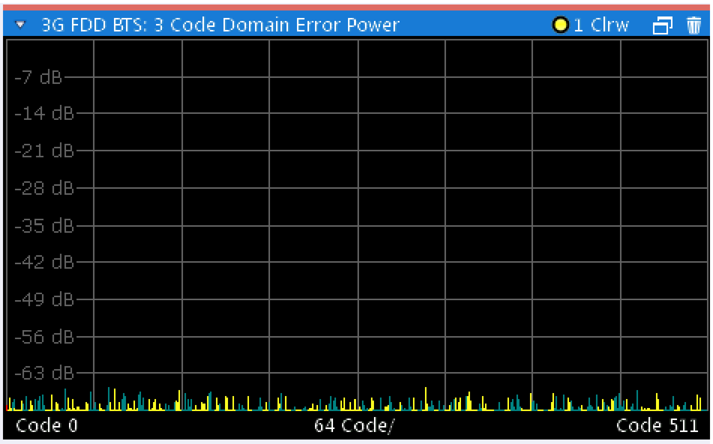



*Figure 3-4: Code Domain Error Power Display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, CDEPower`, see `LAYout:ADD[:WINDow]?` on page 218
`TRACe<n>[:DATA]? TRACE<1...4>`

**Composite Constellation**
The "Composite Constellation" evaluation analyzes the entire signal for one single slot. If many channels are 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 to the total power.

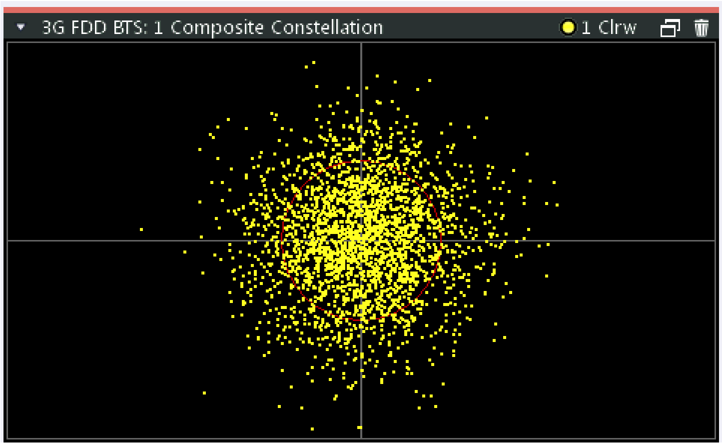



*Figure 3-5: Composite Constellation display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, CCONst`, see `LAYout:ADD[:WINDow]?` on page 218
`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 |

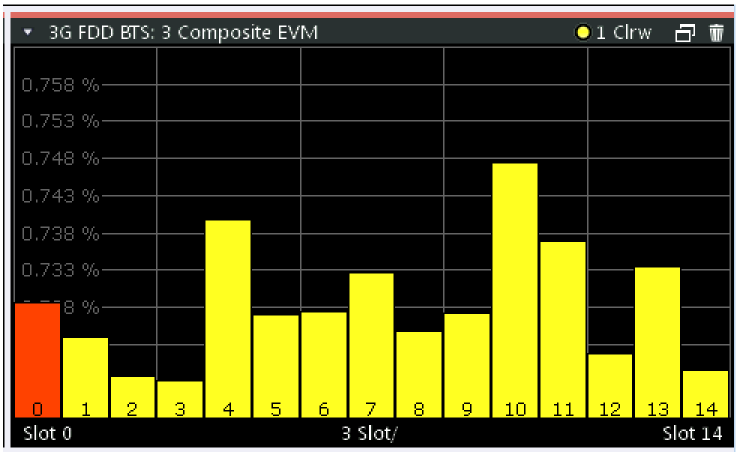



*Figure 3-6: Composite EVM display for 3GPP FDD BTS measurements*

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 because 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 218
`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 99).

The EVM is calculated by the root of the square difference of received signal and reference signal. The reference signal is estimated from the channel configuration of all active channels. The EVM is related to the square root of the mean power of reference signal and given in percent.

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

where:

| | |
|---|---|
| $EVM_k$ | vector error of the chip EVM of chip number k |
| $s_k$ | complex chip value of received signal |
| $x_k$ | complex chip value of reference signal |

| | |
|---|---|
| k | index number of the evaluated chip |
| N | number of chips at each CPICH slot |
| n | index number for mean power calculation of reference signal |

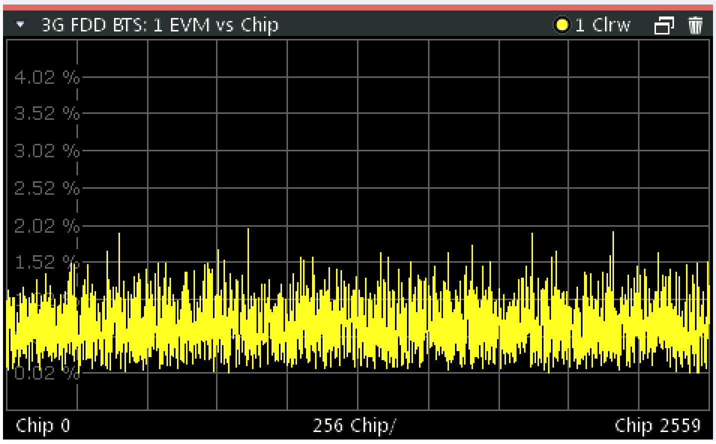



*Figure 3-7: EVM vs Chip display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, EVMChip`, see `LAYout:ADD[:WINDow]?` on page 218
`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.

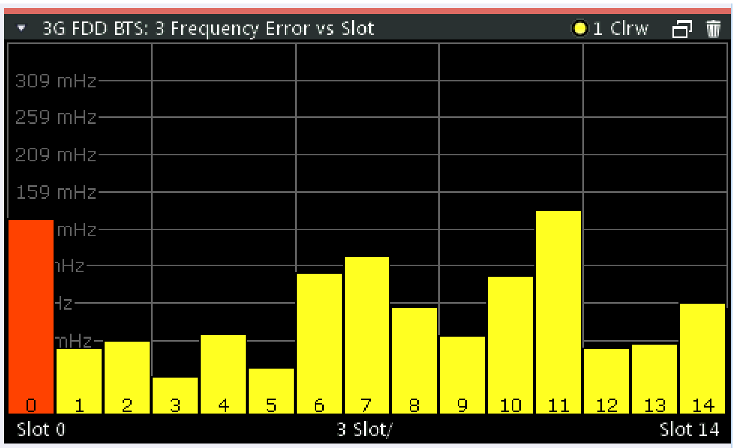



*Figure 3-8: Frequency Error vs Slot display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, FESLot`, see `LAYout:ADD[:WINDow]?` on page 218
`TRACe<n>[:DATA]? ATRACE`

**Magnitude Error vs Chip**

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

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.

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

Where:

| | |
|---|---|
| $MAG_k$ | Magnitude error of chip number k |
| $s_k$ | Complex chip value of received signal |
| $x_k$ | Complex chip value of reference signal |
| k | Index number of the evaluated chip |
| N | Number of chips at each CPICH slot |
| n | Index number for mean power calculation of reference signal |

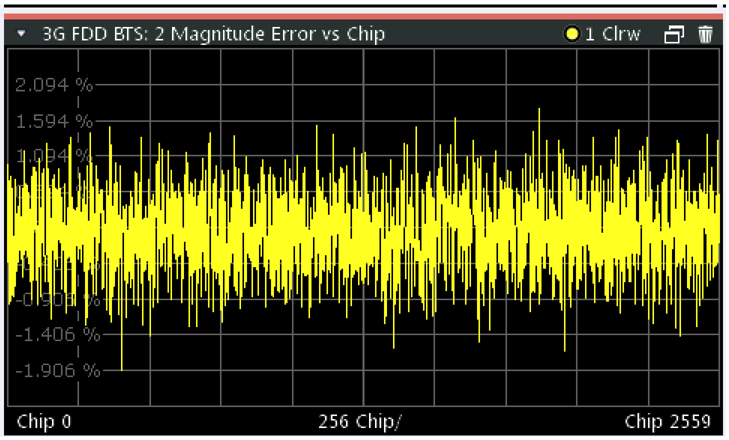



*Figure 3-9: Magnitude Error vs Chip display for 3GPP FDD BTS measurements*

Remote command:

`LAY:ADD? '1',RIGH, MECHip`, see `LAYout:ADD[:WINDow]?` on page 218

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

**Marker Table**

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

This table is displayed automatically if configured accordingly.

(See "Marker Table Display" on page 105).

3 Marker Table

| Wnd | Type | Ref | X-Value | Y-Value |
|---|---|---|---|---|
| 1 | M1 | | 0.256 | 0.00 dB |
| 1 | D2 | M1 | 415.512 | -1.94 dB |
| 1 | D3 | M1 | 489.512 | -1.95 dB |
| 1 | D4 | M1 | 266.512 | -2.00 dB |

Remote command:
`LAY:ADD? '1',RIGH, MTAB`, see `LAYout:ADD[:WINDow]?` on page 218
Results:
`CALCulate<n>:MARKer<m>:X` on page 249
`CALCulate<n>:MARKer<m>:Y?` on page 250

**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.

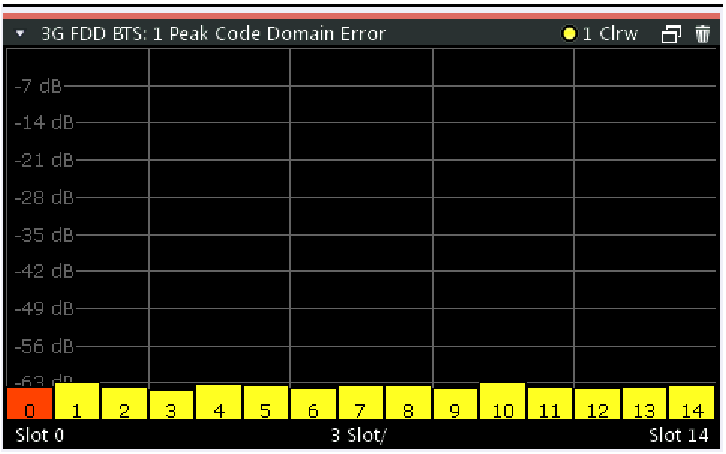



*Figure 3-10: Peak Code Domain Error display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, PCDerror`, see `LAYout:ADD[:WINDow]?` on page 218
`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.

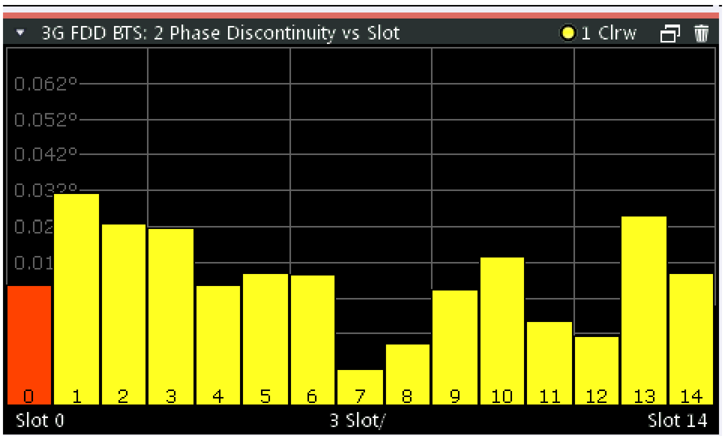



*Figure 3-11: Phase Discontinuity vs Slot display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, PDSLot`, see `LAYout:ADD[:WINDow]?` on page 218
`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.

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°.

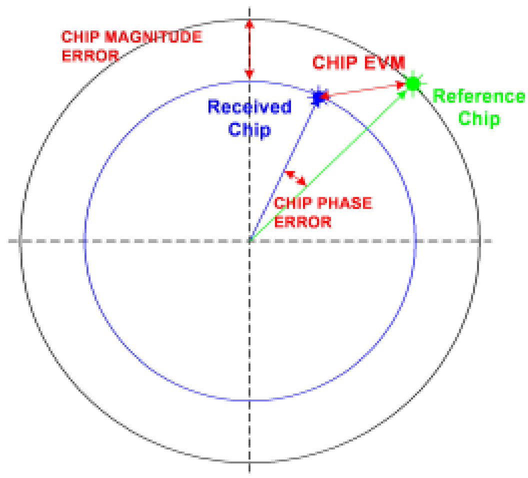
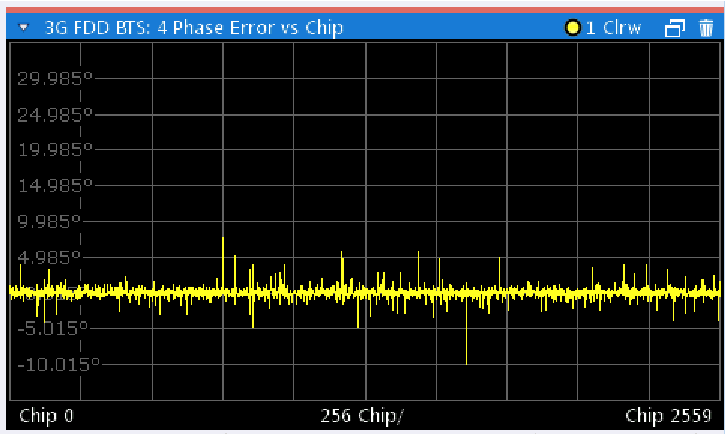



*Figure 3-12: Calculating the magnitude, phase and vector error per chip*

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

Where:

| | |
|---|---|
| $PHI_k$ | Phase error of chip number k |
| $s_k$ | Complex chip value of received signal |
| $x_k$ | Complex chip value of reference signal |
| k | Index number of the evaluated chip |
| N | Number of chips at each CPICH slot |
| φ(x) | Phase calculation of a complex value |




Remote command:
`LAY:ADD? '1',RIGH, PECHip`, see `LAYout:ADD[:WINDow]?` on page 218
`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.

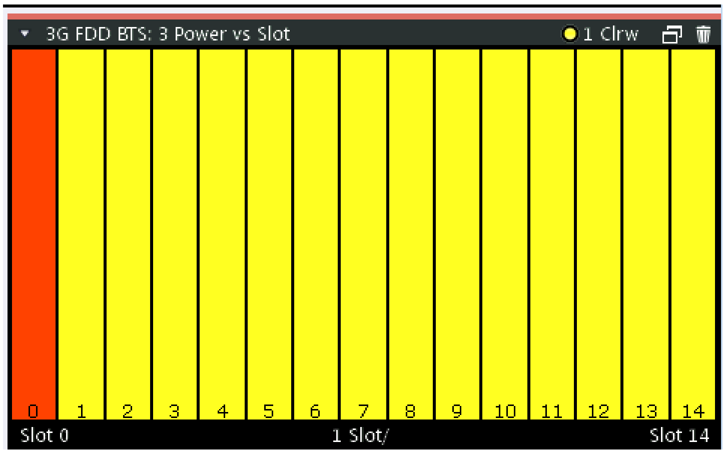



*Figure 3-13: Power vs Slot Display for 3GPP FDD BTS measurements*

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 can 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 218
`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.

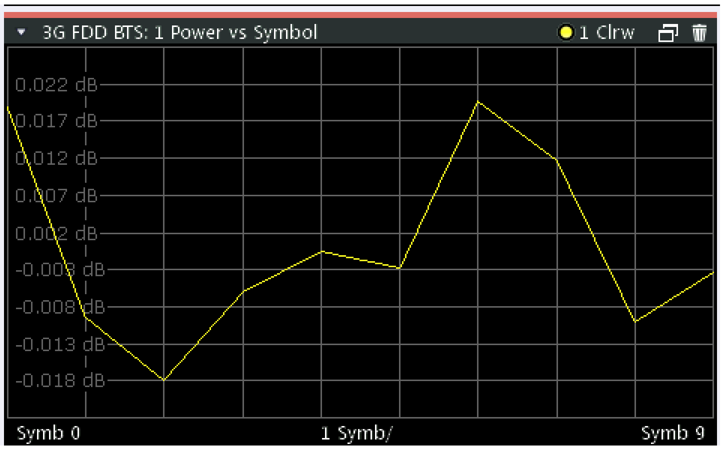



*Figure 3-14: Power vs Symbol display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, PSYMbol`, see `LAYout:ADD[:WINDow]?` on page 218
`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.

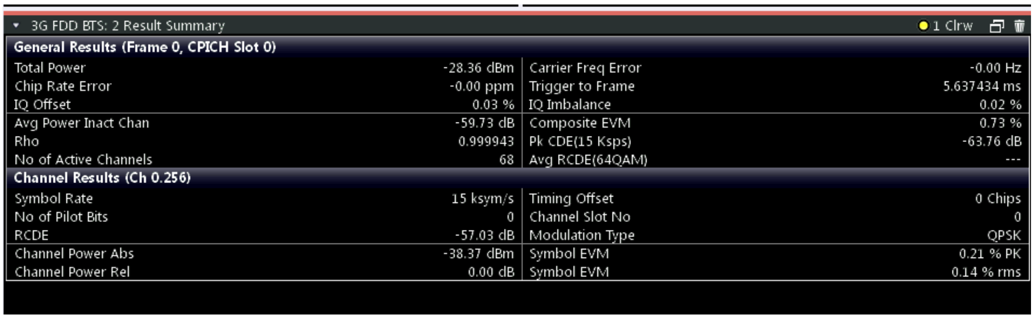



*Figure 3-15: Result Summary display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, RSUMmary`, see `LAYout:ADD[:WINDow]?` on page 218
`TRACe<n>[:DATA]? TRACE<1...4>`
`TRACe[:DATA]? TRACE<1...4>`

**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.

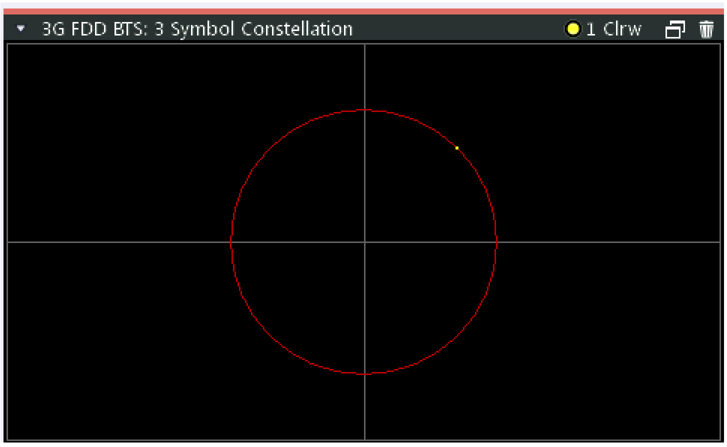



*Figure 3-16: Symbol Constellation display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, SCONst`, see `LAYout:ADD[:WINDow]?` on page 218
`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.

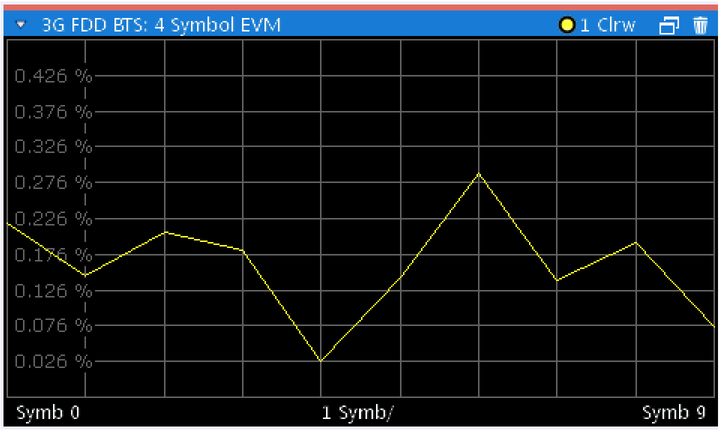



*Figure 3-17: Symbol EVM display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, SEVM`, see `LAYout:ADD[:WINDow]?` on page 218
`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.

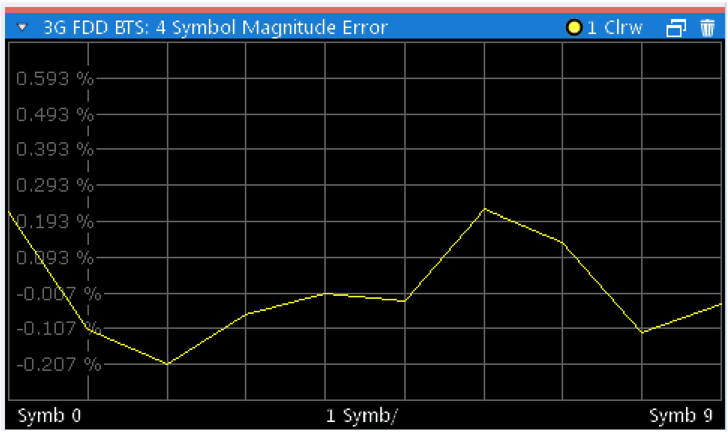



*Figure 3-18: Symbol Magnitude Error display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, SMERror`, see `LAYout:ADD[:WINDow]?` on page 218
`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.

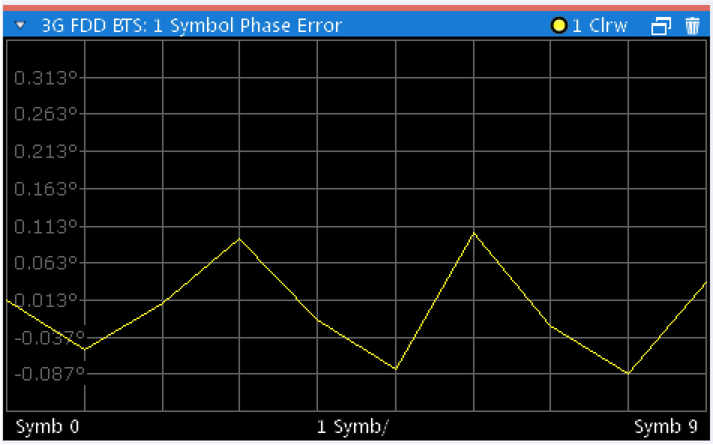



*Figure 3-19: Symbol Phase Error display for 3GPP FDD BTS measurements*

Remote command:
`LAY:ADD? '1',RIGH, SPERror`, see `LAYout:ADD[:WINDow]?` on page 218
`TRACe<n>[:DATA]? TRACE<1...4>`

## 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 numeric results are displayed in a table.

**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 47.

### Evaluation Methods

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

### Time Alignment Error

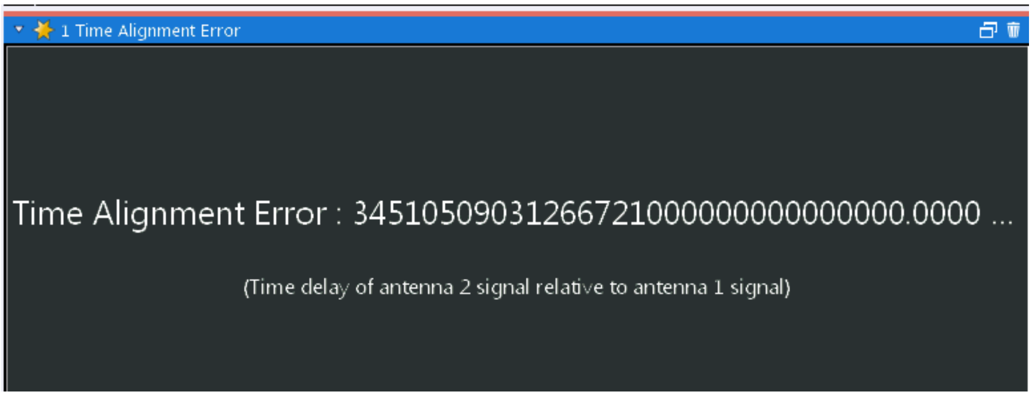



*Figure 3-20: Time Alignment Error display for 1 base station*

Provides the following time alignment information for the selected frame:

| | |
|---|---|
| "Carrier" | Carrier number |
| "Offset" | Frequency offset from the nominal frequency for each carrier |
| "Ant1 [chips]"/ "Ant2 [chips]" | Time delay (in chips) for each antenna, relative to the specified reference carrier. |
| "State" | Synchronization state for each antenna ("OK" / "No Sync)". 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". |

Remote command:
`CONF:WCDP:MEAS TAER`, see`CONFigure:WCDPower[:BTS]:MEASurement` on page 130
Selecting the frame:
`[SENSe:]CDPower:FRAMe[:VALue]` on page 204
Retrieving results:
`CALC:MARK:FUNC:TAER:RES? TAER`, see `CALCulate<n>:MARKer<m>:FUNCtion:TAERror:RESult` on page 225

# 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*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 **P**rimary **C**ommon **C**ontrol **P**hysical **Ch**annel (PCCPCH) must always be contained in the signal. As the name implies, it is responsible for common control of the channels during transmission.

The **S**ynchronization **Ch**annel (SCH) is a time reference and responsible for synchronizing the individual channels.

Another important channel is the **C**ommon **Pi**lot **Ch**annel (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 **D**edicated **P**hysical **Ch**annel (DPCH).

More details on channel types are provided in Chapter 4.2, "BTS channel types", on page 38.

### 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 53).
  In addition, the channel must exceed a minimum power in order to be considered active (see "Inactive Channel Threshold (BTS measurements only)" on page 81).
  **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 |
|---|---|
| **PSCH** | **P**rimary **S**ynchronization **Ch**annel<br>The Primary Synchronization Channel is used to synchronize the signal in the case of SCH synchronization. It is a non-orthogonal channel. Only the power of this channel is determined. |
| **SSCH** | **S**econdary **S**ynchronization **Ch**annel<br>The Secondary Synchronization Channel is a non-orthogonal channel. Only the power of this channel is determined. |
| **PCCPCH** | **P**rimary **C**ommon **C**ontrol **P**hysical **Ch**annel<br>The Primary Common Control Physical Channel is also used to synchronize the signal in the case of SCH synchronization. It is expected at code class 8 and code number 1. |
| **SCCPCH** | **S**econdary **C**ommon **C**ontrol **P**hysical **Ch**annel<br>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.<br>● 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.<br>● 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.<br>● If the application is configured to recognize all QPSK-modulated channels without pilot symbols (see "HSDPA/UPA" on page 53), and one of these channels is received at code class 8 and code number 3, it is displayed as the SCCPCH. |
| **CPICH** | **C**ommon **Pi**lot **Ch**annel<br>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.<br>If it is not contained in the signal configuration, the firmware application must be configured to synchronize to the SCH channel (see "Synchronization Type" on page 78). |

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 |
|---|---|
| **PICH** | **P**aging **I**ndication **Ch**annel<br>The Paging Indication Channel is expected at code class 8 and code number 16.<br>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". |
| **DPCH** | **D**edicated **P**hysical **Ch**annel of a standard frame<br>The Dedicated Physical Channel is a data channel that contains pilot symbols. The displayed channel type is DPCH. |
| **CPRSD** | Dedicated Physical Channel (DPCH) in **com**p**r**e**s**se**d** mode<br>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.<br>To evaluate compressed mode channels, the associated measurement mode needs to be activated (see "Compressed Mode" on page 54). |
| **CPR-TPC** | DPCH in **compressed** mode where **TPC** symbols are sent in the first slot of the transmitting gap |
| **CPR-SF/2** | DPCH in **compressed** mode using half spreading factor (**SF/2)** to increase the symbol rate of the active slots by two |
| **CPR-SF/2-TPC** | DPCH in **compressed** mode using half spreading factor (**SF/2**) to increase the symbol rate of the active slots by two, where **TPC** symbols are sent in the first slot of the transmitting gap |
| **HS-PDSCH** | HSDPA: **H**igh **S**peed **P**hysical **D**ownlink **S**hared **Ch**annel<br>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.<br>**HSPDSCH-QPSK_:** QPSK-modulated slot of an HS PDSCH channel<br>**HSPDSCH-16QAM_:** 16QAM-modulated slot of an HS PDSCH channel<br>**HSPDSCH-NONE_:** slot without power of an HS PDSCH channel |
| **HS-SCCH** | HSDPA: **H**igh **S**peed **S**hared **C**ontrol **Ch**annel<br>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.<br>If the application is configured to recognize all QPSK-modulated channels without pilot symbols (see "HSDPA/UPA" on page 53), 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. There-fore, the unassigned codes are always to be found at the end of the table.<br>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. |

| Channel type | Description |
|---|---|
| **EHICH-ERGCH** | HSUPA:<br>**E**nhanced **H**ARQ Hybrid Acknowledgement **I**ndicator **Ch**annel<br>**E**nhanced **R**elative **G**rant **Ch**annel |
| **EAGCH** | **E**nhanced **A**bsolute **G**rant **Ch**annel |
| **SCPICH** | **S**econdary **C**ommon **Pi**lot **Ch**annel |
| **CHAN** | If the application is configured to recognize all QPSK-modulated channels without pilot symbols (see "HSDPA/UPA" on page 53), 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 **D**edicated **P**hysical **C**ontrol **Ch**annel 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 **H**igh **S**peed **D**edicated **P**hysical **C**ontrol **Ch**annel (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 **E**nhanced **D**edicated **P**hysical **C**ontrol **Ch**annel 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 **D**edicated **P**hysical **D**ata **Ch**annel is used to carry UPLINK data from the UE to the BS. The code allocation depends on the total required symbol rate. |
| EDPDCH | The **E**nhanced **D**edicated **P**hysical **D**ata **Ch**annel 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 (×256Tchip) |
|---|---|---|---|---|---|
| PCCPCH+SCH | 1 | 10 | -10 | 1 | 0 |
| Primary CPICH | 1 | 10 | -10 | 0 | 0 |
| PICH | 1 | 1.6 | -18 | 16 | 120 |
| SCCPCH (SF=256) | 1 | 1.6 | -18 | 3 | 0 |
| DPCH (SF=128) | 16/32/64 | 76.8 total | see TS 25.141 | see TS 25.141 | see TS 25.141 |

*Table 4-9: 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 × 10, 1 × 50 | 2 × -10, 1 × -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 (×256Tchip) |
|---|---|---|---|---|---|
| PCCPCH+SCH | 1 | 12.6/7.9 | -9/-11 | 1 | 0 |
| Primary CPICH | 1 | 12.6/7.9 | -9/-11 | 0 | 0 |
| PICH | 1 | 5/1.6 | -13/-18 | 16 | 120 |
| SCCPCH (SF=256) | 1 | 5/1.6 | -13/-18 | 3 | 0 |
| DPCH (SF=256) | 16/32 | 63,7/80,4 total | see TS 25.141 | see TS 25.141 | see TS 25.141 |

*Table 4-11: 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 connected instrument 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 VSE 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 VSE for 3GPP FDD UE user equipment tests. As a prerequisite for starting the test, the connected instrument 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 |
|---|---|
| ³55 to 60 dBm | 35 to 40 dB |
| ³50 to 55 dBm | 30 to 35 dB |
| ³45 to 50 dBm | 25 to 30 dB |
| ³40 to 45 dBm | 20 to 25 dB |
| ³35 to 40 dBm | 15 to 20 dB |
| ³30 to 35 dBm | 10 to 15 dB |
| ³25 to 30 dBm | 5 to 10 dB |
| ³20 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 VSE 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.



### 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 VSE shows the measurement setup.

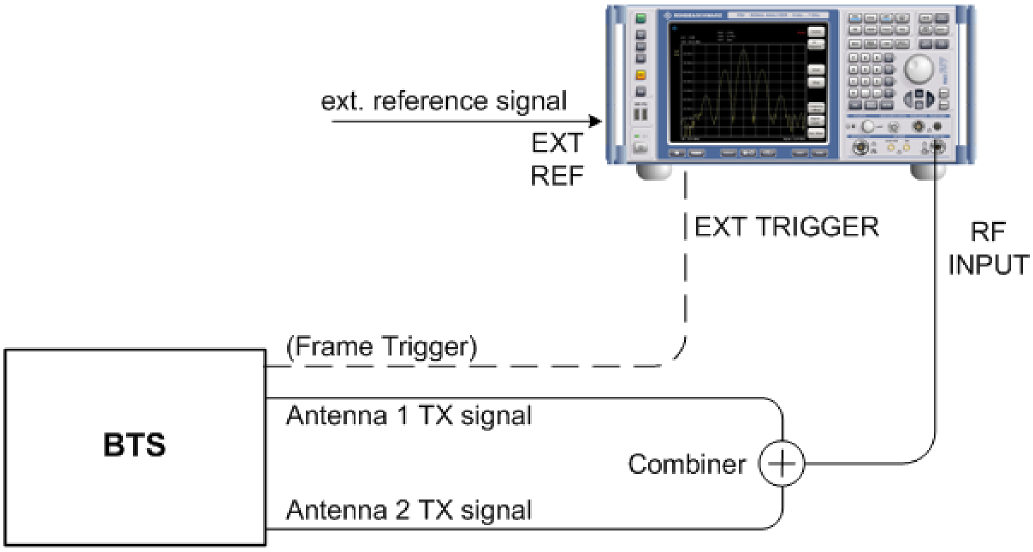



*Figure 4-1: Time Alignment Error Measurement setup for one base station using an R&S VSE*

**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 10.10, "Querying the status registers", on page 258).

### 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 VSE 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 VSE 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 VSE 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 VSE with no bandwidth extension options: 1 carrier only (multi-carrier not available)
- R&S VSE with bandwidth extension option B40: ±17.5 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.

# 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.

**Multiple access paths to functionality**

The easiest way to configure a measurement channel is via the "Overview" dialog box, which is displayed when you select the "Overview" icon from the main toolbar or the "Meas Setup" > "Overview" menu item.

Alternatively, you can access the individual dialog boxes from the corresponding menu items, or via tools in the toolbars, if available.

In this documentation, only the most convenient method of accessing the dialog boxes is indicated - usually via the "Overview". For an overview of all available menu items and toolbar icons see Chapter A, "Reference", on page 272.

**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 "Select Measurement". Select the required measurement.
- From the "Meas Setup" menu, select "Select Measurement". Select the required measurement.



## 5.1 Code domain analysis

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

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

**General R&S VSE functions**

The application-independent functions for general tasks on the R&S VSE are also available for 3GPP FDD measurements and are described in the R&S VSE Base Software User Manual. In particular, this comprises the following functionality:

- Controlling Instruments and Capturing I/Q Data
- Data Management
- General Software Preferences and Information



### 5.1.1 Configuration overview

**Access**: "Meas Setup" > "Overview"

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

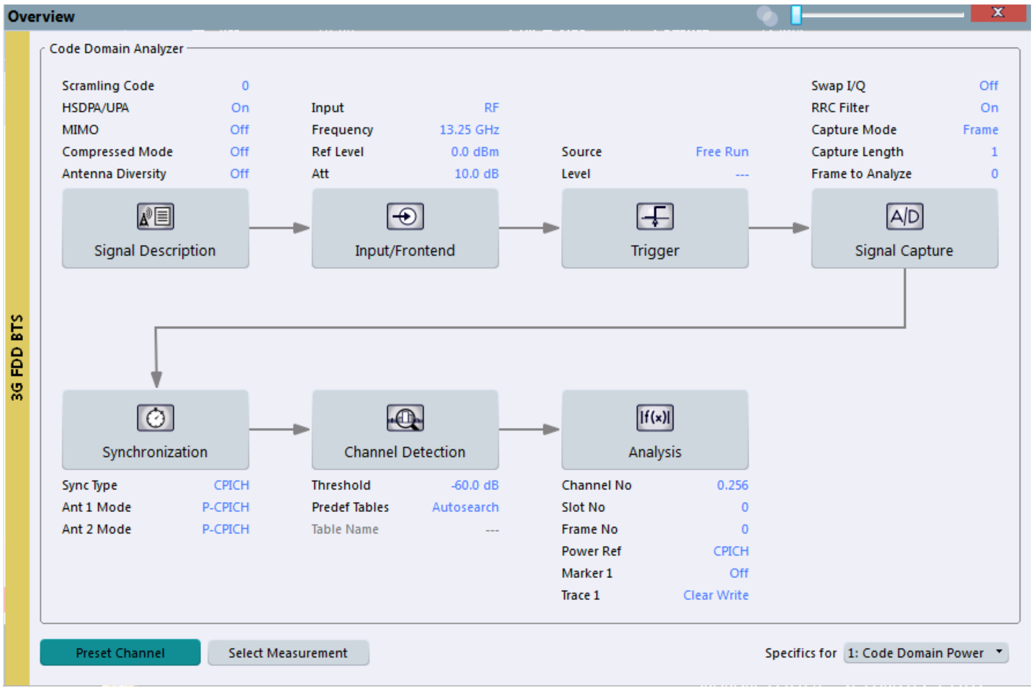



*Figure 5-1: Configuration "Overview" for CDA measurements*

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 5.2.1, "Configuration overview", on page 88.

**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.



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

Remote command:
`SYSTem:PRESet:CHANnel[:EXEC]` on page 131

**Select Measurement**
Selects a different measurement to be performed.

See Chapter 3, "Measurements and result display", on page 15.

**Specific Settings for**
The channel can 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 "Specific Settings 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.

## 5.1.2 Signal description

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

**or**: "Meas Setup" > "Signal Description"

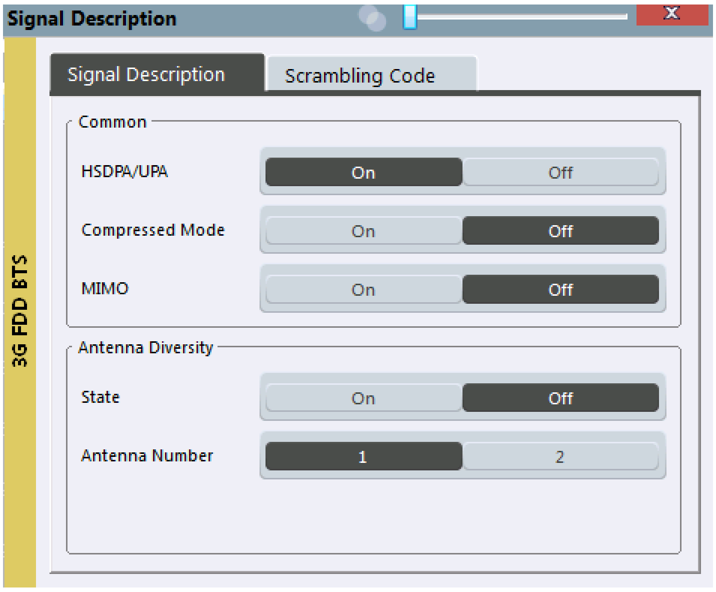
The signal description provides information on the expected input signal.

### 5.1.2.1 BTS signal description

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

**or**: "Meas Setup" > "Signal Description"

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






**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 132

**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 38).

Remote command:
`[SENSe:]CDPower:PCONtrol` on page 134

**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 41.

Remote command:
`[SENSe:]CDPower:MIMO` on page 134

**Antenna Diversity**
This option switches the antenna diversity mode on and off.

Remote command:
`[SENSe:]CDPower:ANTenna` on page 132

**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.

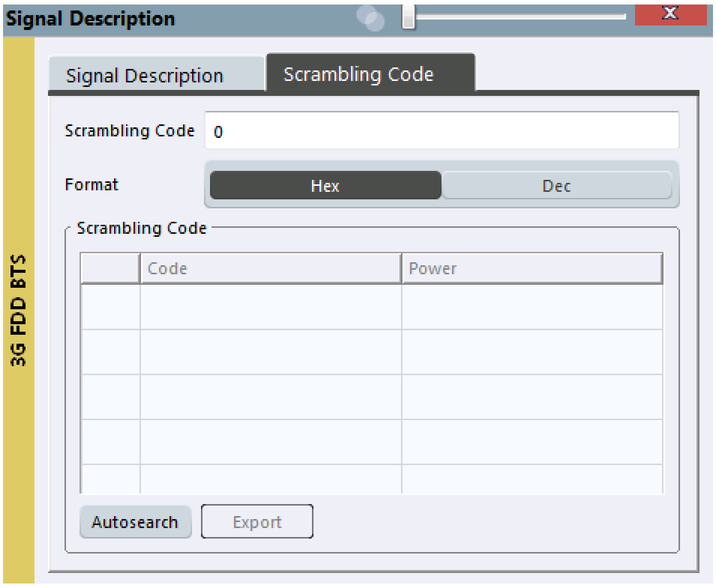
Remote command:
`[SENSe:]CDPower:ANTenna` on page 132

### 5.1.2.2 BTS scrambling code

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

**or**: "Meas Setup" > "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**

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 135

**Format Hex/Dec**

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

Remote command:

`[SENSe:]CDPower:LCODe:DVALue` on page 135

`[SENSe:]CDPower:LCODe[:VALue]` on page 135

**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 133

**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.

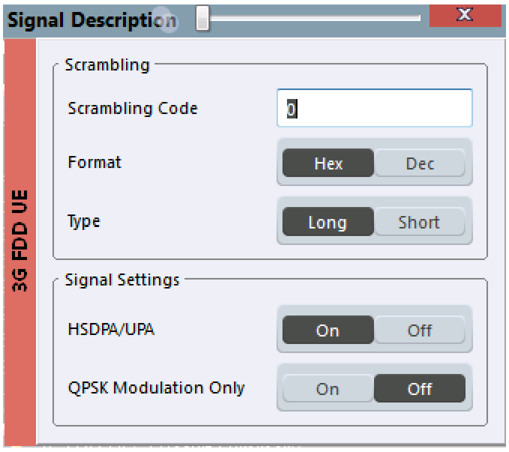
Remote command:
`[SENSe:]CDPower:LCODe:SEARch[:IMMediate]` on page 133

**Export**
Writes the detected scrambling codes together with their powers into a text file in the R&S user directory
(C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\ScrCodes.txt)

### 5.1.2.3 UE signal description (UE measurements)

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

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






**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 135

**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 135)

**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 136

**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 132

**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:QPSKonly` on page 136

## 5.1.3 Input source settings

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

**Or**: "Input & Output" > "Input Source"

The R&S VSE can control the input sources of the connected instruments.



### 5.1.3.1 Radio frequency input

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

**Or**: "Input & Output" > "Input Source" > "Radio Frequency"

The default input source for the connected instrument is "Radio Frequency". Depending on the connected instrument, different input parameters are available.

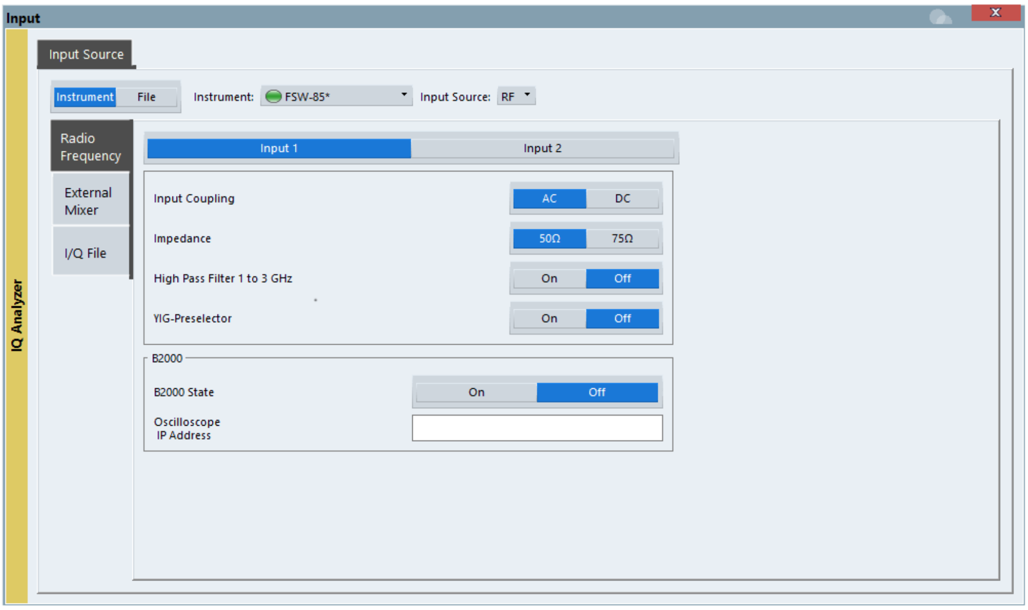



*Figure 5-2: RF input source settings for an R&S FSW with B2000 option*

If the Frequency Response Correction option (R&S VSE-K544) is installed, the R&S VSE 3GPP FDD Measurements application also supports frequency response correction using Touchstone (`.snp`) files or `.fres` files.

For details on user-defined frequency response correction, see the R&S VSE Base Software User Manual.



**Input Type (Instrument / File)**

Selects an instrument or a file as the type of input provided to the channel.

**Note:** External mixers are only available for input from a connected instrument.

**Note:** If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>` on page 144
`INPut:SELect` on page 143

**Instrument**
Specifies a configured instrument to be used for input.

**Input 1 / Input 2**
For instruments with two input connectors, you must define which input source is used for each measurement channel.

If an external frontend is active, select the connector the external frontend is connected to. You cannot use the other RF input connector simultaneously for the same channel. However, you can configure the use of the other RF input connector for another active channel at the same time.

| | |
|---|---|
| "Input 1" | R&S FSW85: 1.00 mm RF input connector for frequencies up to 85 GHz (90 GHz with option R&S FSW-B90G) |
| "Input2" | R&S FSW85: 1.85 mm RF input connector for frequencies up to 67 GHz |

Remote command:
`INPut:TYPE` on page 144

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

The RF input of the connected instrument can be coupled by alternating current (AC) or direct current (DC).

Not available for input from the optional "Analog Baseband" interface.

AC coupling blocks any DC voltage from the input signal. AC coupling is activated by default to prevent damage to the instrument. Very low frequencies in the input signal can 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<ip>:COUPling<ant>` on page 138

**Impedance**
For some measurements, the reference impedance for the measured levels of the connected instrument can be set to 50 Ω or 75 Ω.

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

This value also affects the unit conversion (see "Reference Level" on page 67).

Not available for input from the optional "Analog Baseband" interface. For analog baseband input, an impedance of 50 Ω is always used.

Remote command:
`INPut<ip>:IMPedance<ant>` on page 140

**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 disabled. 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<ip>:DPATh` on page 139

**High Pass Filter 1 to 3 GHz**

Activates an additional internal highpass 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.

For some connected instruments, this function requires an additional hardware option on the instrument.

**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<ip>:FILTer:HPASs[:STATe]` on page 140

**YIG-Preselector**

Enables or disables the YIG-preselector.

This setting requires an additional option on the connected instrument.

An internal YIG-preselector at the input of the connected instrument ensures that image frequencies are rejected. However, image rejection is only possible for a restricted bandwidth. To use the maximum bandwidth for signal analysis you can disable the YIG-preselector at the input of the connected instrument, which can lead to image-frequency display.

**Note:** Note that the YIG-preselector is active only higher frequencies, depending on the connected instrument. Therefore, switching the YIG-preselector on or off has no effect if the frequency is below that value.

To use the optional 90 GHz frequency extension (R&S FSW-B90G), the YIG-preselector must be disabled.

To use the optional 54 GHz frequency extension (R&S FSV3-B54G), the YIG-preselector must be disabled.

Remote command:
`INPut<ip>:FILTer:YIG[:STATe]` on page 140

**Capture Mode**
Determines how data from an oscilloscope is input to the R&S VSE software.

This function is only available for a connected R&S oscilloscope with a firmware version 3.0.1.1 or higher (for other versions and instruments the input is always I/Q data).

"I/Q" — The measured waveform is converted to I/Q data directly on the R&S oscilloscope (requires option K11), and input to the R&S VSE software as I/Q data.
For data imports with small bandwidths, importing data in this format is quicker. However, the maximum record length is restricted by the R&S oscilloscope. (Memory options on the R&S oscilloscope are not available for I/Q data.)

"Waveform" — The data is input in its original waveform format and converted to I/Q data in the R&S VSE software. No additional options are required on the R&S oscilloscope.
For data imports with large bandwidths, this format is more convenient as it allows for longer record lengths if appropriate memory options are available on the R&S oscilloscope.

"Auto" — Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement, oscilloscope baseband input).

Remote command:
`INPut<ip>:RF:CAPMode` on page 141

**B2000 State**
Activates the optional 2 GHz bandwidth extension (R&S FSW-B2000).

**Note:** The R&S VSE software supports input from a connected R&S FSW with a B2000 option installed. However, the R&S FSW interface to the oscilloscope must be set up and aligned directly on the instrument before the R&S VSE software can start analyzing the input.
The analysis bandwidth is defined in the data acquisition settings of the application as usual. Note that the maximum bandwidth cannot be restricted manually as for other bandwidth extension options.

Manual operation on the connected oscilloscope, or remote operation other than by the R&S VSE, is not possible while the B2000 option is active.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope[:STATe]` on page 145

**Oscilloscope Sample Rate**
Determines the sample rate used by the connected oscilloscope.

This setting is only available if an R&S oscilloscope is used to obtain the input data, either directly or via the R&S FSW.

| | |
|---|---|
| "10 GHz" | Default for waveform Capture Mode (not available for I/Q Capture Mode); provides maximum record length |
| "20 GHz" | Achieves a higher decimation gain, but reduces the record length by half.<br>Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).<br>For R&S oscilloscopes with an analysis bandwidth of 4 GHz or larger, a sample rate of 20 GHZ is always used in waveform Capture Mode |
| "40 GHz" | Provides a maximum sample rate.<br>Only available for I/Q Capture Mode, and only for R&S RTP13/RTP16 models that support a sample rate of 40 GHz (see data sheet) |

Remote command:
Input source R&S FSW via oscilloscope:
`SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe` on page 146
Input source oscilloscope waveform mode:
`INPut<ip>:RF:CAPMode:WAVeform:SRATe` on page 143
Input source oscilloscope I/Q mode:
`INPut<ip>:RF:CAPMode:IQ:SRATe` on page 142

**Oscilloscope Splitter Mode**

Activates the use of the power splitter inserted between the "IF 2 GHZ OUT" connector of the R&S FSW and the "CH1" and "CH3" input connectors of the oscilloscope. Note that this mode requires an additional alignment with the power splitter.

For details see the R&S FSW I/Q Analyzer and I/Q Input user manual.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope:PSMode[:STATe]` on page 146

**Oscilloscope IP Address**

When using the optional 2 GHz bandwidth extension (R&S FSW-B2000) with an R&S FSW as the connected instrument, the entire measurement, as well as both instruments, are controlled by the R&S VSE software. Thus, the instruments must be connected via LAN, and the TCPIP address of the oscilloscope must be defined in the R&S VSE software.

For tips on how to determine the computer name or TCPIP address, see the oscilloscope's user documentation.

Remote command:
`SYSTem:COMMunicate:RDEVice:OSCilloscope:TCPip` on page 146

**Preselector State**

Turns the preselector on and off.

When you turn on the preselector, you can configure the characteristics of the preselector and add the preamplifier into the signal path.

When you turn off the preselector, the signal bypasses the preselector and the preamplifier, and is fed into the input mixer directly.

Remote command:
`INPut<ip>:PRESelection[:STATe]` on page 141

**Preselector Mode**
Selects the preselection filters to be applied to the measurement.

"Auto" Automatically applies all available bandpass filters in a measurement. Available with the optional preamplifier.

"Auto Wide" Automatically applies the wideband filters consecutively:
- Lowpass 40 MHz
- Bandpass 30 MHz to 2250 MHz
- Bandpass 2 GHz to 8 GHz
- Bandpass 8 GHz to 26.5 GHz

Available with the optional preselector.

"Auto Narrow" Automatically applies the most suitable narrowband preselection filters in a measurement, depending on the bandwidth you have selected.
For measurement frequencies up to 30 MHz, the connected instrument uses combinations of lowpass and highpass filters. For higher frequencies, the connected instrument uses bandpass filters.
Available with the optional preselector.

"Manual" Applies the filter settings you have defined manually.

Remote command:
`INPut<ip>:PRESelection:SET` on page 141

**10 dB Minimum Attenuation**
Turns the availability of attenuation levels of less than 10 dB on and off.

When you turn on this feature, the attenuation is always at least 10 dB. This minimum attenuation protects the input mixer and avoids accidental setting of 0 dB, especially if you measure EUTs with high RFI voltage.

When you turn it off, you can also select attenuation levels of less than 10 dB.

The setting applies to a manual selection of the attenuation as well as the automatic selection of the attenuation.

Remote command:
`INPut:ATTenuation:PROTection:RESet` on page 138

### 5.1.3.2 I/Q file input

**Access**: "Overview" > "Input/Frontend" > "Input Source" > "I/Q File"

**Or**: "Input & Output" > "Input Source" > "I/Q File"

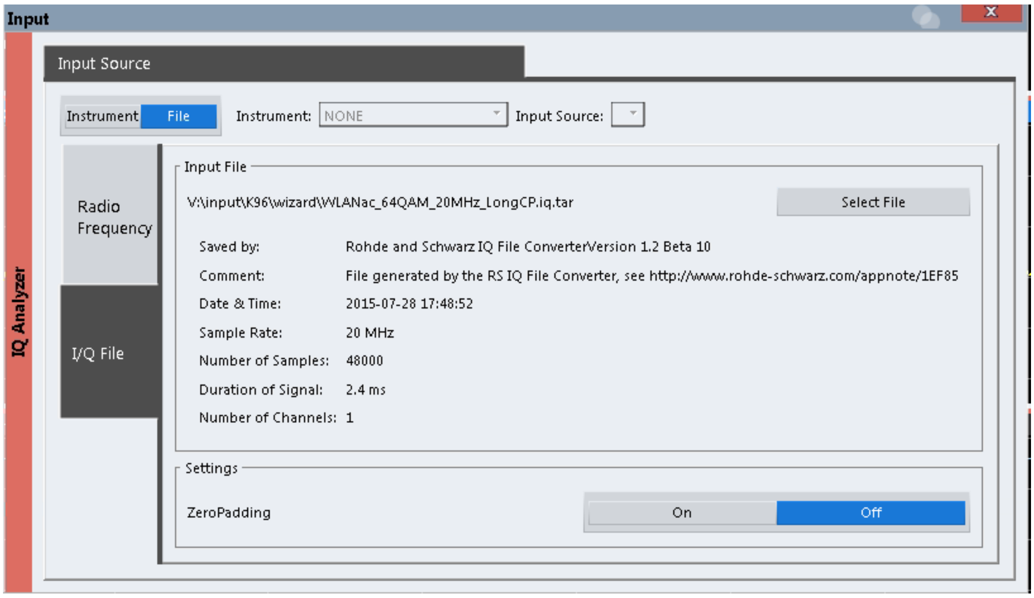
**Loading a file via drag&drop**

You can load a file simply by selecting it in a file explorer and dragging it to the R&S VSE software. Drop it into the "Measurement Group Setup" window or the channel bar for any channel. The channel is automatically configured for file input, if necessary. If the file contains all essential information, the file input is immediately displayed in the channel. Otherwise, the "Recall I/Q Recording" dialog box is opened for the selected file so you can enter the missing information.

If the file contains data from multiple channels (e.g. from LTE measurements), it can be loaded to individual input sources, if the application supports them.

For details see the R&S VSE Base Software User Manual.

The "Input Source" settings defined in the "Input" dialog box are identical to those configured for a specific channel in the "Measurement Group Setup" window.




If the Frequency Response Correction option (R&S VSE-K544) is installed, the R&S VSE 3GPP FDD Measurements application also supports frequency response correction using Touchstone (`.snp`) files or `.fres` files.

For details on user-defined frequency response correction, see the R&S VSE Base Software User Manual.

Encrypted `.wv` files can also be imported. Note, however, that traces resulting from encrypted file input cannot be exported or stored in a saveset.

**Input Type (Instrument / File)**
Selects an instrument or a file as the type of input provided to the channel.

**Note:** External mixers are only available for input from a connected instrument.

**Note:** If the R&S VSE software is installed directly on an instrument, or integrated in Cadence®AWR®VSS, some restrictions apply on the available input type.

Remote command:
`INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>` on page 144
`INPut:SELect` on page 143

**Input File**
Specifies the I/Q data file to be used for input.

Select "Select File" to open the "Load I/Q File" dialog box.

**Zero Padding**
Enables or disables zero padding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

If enabled, the required number of samples are inserted as zeros at the beginning and end of the file. The entire input data is analyzed. However, the additional zeros can effect the determined spectrum of the I/Q data. If zero padding is enabled, a status message is displayed.

If disabled (default), no zeros are added. The required samples for filter settling are taken from the provided I/Q data in the file. The start time in the R&S VSE Player is adapted to the actual start (after filter settling).

**Note:** You can activate zero padding directly when you load the file, or afterwards in the "Input Source" settings.

Remote command:
`INPut<ip>:FILE:ZPADing` on page 139

## 5.1.4 Frontend settings

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

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



### 5.1.4.1 Amplitude settings

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

**Or**: "Input & Output" > "Amplitude"

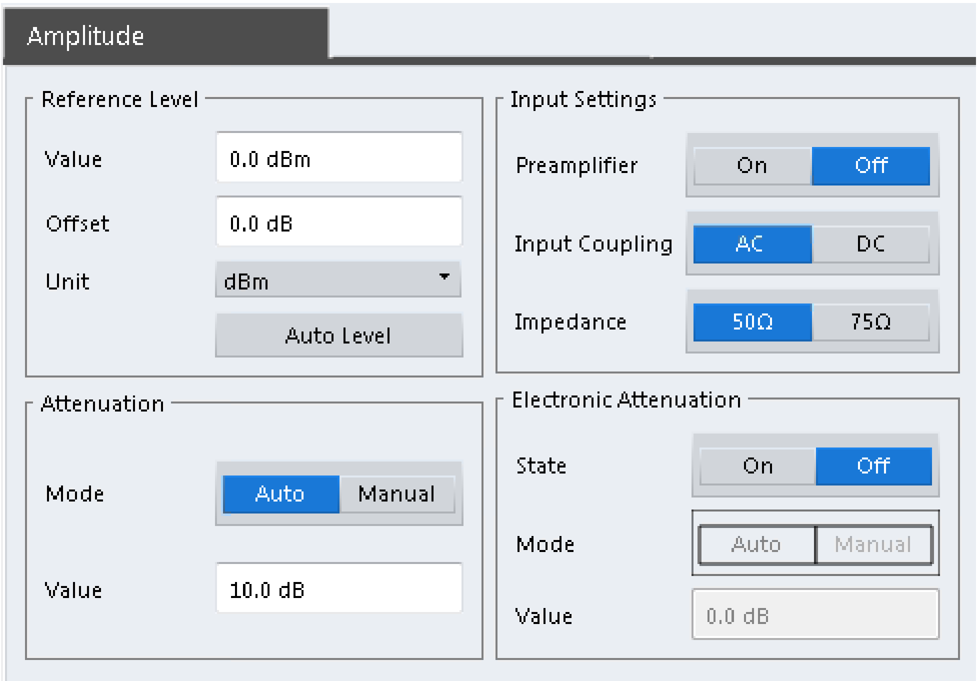
Amplitude settings determine how the connected instrument must process or display the expected input power levels.

Configuring amplitude settings allows you to:

- Adapt the instrument hardware to the expected maximum signal level by setting the Reference Level to this maximum
- Consider an external attenuator or preamplifier (using the "Offset").
- Optimize the SNR of the measurement for low signal levels by configuring the Reference Level as high as possible without introducing compression, clipping or overload. Use early amplification by the preamplifier and a low attenuation.
- Optimize the SNR for high signal levels and ensure that the instrument hardware is not damaged, using high attenuation and AC coupling (for DC input voltage).
- Adapt the reference impedance for power results when measuring in a 75-Ohm system by connecting an external matching pad to the RF input.

Which amplitude settings are available depends on the connected instrument.

Amplitude settings for input from the optional "Analog Baseband" interface are described in the R&S VSE I/Q Analyzer and I/Q Input User Manual.



**Reference Level**
Defines the expected maximum input signal level. Signal levels above this value are possibly not measured correctly, which is indicated by the "IF Overload" status display ("OVLD" for baseband input).

Defines the expected maximum reference level. Signal levels above this value are possibly not measured correctly. Signals above the reference level are indicated by an "IF Overload" status display.

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

Since the hardware of the connected instrument 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 optimal measurement (no compression, good signal-to-noise ratio).

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant> on page 174

**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 VSE so the application shows correct power results. All displayed power level results are shifted by this value.

The setting range is ±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 VSE must handle. Do not rely on the displayed reference level (internal reference level = displayed reference level - offset).

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>:OFFSet on page 174

**Unit ← Reference Level**
For CDA measurements, do not change the unit, as it would lead to useless results.

**Setting the Reference Level Automatically (Auto Level) ← Reference Level**
The connected instrument automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized. This function is not available on all supported instruments.

Remote command:
[SENSe<ip>:]ADJust:LEVel on page 204

**Attenuation Mode / Value**
Defines the attenuation applied to the RF input of the R&S VSE.

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

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 can lead to hardware damage.

Remote command:
`INPut<ip>:ATTenuation` on page 176
`INPut<ip>:ATTenuation:AUTO` on page 177

**Using Electronic Attenuation**
If the (optional) Electronic Attenuation hardware is installed on the connected instrument, 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.

**Note:** Note that restrictions can apply concerning which frequencies electronic attenuation is available for, depending on which instrument is connected to the R&S VSE software. Check your instrument documentation for details.
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 can 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.

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 178
`INPut:EATT:AUTO` on page 178
`INPut:EATT` on page 177

**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 5.1.3.1, "Radio frequency input", on page 57.

**Preamplifier ← Input Settings**
If the (optional) internal preamplifier hardware is installed on the connected instrument, a preamplifier can be activated for the RF input signal.

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

**Note:** If an optional external preamplifier is activated, the internal preamplifier is automatically disabled, and vice versa.

"Off" Deactivates the preamplifier.

"15 dB" The RF input signal is amplified by about 15 dB.

"30 dB" The RF input signal is amplified by about 30 dB.

Depending on the connected instrument, different settings are available. See the instrument's documentation for details.

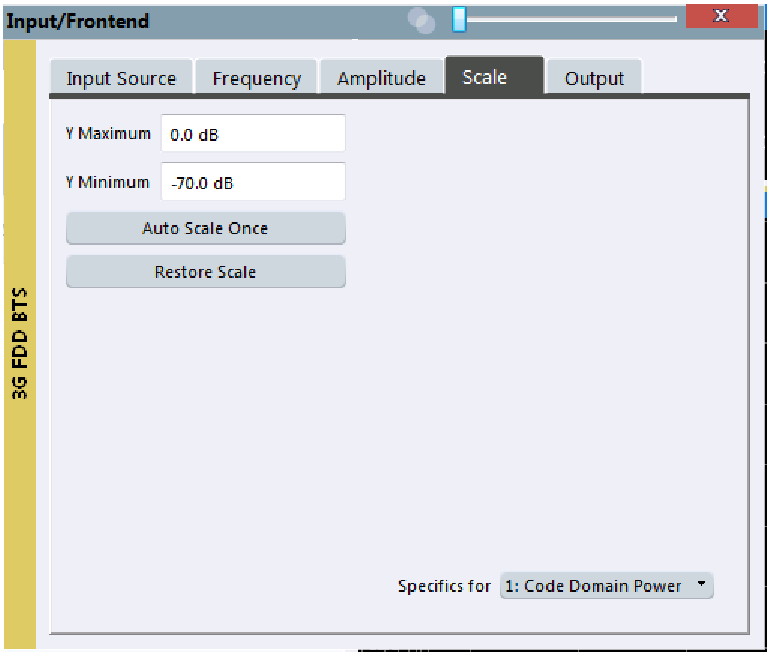
Remote command:
`INPut<ip>:GAIN<ant>:STATe` on page 175
`INPut<ip>:GAIN<ant>[:VALue]` on page 176

### 5.1.4.2 Y-axis scaling

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

**Or**: "Input & Output" > "Scale"

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






**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 175
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum` on page 175

**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.

This function is only available for RF measurements.

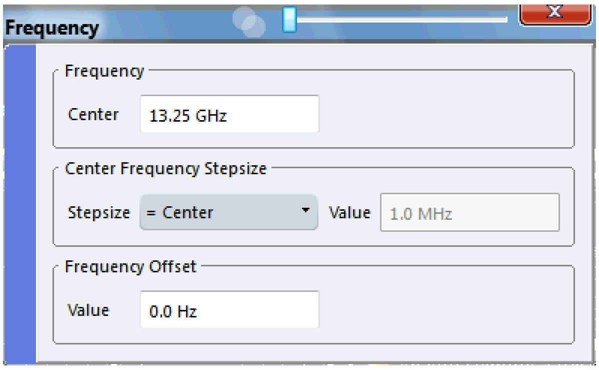
Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE` on page 173

**Restore Scale (Window)**
Restores the default scale settings in the currently selected window.

### 5.1.4.3 Frequency settings

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

**Or**: "Input & Output" > "Frequency"






**Center Frequency**
Defines the center frequency of the signal in Hertz.

$0\ \text{Hz} \leq f_{center} \leq f_{max}$

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

**Note:** For file input, you can shift the center frequency of the current measurement compared to the stored measurement data. The maximum shift depends on the sample rate of the file data.

$$CF_{shift_{max}} = CF_{file} \pm \frac{SR_{file}}{2}$$

If the file does not provide the center frequency, it is assumed to be 0 Hz.

To ensure that the input data remains within the valid analysis bandwidth, define the center frequency and the analysis bandwidth for the measurement such that the following applies:

$$CF + \frac{ABW_{channel}}{2} > CF_{file} + \frac{ABW_{file}}{2}$$

$$CF - \frac{ABW_{channel}}{2} > CF_{file} - \frac{ABW_{file}}{2}$$

Remote command:
[SENSe<ip>:]FREQuency:CENTer on page 171

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

When you use the mouse wheel, 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.<br>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 171

**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, 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. However, if it shows frequencies relative to the signal's center frequency, it is not shifted.

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 -1 THz to 1 THz. The default setting is 0 Hz.

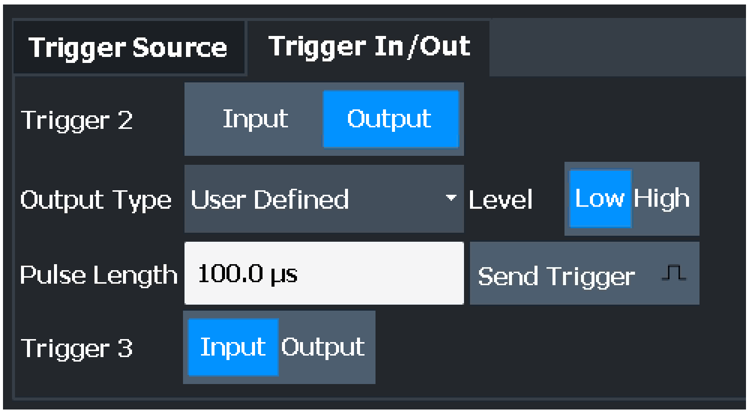
Remote command:
[SENSe<ip>:]FREQuency:OFFSet on page 172

### 5.1.5 Trigger settings

**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 VSE are configured in a separate tab of the dialog box.




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

**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 182

**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 182

**External Trigger / Trigger Channel X ← Trigger Source ← Trigger Source**
Data acquisition starts when the signal fed into the specified input connector or input channel of the connected instrument meets or exceeds the specified trigger level.

**Note:** Which input and output connectors are available depends on the connected instrument. For details, see the instrument's documentation.
For a connected R&S oscilloscope, the following signals are used as trigger input:
- "External Trigger": EXT TRIGGER INPUT connector on rear panel of instrument
- "Trigger Channel 2"/"Trigger Channel 3"/"Trigger Channel 4": Input at channel connectors CH 2/3/4 on front panel of instrument - if not used as an input source

Remote command:
`TRIG:SOUR EXT`, `TRIG:SOUR EXT2`, `TRIG:SOUR EXT3`, `TRIG:SOUR EXT4`
See `TRIGger[:SEQuence]:SOURce` on page 182

**IF Power ← Trigger Source ← Trigger Source**
The R&S VSE starts capturing data as soon as the trigger level is exceeded around the third intermediate frequency.

(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.

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 182

**Magnitude (Offline) ← Trigger Source ← Trigger Source**
For (offline) input from a file, rather than an instrument. Triggers on a specified signal level.

Remote command:
`TRIG:SOUR MAGN`, see `TRIGger[:SEQuence]:SOURce` on page 182

**Manual ← Trigger Source ← Trigger Source**
Only available for a connected R&S RTP:

Any trigger settings in the R&S VSE software are ignored; only trigger settings defined on the connected instrument are considered. Thus, you can make use of the more complex trigger settings available on an R&S RTP.

Remote command:
`TRIG:SOUR MAN`, see `TRIGger[:SEQuence]:SOURce` on page 182

**Trigger Level ← Trigger Source**
Defines the trigger level for the specified trigger source.

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

Remote command:
`TRIGger[:SEQuence]:LEVel[:EXTernal<port>]` on page 181
For baseband input only:
`TRIGger[:SEQuence]:LEVel:BBPower` on page 180

**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) |

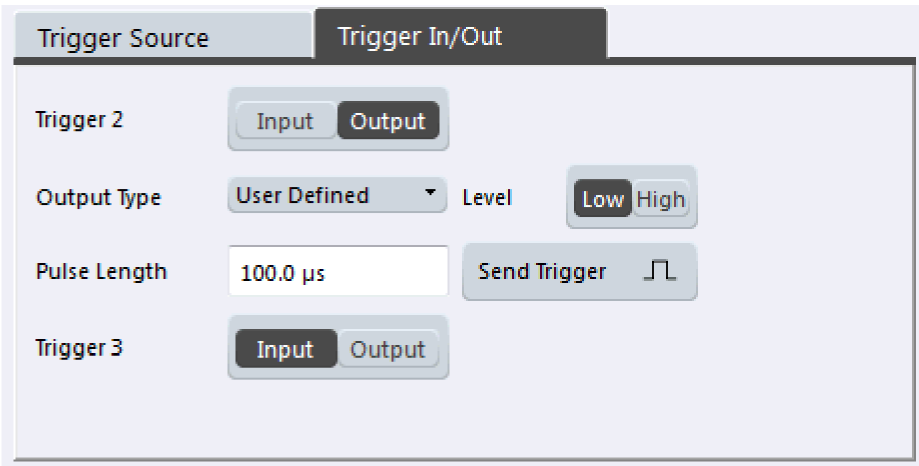
(If supported by the connected instrument.)

Remote command:
`TRIGger[:SEQuence]:HOLDoff[:TIME]` on page 180

**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 182

**Trigger 1/2/3**



The trigger input and output functionality depends on how the variable "Trigger Input/ Output" connectors are used.

Which output settings are available depends on the type of connected instrument. For details, see the instrument's documentation.

| | |
|---|---|
| "Trigger 1" | "Trigger 1" is input only. |
| "Trigger 2" | Defines the usage of the variable "Trigger Input/Output" connector on the front panel |
| "Trigger 3" | Defines the usage of the variable "Trigger 3 Input/Output" connector on the rear panel |
| "Input" | The signal at the connector is used as an external trigger source by the connected instrument. Trigger input parameters are available in the "Trigger" dialog box. |
| "Output" | The connected instrument sends a trigger signal to the output connector to be used by connected devices.<br>Further trigger parameters are available for the connector. |

Remote command:
`OUTPut:TRIGger<tp>:DIRection` on page 184

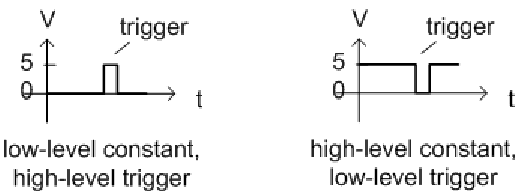
**Output Type ← Trigger 1/2/3**
Type of signal to be sent to the output

| | |
|---|---|
| "Device Triggered" | (Default) Sends a trigger when the connected instrument triggers. |
| "Trigger Armed" | Sends a (high level) trigger when the connected instrument is in "Ready for trigger" state.<br>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).<br>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) of the connected instrument, if available. |
| "User Defined" | Sends a trigger when you select "Send Trigger".<br>In this case, further parameters are available for the output signal. |

Remote command:
`OUTPut:TRIGger<tp>:OTYPe` on page 185

**Level ← Output Type ← Trigger 1/2/3**
Defines whether a high (1) or low (0) constant signal is sent to the trigger output connector (for "Output Type": "User Defined".

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<tp>:LEVel` on page 184

**Pulse Length ← Output Type ← Trigger 1/2/3**
Defines the duration of the pulse (pulse width) sent as a trigger to the output connector.

Remote command:
`OUTPut:TRIGger<tp>:PULSe:LENGth` on page 185

**Send Trigger ← Output Type ← Trigger 1/2/3**
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 is sent is indicated by a graphic on the button.

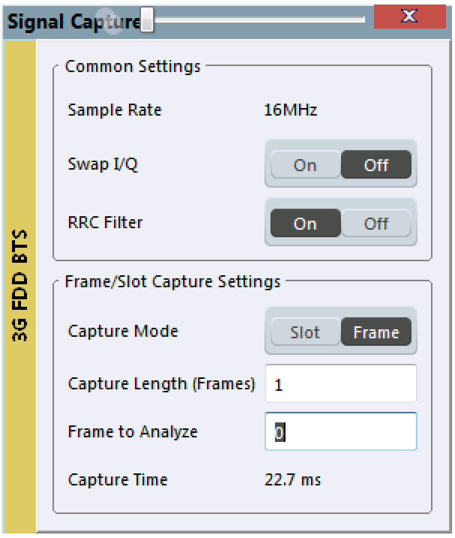
Remote command:
`OUTPut:TRIGger<tp>:PULSe:IMMediate` on page 185

## 5.1.6 Signal capture (data acquisition)

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

**or**: "Meas Setup" > "Capture"

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



**Sample Rate**

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

**Swap I/Q**

Activates or deactivates the inverted I/Q modulation. If the I and Q parts of the signal from the DUT are interchanged, the R&S VSE can do the same to compensate for it.

| | |
|---|---|
| On | I and Q signals are interchanged<br>Inverted sideband, Q+j*I |
| Off | I and Q signals are not interchanged<br>Normal sideband, I+j*Q |

Remote command:
[SENSe:]SWAPiq on page 187

**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 186

**Capture Mode**

Captures a single slot or one complete frame.

Remote command:
[SENSe:]CDPower:BASE on page 186

**Capture Length (Frames)**

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

Remote command:
[SENSe:]CDPower:IQLength on page 187

**Frame To Analyze**

Defines the frame to be analyzed and displayed.

Remote command:
[SENSe:]CDPower:FRAMe[:VALue] on page 204

**Capture Time**

This setting is read-only.

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

**Capture / Average Count**
**Access**: "Meas Setup" > "Capture / Average Count"

Defines the number of captures to be performed in the single capture mode. Values from 0 to 32767 are allowed. If the values 0 or 1 are set, one capture is performed.

The"Capture / Average Count" is applied to all 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 capture mode, if "Capture / Average Count" = 0 (default), averaging is performed over 10 captures. For "Capture / Average Count" =1, no averaging, maxhold or minhold operations are performed.

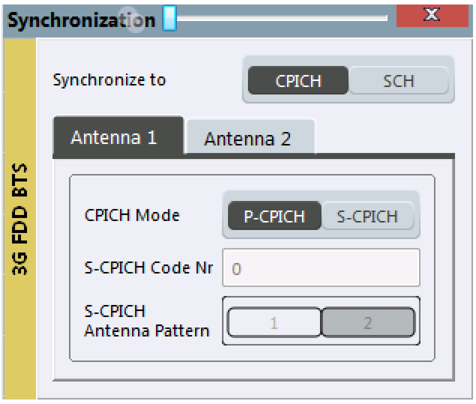
Remote command:
`[SENSe:]SWEep:COUNt` on page 187
`[SENSe:]AVERage<n>:COUNt` on page 187

## 5.1.7 Synchronization (BTS measurements only)

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

**or**: "Meas Setup" > "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**
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 189

**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 132

**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:ANTenna<antenna>[:STATe] on page 263

**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:ANTenna<antenna>:CODE on page 188

**S-CPICH Antenna Pattern**
Defines the pattern used for evaluation.

Remote command:
[SENSe:]CDPower:UCPich:ANTenna<antenna>:PATTern on page 263

## 5.1.8 Channel detection

**Access**: "Overview" > "Channel Detection"

**or**: "Meas Setup" > "Channel Detection"

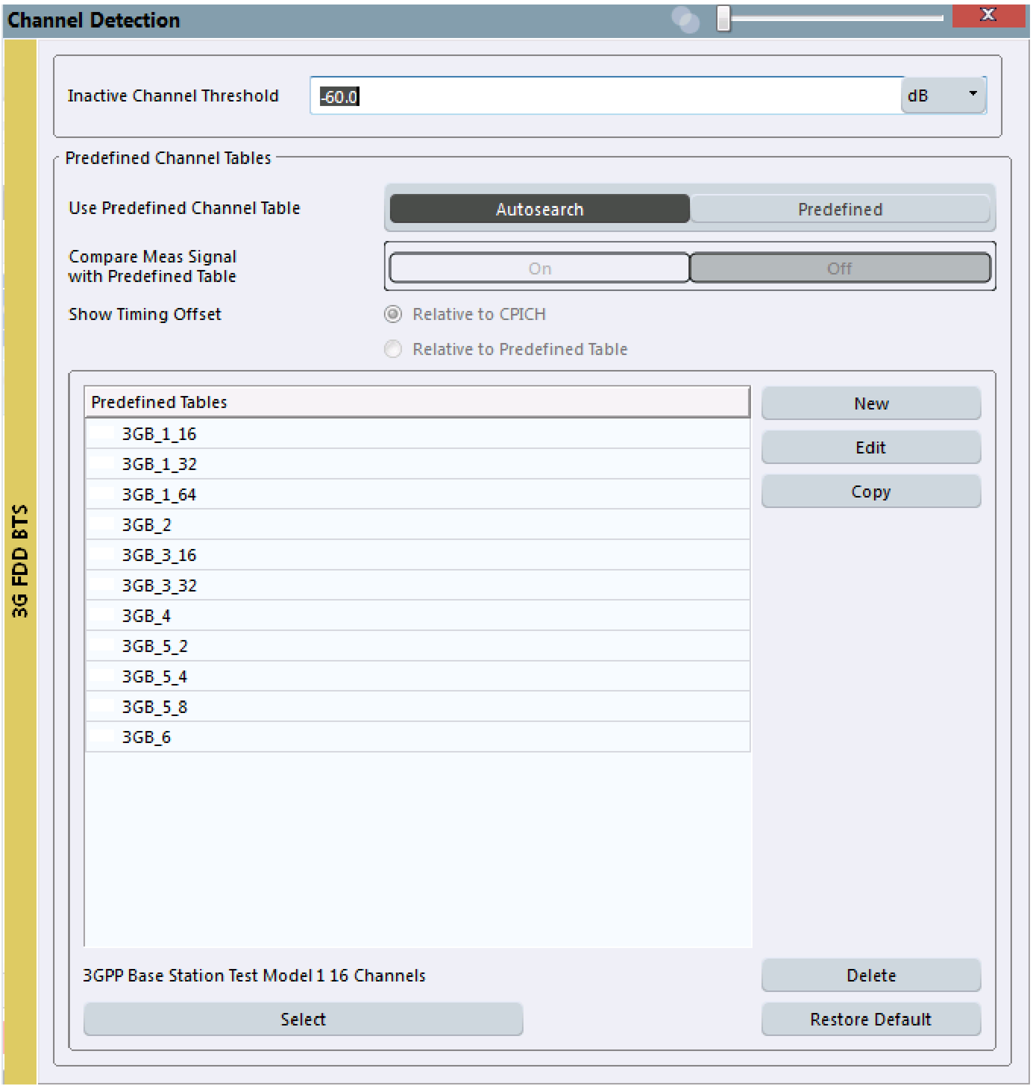
The channel detection settings determine which channels are found in the input signal.



### 5.1.8.1 General channel detection settings

**Access**: "Overview" > "Channel Detection"

**or**: "Meas Setup" > "Channel Detection"



**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 191

**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

"Autosearch" Detects channels automatically using pilot sequences

Remote command:
BTS measurements:
`CONFigure:WCDPower[:BTS]:CTABle[:STATe]` on page 192
UE measurements:
`CONFigure:WCDPower:MS:CTABle[:STATe]` on page 194

**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 190

**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:MS:CTABle:TOFFset` on page 191

### 5.1.8.2 Channel table management

**Access**: "Overview" > "Channel Detection"

**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 192
UE measurements:
`CONFigure:WCDPower:MS:CTABle:CATalog` on page 194

**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 194
UE measurements:
`CONFigure:WCDPower:MS:CTABle:SELect` on page 195

**Creating a New Table**
Creates a new channel table. See Chapter 5.1.8.4, "Channel details", on page 84.

For step-by-step instructions on creating a new channel table, see "To define or edit a channel table" on page 110.

**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 5.1.8.4, "Channel details", on page 84.

**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 5.1.8.4, "Channel details", on page 84.

Remote command:
BTS measurements:
`CONFigure:WCDPower[:BTS]:CTABle:COPY` on page 193
UE measurements:
`CONFigure:WCDPower:MS:CTABle:COPY` on page 195

**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 194
UE measurements:
`CONFigure:WCDPower:MS:CTABle:DELete` on page 195

**Restoring Default Tables**
Restores the predefined channel tables delivered with the software.

### 5.1.8.3 Channel table settings and functions

**Access**: "Overview" > "Channel Detection" > "New"/"Copy"/"Edit"

**or**: "Meas Setup" > "Channel Detection" > "New"/"Copy"/"Edit"

Some general settings and functions are available when configuring a predefined channel table.



**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 197
UE measurements:
`CONFigure:WCDPower:MS:CTABle:NAME` on page 197

**Comment**
Optional description of the channel table.

Remote command:
BTS measurements:
`CONFigure:WCDPower[:BTS]:CTABle:COMMent` on page 196
UE measurements:
`CONFigure:WCDPower:MS:CTABle:COMMent` on page 197

**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]:CTABle:MTABle` on page 196
UE measurements:
`CONFigure:WCDPower:MS:CTABle:MTABle` on page 198

**Sorting the Table**
Sorts the channel table entries.

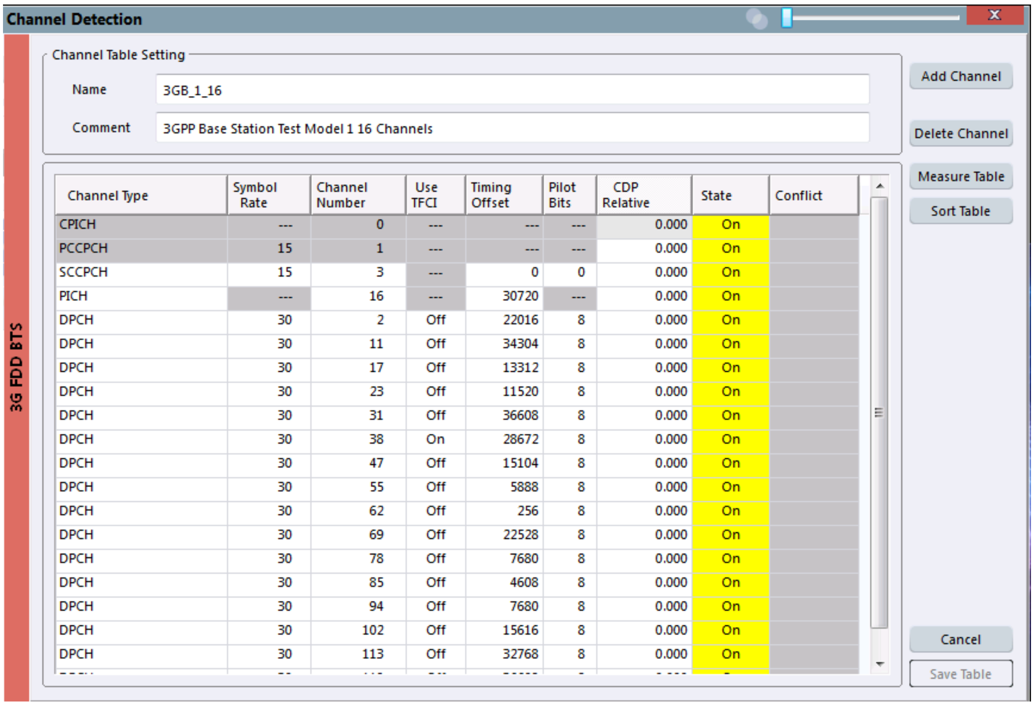
**Cancelling Configuration**
Closes the "Channel Table" dialog box without saving the changes.

**Saving the Table**
Saves the changes to the table and closes the "Channel Table" dialog box.

### 5.1.8.4 Channel details

**Access**: "Overview" > "Channel Detection" > "New"/"Copy"/"Edit"

**or**: "Meas Setup" > "Channel Detection" > "New"/"Copy"/"Edit"






**Channel Type**
Type of channel. For a list of possible channel types see Chapter 4.2, "BTS channel types", on page 38.

Remote command:
BTS measurements:
`CONFigure:WCDPower[:BTS]:CTABle:DATA` on page 198
UE measurements:
`CONFigure:WCDPower:MS:CTABle:DATA` on page 199

**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 198
UE measurements:
`CONFigure:WCDPower:MS:CTABle:DATA` on page 199

**Use TFCI**
Indicates whether the slot format and data rate are determined by the Transport Format Combination Indicator(TFCI).

This function is available in BTS mode only.

Remote command:
`CONFigure:WCDPower[:BTS]:CTABle:DATA` on page 198

**Mapping (UE only)**
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.

**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 81).

Remote command:
`CONFigure:WCDPower[:BTS]:CTABle:DATA` on page 198

**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 198
UE measurements:
`CONFigure:WCDPower:MS:CTABle:DATA` on page 199

**CDP Relative**
Code domain power (relative to the total power of the signal)

Remote command:
BTS measurements:
`CONFigure:WCDPower[:BTS]:CTABle:DATA` on page 198

UE measurements:
CONFigure:WCDPower:MS:CTABle:DATA on page 199

**State**
Indicates the channel state. Codes that are not assigned are marked as inactive channels.

Remote command:
BTS measurements:
CONFigure:WCDPower[:BTS]:CTABle:DATA on page 198
UE measurements:
CONFigure:WCDPower:MS:CTABle:DATA on page 199

**Conflict**
Indicates a code domain conflict between channel definitions (e.g. overlapping channels).

## 5.1.9 Automatic settings

**Access:** "Auto Set" toolbar

Some settings can be adjusted by the R&S VSE 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.



**Adjusting all Determinable Settings Automatically (Auto All)**
Activates all automatic adjustment functions for the current measurement settings, including:

- "Setting the Reference Level Automatically (Auto Level)" on page 67
- "Autosearch for Scrambling Code" on page 55
- "Auto Scale All" on page 87

Remote command:
[SENSe<ip>:]ADJust:ALL on page 202

**Setting the Reference Level Automatically (Auto Level)**
The connected instrument automatically determines the optimal reference level for the current input data. At the same time, the internal attenuators and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized. This function is not available on all supported instruments.

Remote command:
[SENSe<ip>:]ADJust:LEVel on page 204

**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.

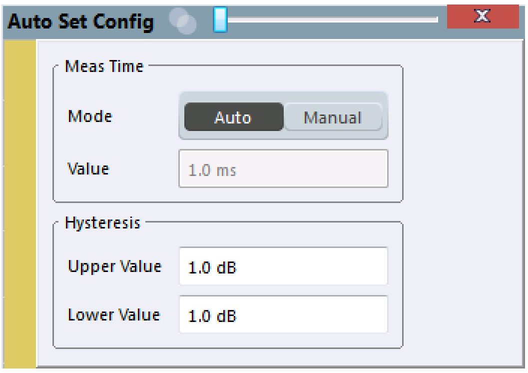
Searching requires that the correct center frequency and level are set. The scrambling code search can automatically determine the primary scrambling code number. The secondary scrambling code number is expected as 0. Alternative scrambling codes can not be detected. Therefore the range for detection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

Remote command:
[SENSe:]CDPower:LCODe:SEARch[:IMMediate] on page 133

**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.

**Auto Settings Configuration**
For some automatic settings, additional parameters can be configured. The "Auto Set Config" dialog box is available when you select the icon from the "Auto Set" toolbar.




**Automatic Measurement Time Mode and Value ← Auto Settings Configuration**
To determine the optimal reference level automatically, a level measurement is performed on the connected instrument. You can define whether the duration of this measurement is determined automatically or manually.

To define the duration manually, enter a value in seconds.

Remote command:
[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE on page 203
[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation on page 202

**Upper Level Hysteresis ← Auto Settings Configuration**
When the reference level is adjusted automatically using the Auto Level function, the internal attenuators and the preamplifier (if available) of the connected instrument are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines an upper threshold that the signal must exceed (compared to the last measurement) before the reference level is adapted automatically.

Remote command:
[SENSe<ip>:]ADJust:CONFigure:HYSTeresis:UPPer on page 203

**Lower Level Hysteresis ← Auto Settings Configuration**
When the reference level is adjusted automatically using the Auto Level function, the internal attenuators and the preamplifier (if available) of the connected instrument 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 that the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Remote command:
[SENSe<ip>:]ADJust:CONFigure:HYSTeresis:LOWer on page 203

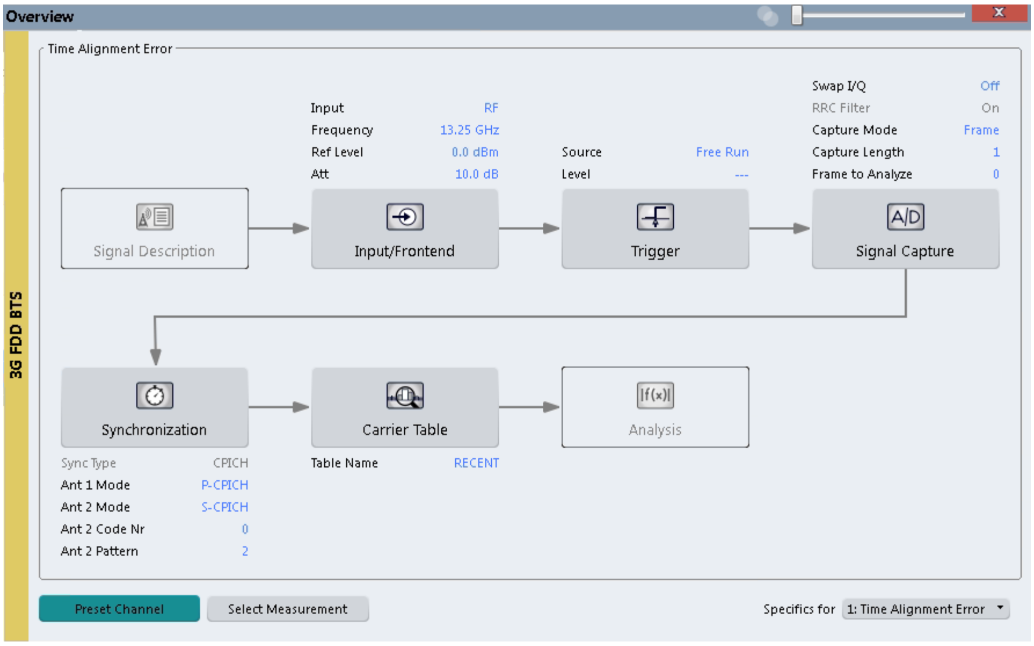
## 5.2 Time alignment error measurements

**Access**: "Overview" > "Select Measurement" > "Time Alignment Error"

### 5.2.1 Configuration overview

**Access**: "Meas Setup" > "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 5.1.2.2, "BTS scrambling code", on page 54
3. "Input/ Frontend"
   See Chapter 5.1.3, "Input source settings", on page 57 and Chapter 5.1.4, "Frontend settings", on page 65
4. (Optionally:) "Trigger"
   See Chapter 5.1.5, "Trigger settings", on page 72
5. "Signal Capture"
   See Chapter 5.1.6, "Signal capture (data acquisition)", on page 76
6. "Synchronization"
   See Chapter 5.1.7, "Synchronization (BTS measurements only)", on page 78
7. "Carrier Table"
   See Chapter 5.2.2, "Carrier table configuration", on page 90
8. "Display Configuration"
   See Chapter 3.1.2, "Evaluation methods for code domain analysis", on page 18 and "Evaluation Methods" on page 34

All settings required for "Time Alignment Error" measurements are identical to those described for Code Domain Analysis (see Chapter 5.1, "Code domain analysis", on page 50).

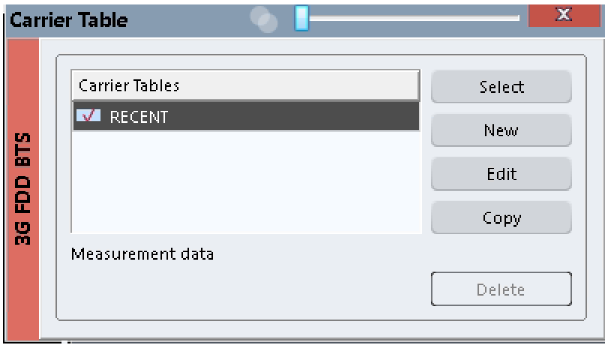
For TAE measurement on multiple base stations, however, the carrier table must be defined.

## 5.2.2 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.

### 5.2.2.1 Carrier table management

**Access**: "Overview" > "Select Measurement":"Time Alignment Error" > "Carrier Table"






**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:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\chan_tab\carrier_table\`.

Remote command:
`[SENSe:]TAERror:CATalog` on page 212

**Selecting a Table**

Selects the currently highlighted carrier table.

Remote command:
`[SENSe:]TAERror:PRESet` on page 213

**Creating a New Table**

Creates a new carrier table. See Chapter 5.2.2.2, "Carrier table settings and functions", on page 91.

Remote command:
`[SENSe:]TAERror:NEW` on page 213

**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 5.2.2.2, "Carrier table settings and functions", on page 91.

**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 5.2.2.2, "Carrier table settings and functions", on page 91.

**Deleting a Table**
Deletes the currently selected carrier table after a message is confirmed.

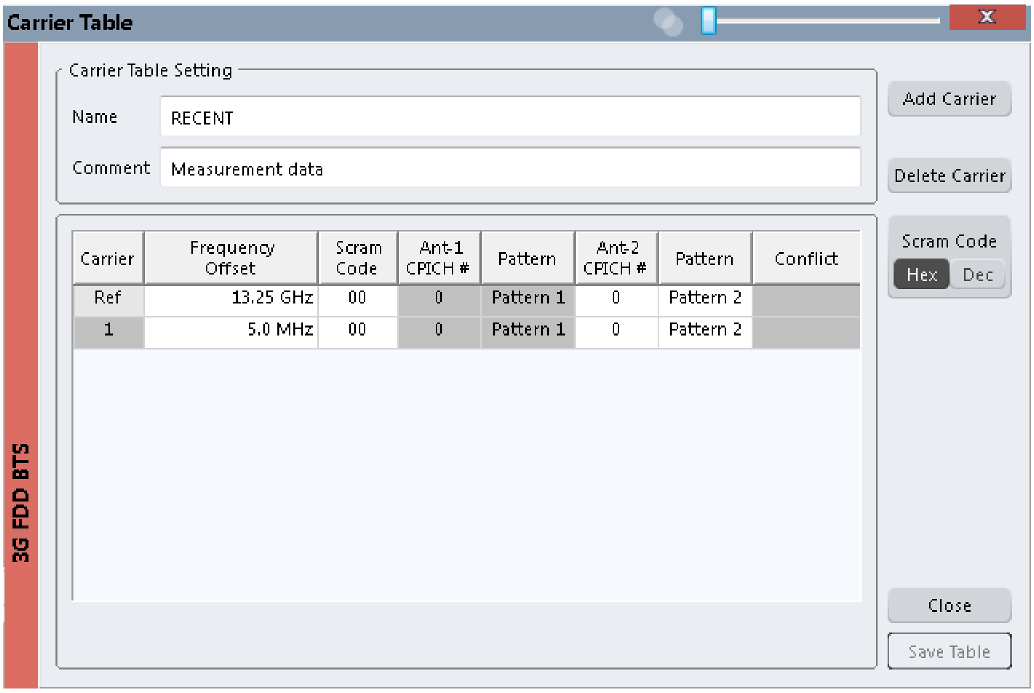
The default table ("RECENT") cannot be deleted.

Remote command:
[SENSe:]TAERror:DELete on page 212

### 5.2.2.2 Carrier table settings and functions

**Access**: "Overview" > "Select Measurement":"Time Alignment Error" > "Carrier Table" > "New"/ "Copy"/ "Edit"

Some general settings and functions are available when configuring a carrier table.



**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 211

**Deleting a Carrier**
Deletes the currently selected carrier from the table.

Remote command:
[SENSe:]TAERror:CARRier<c>:DELete on page 211

**Selecting the Scrambling Code Format**
The Scrambling Code can be defined in hexadecimal (default) or in decimal format.

**Cancelling and Closing Configuration**
Closes the "Carrier Table Settings" dialog box without saving the changes.

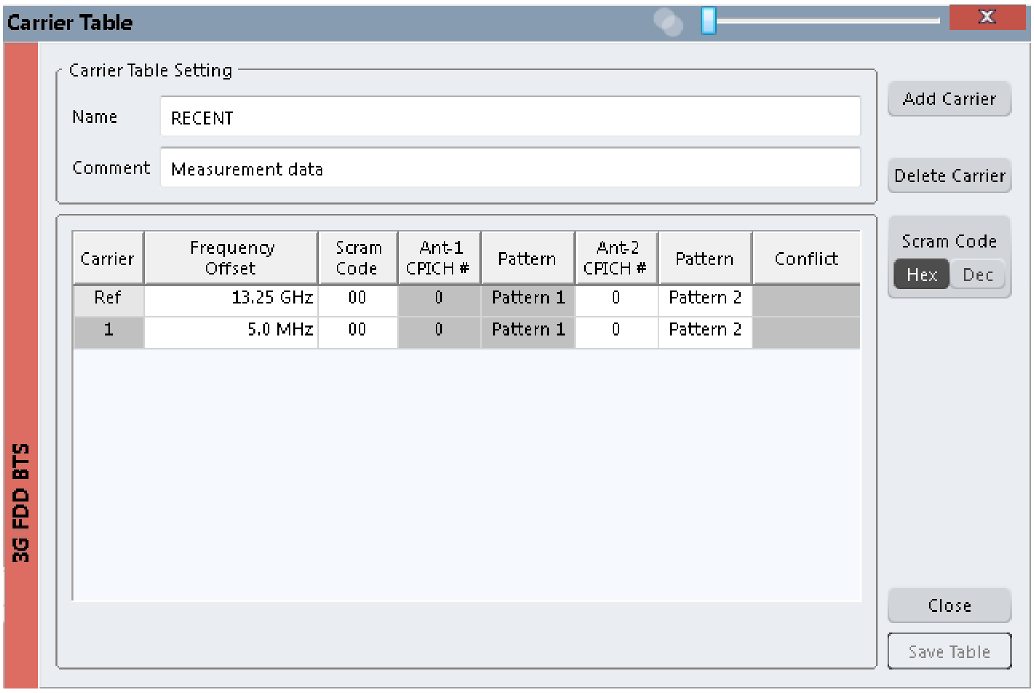
**Saving the Table**
Saves the changes to the table and closes the "Carrier Table Settings" dialog box.

The new or edited table is stored in the default directory for carrier tables:
`C:\ProgramData\Rohde-Schwarz\VSE\<version_no>\user\chan_tab\carrier_table\`.

Remote command:
[SENSe:]TAERror:SAVE on page 213

### 5.2.2.3 Carrier details

**Access**: "Overview" > "Select Measurement":"Time Alignment Error" > "Carrier Table" > "New"/ "Copy"/ "Edit"






**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<c>:COUNt` on page 210

**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 49).

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 211

**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 92).

The scrambling code for the reference carrier is taken from the Signal Description settings for CDA measurements (see Chapter 5.1.2.2, "BTS scrambling code", on page 54).

Remote command:
[SENSe:]TAERror:CARRier<c>:SCODe on page 212

**Antenna 1: CPICH-Number**
The CPICH number used for synchronization

Remote command:
[SENSe:]TAERror:CARRier<c>:ANTenna<antenna>:CPICh on page 209

**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 210

**Antenna 2: CPICH-Number**
The CPICH number used for synchronization

Remote command:
[SENSe:]TAERror:CARRier<c>:ANTenna<antenna>:CPICh on page 209

**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 210

**Conflict**
Indicates a conflict between carriers, such as overlapping frequencies or frequencies outside the allowed range (see "Frequency Offset" on page 93). The detailed conflict message is displayed beneath the carrier table.

# 6 Analysis

**Access**: "Overview" > "Analysis"

General result analysis settings concerning the evaluation range, trace, markers, etc. can be configured

The remote commands required to perform these tasks are described in Chapter 10.9, "Analysis", on page 247.

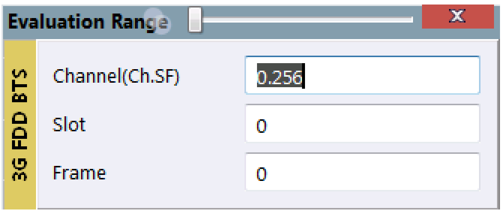


## 6.1 Evaluation range

**Access**: "Overview" > "Analysis" > "Evaluation Range"

**or**: "Meas Setup" > "Evaluation Range"

The evaluation range defines which channel, slot or frame is evaluated in the result display.






**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 204

**(CPICH) Slot**
Selects the (CPICH) 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 205

**Frame To Analyze**
Defines the frame to be analyzed and displayed.

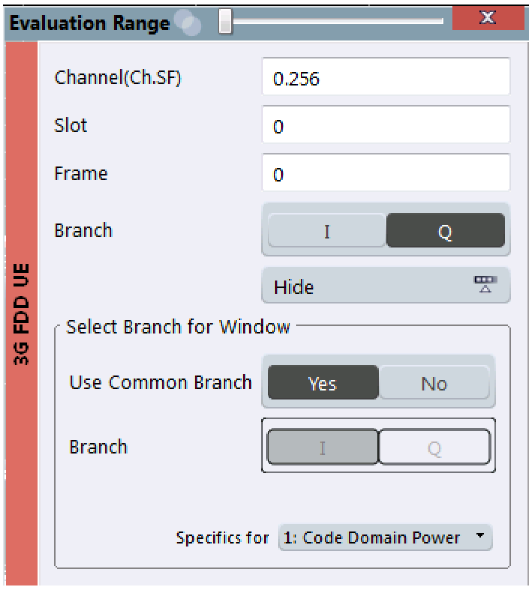
Remote command:
`[SENSe:]CDPower:FRAMe[:VALue]` on page 204

**Branch (UE measurements only)**
Switches between the evaluation of the I and the Q branch in UE measurements.

Remote command:
`[SENSe:]CDPower:MAPPing` on page 205

**Details / Hide ← Branch (UE measurements only)**
**Access**: "Overview" > "Analysis" > "Evaluation Range" > "Details"/"Hide"

By default, the same branch is used for all evaluations. However, you can select a different branch for individual windows.




**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:

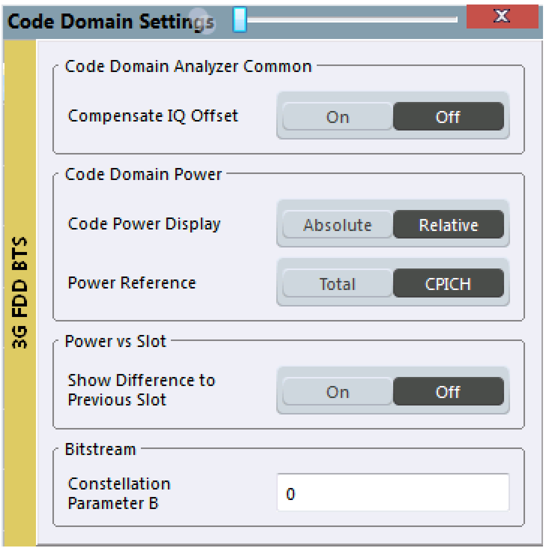
`[SENSe:]CDPower:MAPPing` on page 205

## 6.2 Code domain settings (BTS measurements)

**Access**: "Overview" > "Analysis" > "Code Domain Settings"

**or**: "Meas Setup" > "Code Domain Settings"

Some evaluations provide further settings for the results. The settings for BTS measurements are described here.






**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 207

**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 207
`[SENSe:]CDPower:PREFerence` on page 208

**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 207

**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:

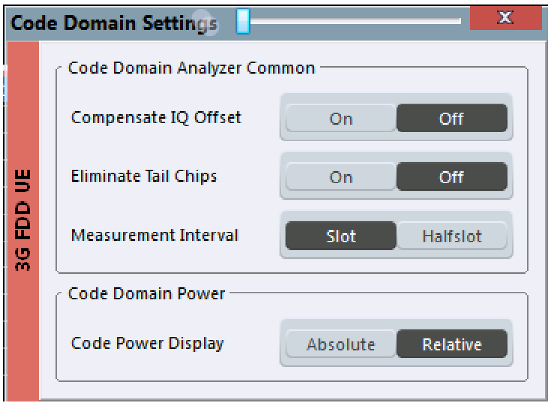
[SENSe:]CDPower:CPB on page 206

## 6.3 Code domain settings (UE measurements)

**Access**: "Overview" > "Analysis" > "Code Domain Settings"

**or**: "Meas Setup" > "Code Domain Settings"

Some evaluations provide further settings for the results. The settings for UE measurements are described here.






**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 209

**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 207

**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 µs 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 208

**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

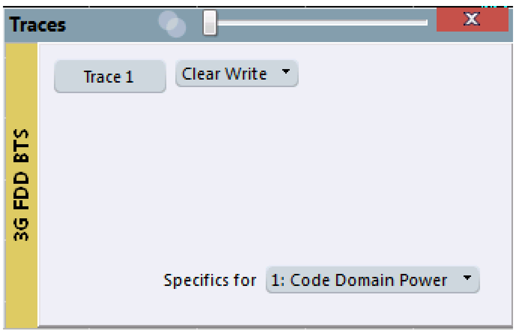
Remote command:
[SENSe:]CDPower:PDISplay on page 207

## 6.4 Traces

**Access**: "Overview" > "Analysis" > "Trace"

**Or**: "Trace" > "Trace"

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 VSE 3GPP FDD Measurements application can be exported to an ASCII file using the common R&S VSE trace export functionality.

For details, see the trace configuration chapter in the R&S VSE 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 (default): the trace is overwritten by each measurement.
All available detectors can be selected.

"Max Hold" The maximum value is determined over several measurements and displayed. The R&S VSE saves the measurement result 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 VSE saves the measurement result in the trace memory only if the new value is lower than the previous one.

"Average" The average is formed over several measurements.

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

**Note:** If a trace is frozen, you can change the measurement settings, apart from scaling settings, without impact on the displayed trace. The fact that the displayed trace no longer matches the current measurement settings is indicated by a yellow asterisk on the tab label.
If you change any parameters that affect the scaling of the diagram axes, the R&S VSE automatically adapts the trace data to the changed display range. Thus, you can zoom into the diagram after the measurement to show details of the trace.

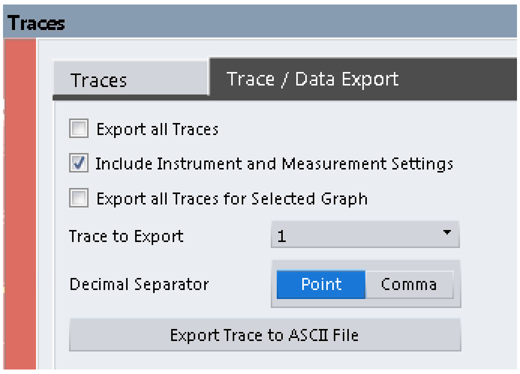
"Blank" Removes the selected trace from the display.

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE` on page 247

## 6.5 Trace / data export configuration

Traces resulting from encrypted file input cannot be exported.

The standard data management functions that are available for all R&S VSE applications are not described here, e.g. saving or loading instrument settings, or exporting the I/Q data in other formats.






**Export all Traces and all Table Results**
Selects all displayed traces and result tables (e.g. "Result Summary", marker table etc.) in the current application for export to an ASCII file.

Alternatively, you can select one specific trace only for export (see Trace to Export).

The results are output in the same order as they are displayed on the screen: window by window, trace by trace, and table row by table row.

Remote command:
`FORMat:DEXPort:TRACes` on page 246

**Include Instrument & Measurement Settings**
Includes additional instrument and measurement settings in the header of the export file for result data.

See the R&S VSE base software user manual for details.

Remote command:
`FORMat:DEXPort:HEADer` on page 246

**Trace to Export**
Defines an individual trace to be exported to a file.

This setting is not available if Export all Traces and all Table Results is selected.

**Decimal Separator**
Defines the decimal separator for floating-point numerals for the data export/import files. Evaluation programs require different separators in different languages.

Remote command:
`FORMat:DEXPort:DSEParator` on page 245

## 6.6 Markers

**Access**: "Overview" > "Analysis" > "Marker"

**Or**: "Marker"

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.

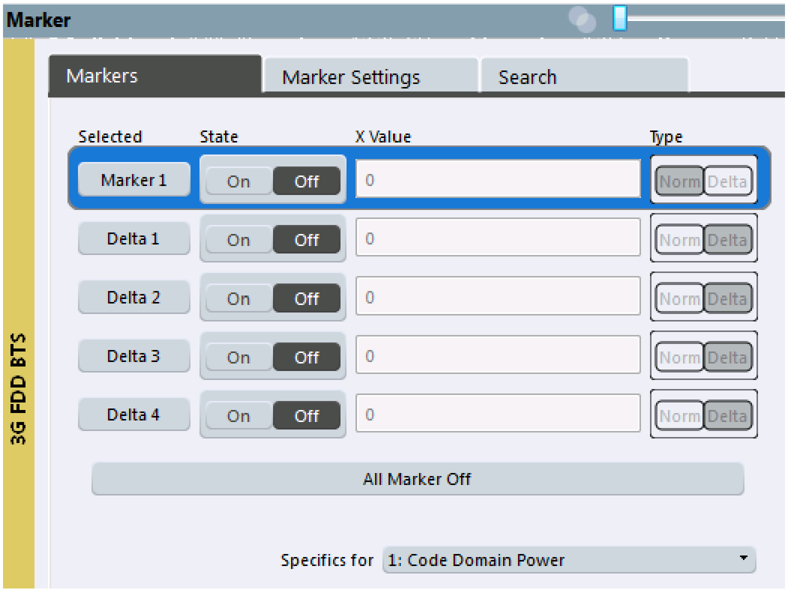


## 6.6.1 Individual marker settings

**Access**: "Overview" > "Analysis" > "Marker" > "Markers"

**Or**: "Marker" > "Marker"

In CDA evaluations, up to four markers can be activated in each diagram at any time.



**Place New Marker**
Activates the next currently unused marker and sets it to the peak value of the current trace in the current window.

**Marker 1/ Delta 1/ Delta 2/.../Delta 4**
When you select the arrow on the marker selection list in the toolbar, or select a marker from the "Marker > Select Marker" menu, the marker is activated.An edit dialog box is displayed to enter the marker position ("X-value").

To deactivate a marker, select the marker name in the marker selection list in the toolbar (not the arrow) to display the "Select Marker" dialog box. Change the "State" to "Off".

Marker 1 is always the default reference marker for relative measurements. If activated, markers 2 to 4 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display using the "Marker Type" function.

Several markers can be configured very easily using the "Marker" dialog box, see Chapter 6.6, "Markers", on page 102.

Remote command:
`CALCulate<n>:MARKer<m>[:STATe]` on page 249
`CALCulate<n>:MARKer<m>:X` on page 249
`CALCulate<n>:MARKer<m>:Y?` on page 250
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 250
`CALCulate<n>:DELTamarker<m>:X` on page 251
`CALCulate<n>:DELTamarker<m>:X:RELative?` on page 251
`CALCulate<n>:DELTamarker<m>:Y?` on page 252

**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 249
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 250

**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 251
`CALCulate<n>:MARKer<m>:X` on page 249

**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 249
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 250

**All Markers Off**

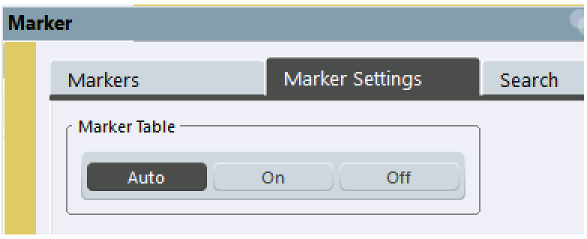
Deactivates all markers in one step.

Remote command:
`CALCulate<n>:MARKer<m>:AOFF` on page 250

## 6.6.2 General marker settings

**Access**: "Overview" > "Analysis" > "Marker" > "Marker Settings"

**Or**: "Marker" > "Marker" > "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" No separate marker table is displayed.
The marker information is displayed within the diagram area.

"Auto" (Default) If more than two markers are active, the marker table is displayed automatically.
The marker information for up to two markers is displayed in the diagram area.

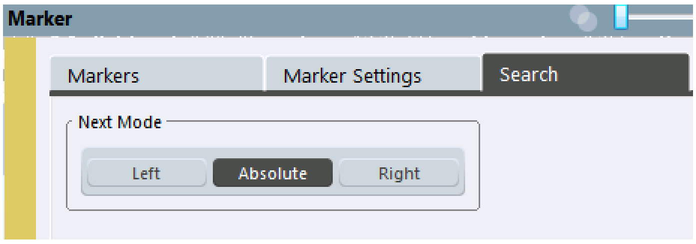
Remote command:
`DISPlay[:WINDow<n>]:MTABle` on page 252

## 6.6.3 Marker search settings

**Access**: "Overview" > "Analysis" > "Marker" > "Search"

**Access:** "Marker" > "Search"

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**
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 10.9.2.3, "Positioning the marker", on page 253

## 6.6.4 Marker positioning functions

**Access:** "Marker" toolbar

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

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 254
CALCulate<n>:MARKer<m>:MAXimum:RIGHt on page 254
CALCulate<n>:MARKer<m>:MAXimum:LEFT on page 254
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 256
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt on page 257
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT on page 256

### 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 255
CALCulate<n>:MARKer<m>:MINimum:LEFT on page 254
CALCulate<n>:MARKer<m>:MINimum:RIGHt on page 255
CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 257
CALCulate<n>:DELTamarker<m>:MINimum:LEFT on page 257
CALCulate<n>:DELTamarker<m>:MINimum:RIGHt on page 258

### 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 254
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK] on page 257

### 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 255
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK] on page 258

### Marker To CPICH

**Access**: "Marker" > "CPICH"

Sets the marker to the CPICH channel.

Remote command:
CALCulate<n>:MARKer<m>:FUNCtion:CPICh on page 253

**Marker To PCCPCH**
**Access**: "Marker" > "PCCPCH"

Sets the marker to the PCCPCH channel.

Remote command:
`CALCulate<n>:MARKer<m>:FUNCtion:PCCPch` on page 253

# 7 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. Open a new channel or replace an existing one and select the "3GPP FDD" application.
2. Configure the input source to be used as described in the R&S VSE Base Software User Manual.
3. Select the "Meas Setup > Overview" menu item to display the "Overview" for a 3GPP FDD measurement.
4. Select the "Signal Description" button and configure the expected input signal and used scrambling code.
5. Select the "Input/Frontend" button and then the "Frequency" tab to define the input signal's center frequency.
6. 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.
7. Select the "Signal Capture" button and define the acquisition parameters for the input signal.
8. If necessary, select the "Synchronization" button and change the channel synchronization settings.
9. 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 110.
10. Select the "Add Window" icon from the toolbar to add further result displays for the 3GPP FDD channel.
11. Select "Meas Setup > Overview" to display the "Overview".
12. 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.
    - Configure markers and delta markers to determine deviations and offsets within the results, e.g. when comparing errors or peaks.

13. In the "Control" toolbar, or in the "Sequence" tool window, select ⇥ "Single" capture mode, then select the ▶ "Capture" function to stop the continuous measurement mode and start a defined number of measurements.

**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. From the "Meas Setup" menu, select "Channel Detection".
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 DPCCH 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. Open a new channel or replace an existing one and select the "3GPP FDD" application.
2. From the "Meas Setup" menu, select "Synchronization". Configure the location of the S-CPICH for antenna 2 and select the "Antenna Pattern".
3. Select the Time Alignment Error measurement:
   a) From the "Meas Setup" menu, select "Select Measurement".
   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. Open a new channel or replace an existing one and select the "3GPP FDD" application.
2. Select the Time Alignment Error measurement:
   a) Open the Configuration "Overview".
   b) Select "Select Measurement".
   c) Select "Time Alignment Error".
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.

# 8 Measurement examples

Some practical examples for basic 3GPP°FDD Base station tests are provided here. They describe how operating and measurement errors can be avoided using correct presettings. The measurements are performed with R&S VSE equipped with option R&S VSE-K72.

It is assumed an instrument is connected and configured for input to the R&S VSE software.

(See the R&S VSE Base Software User Manual).

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 VSE with option R&S VSE-K72: 3GPP FDD measurements
- An R&S FSW Signal and Spectrum Analyzer
- The Vector Signal Generator R&S SMW200A 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:



## 8.1 Measurement 1: 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 A 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 OUT) on the rear panel of the R&S SMW200A (coaxial cable with BNC connectors).

**Settings on the R&S SMW200A**

1. PRESET
2. "Freq. A" = *2.1175 GHz*
3. "Level"= *0 dBm*
4. "Baseband A > CDMA Standards > 3GPP FDD"
5. "General" tab: "Link Direction > DOWN/FORWARD"
6. "Basestations" tab: "Test Setups/Models > Test_Model_1_16_channels"
7. "Basestations" tab: "Select Basestation > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"
9. "RF A": "On"

**Settings in the R&S VSE**

1. "File > Preset > All"
2. "Measurement Group Setup": "Replace Channel > 3GPP FDD BTS"
3. "Input and Output > Amplitude": "Reference level"= *10 dBm*
4. "Input and Output > Frequency": "Center frequency" = *2.1175 GHz*
5. "Input and Output > Scale": "Auto Scale Once"

**Result**

Window 1 shows the Code Domain Power of the signal.

Window 2 shows the Result Summary, i.e. the numeric results of the CDP measurement.


*Figure 8-1: Measurement Example 1: Measuring the Relative Code Domain Power*

## 8.1.1 Synchronizing the reference frequencies

The synchronization of the reference oscillators both of the DUT and the 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 OUT) on the rear panel of the 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 in the R&S VSE

In addition to the settings of the basic test, activate the use of an external reference:

► "Instruments > Info & Settings > Reference": "Reference Frequency Input = External Reference 10 MHz"

The displayed carrier frequency error should be < 10 Hz.

### 8.1.2 Behavior with deviating center frequency

In the following, the behavior 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 in the R&S VSE:
   - Up to 5 kHz, a frequency error causes no apparent difference in measurement accuracy of the code domain power measurement.
   - Above a frequency error of 5 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. 7 kHz, a CDP measurement cannot be performed. The R&S VSE displays all possible codes in blue with a similar level.

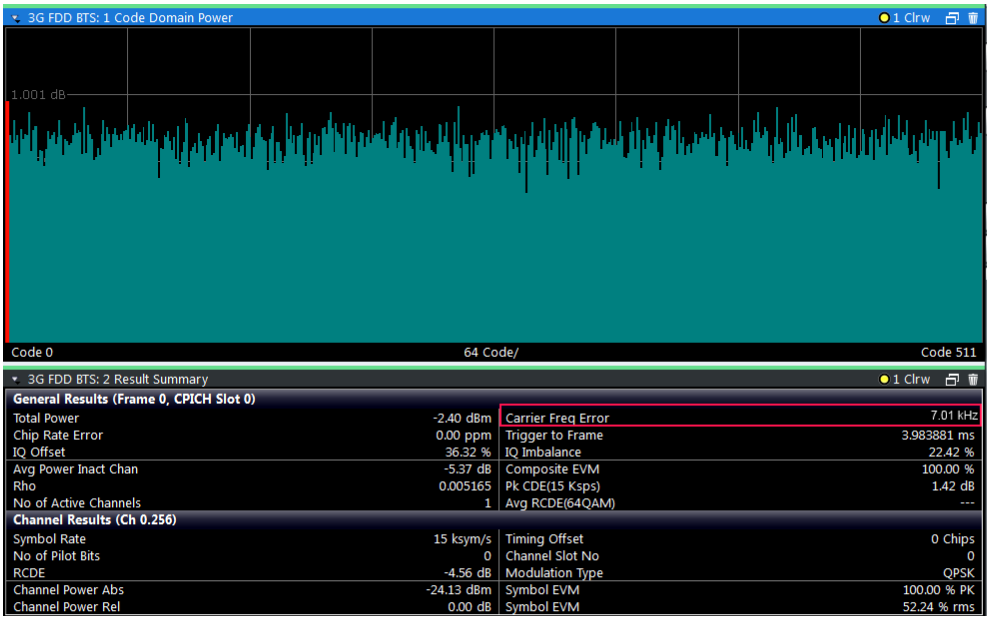



*Figure 8-2: Measurement Example 1: Measuring the Relative Code Domain Power with Incorrect Center Frequency*

3. Reset the frequency to *2.1175 GHz* both on the R&S SMW200A and in the R&S VSE software.

### 8.1.3 Behavior with incorrect scrambling code

A valid CDP measurement can be carried out only if the scrambling code set in the R&S VSE is identical to that of the transmitted signal.

**Settings on the R&S SMW200A**

- "Basestationss" tab > BS 1 > "Common" tab: "Scrambling Code (hex)" = *0000*

**Settings in the R&S VSE**

- "Meas Setup > Scrambling Code" = *0001*

**Result**

The CDP display shows all possible codes with approximately the same level.

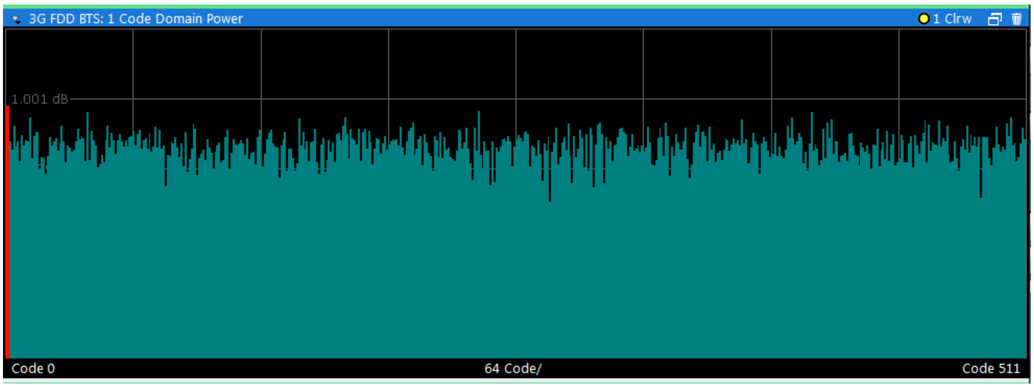



*Figure 8-3: Measurement Example 1: Measuring the Relative Code Domain Power with Incorrect Scrambling Code*

## 8.2 Measurement 2: 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 A 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 [USER 1] of the R&S SMW200A.

**Settings on the R&S SMW200A**

1. PRESET
2. "Freq. A" = *2.1175 GHz*
3. "Level"= *0 dBm*

4. "Baseband A > CDMA Standards > 3GPP FDD"
5. "General" tab: "Link Direction > DOWN/FORWARD"
6. "Basestations" tab: "Test Setups/Models > Test_Model_1_16_channels"
7. "Basestations" tab: "Select Basestation > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"
9. "RF A": "On"

**Settings in the R&S VSE**

1. "File > Preset > All"
2. "Measurement Group Setup": "Replace Channel > 3GPP FDD BTS"
3. "Input and Output > Amplitude": "Reference level"= *10 dBm*
4. "Input and Output > Frequency": "Center frequency" = *2.1175 GHz*
5. "Meas Setup > Scrambling Code" = *0000*
6. "Input and Output > Trigger": "Trigger Source: External Trigger 1"
7. "Input and Output > Scale": "Auto Scale Once"

**Results**

The following is displayed:

- Window 1: Code Domain Power of signal
- Window 2: Result Summery, including the "Trigger to Frame", i.e. offset between trigger event and start of 3GPP FDD BTS frame


*Figure 8-4: Measurement Example 2: 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 in the R&S VSE:
"Input and Output > Trigger""Trigger Offset" = *100 µs*

The "Trigger to Frame" parameter in the Result Summary (Window 2) changes:
"Trigger to Frame" = -100 µs

## 8.3 Measurement 3: 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 A 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 [USER 1] of the R&S SMW200A.

### Settings on the R&S SMW200A

1. PRESET
2. "Freq. A" = *2.1175 GHz*
3. "Level"= *0 dBm*
4. "Baseband A > CDMA Standards > 3GPP FDD"
5. "General" tab: "Link Direction > DOWN/FORWARD"
6. "Basestations" tab: "Test Setups/Models > Test_Model_1_16_channels"
7. "Basestations" tab: "Select Basestation > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"
9. "RF A": "On"

### Settings in the R&S VSE

1. "File > Preset > All"
2. "Measurement Group Setup": "Replace Channel > 3GPP FDD BTS"
3. "Input and Output > Amplitude": "Reference level"= *10 dBm*
4. "Input and Output > Frequency": "Center frequency" = *2.1175 GHz*
5. "Meas Setup > Scrambling Code" = *0000*
6. "Input and Output > Trigger": "Trigger Source: External Trigger 1"
7. Replace the Result Summary display by a Composite EVM display:
   a) Select the "Delete" icon from the Result Summary window title bar.
   b) Select the "Add Window" icon from the toolbar.
   c) Select the "Composite EVM" result display.
8. "Input and Output > Scale": "Auto Scale Once"

### Results

The following is displayed:

- Window 1: Code Domain Power of signal
- Window 2: Composite EVM (EVM for total signal)

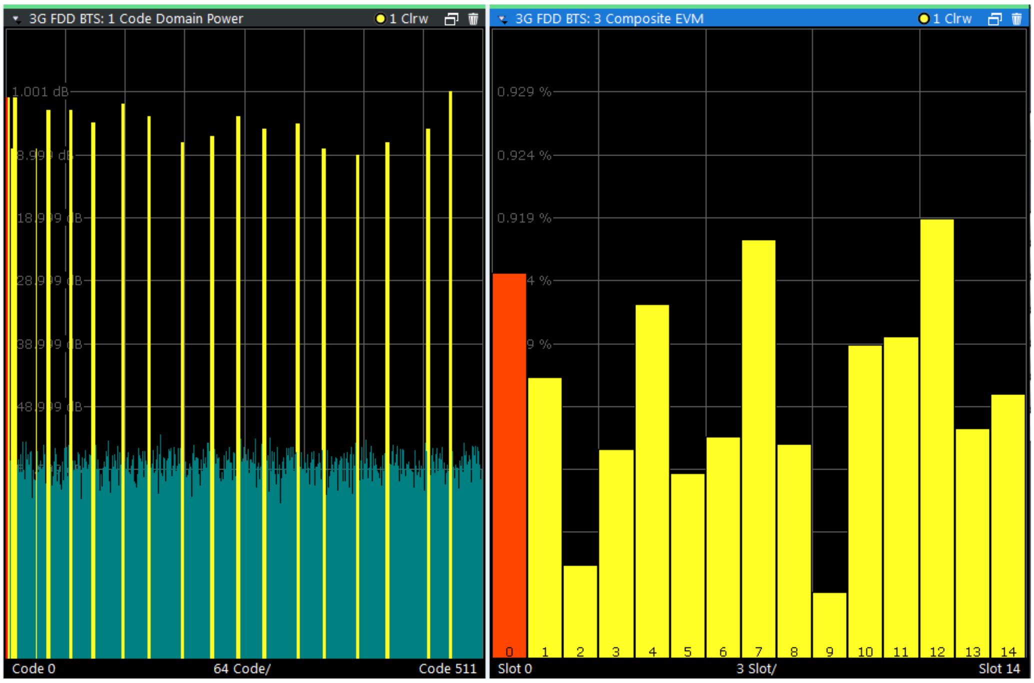



*Figure 8-5: Measurement Example 3: Measuring the Composite EVM*

## 8.4 Measurement 4: 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.

### Test setup

1. Connect the RF A 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 [USER 1] of the R&S SMW200A.

### Settings on the R&S SMW200A

1. PRESET

2. "Freq. A" = *2.1175 GHz*
3. "Level"= *0 dBm*
4. "Baseband A > CDMA Standards > 3GPP FDD"
5. "General" tab: "Link Direction > DOWN/FORWARD"
6. "Basestations" tab: "Test Setups/Models > Test_Model_1_16_channels"
7. "Basestations" tab: "Select Basestation > BS 1 > ON"
8. "General" tab: "3GPP FDD > STATE > ON"
9. "RF A": "On"

**Settings in the R&S VSE**

1. "File > Preset > All"
2. "Measurement Group Setup": "Replace Channel > 3GPP FDD BTS"
3. "Input and Output > Amplitude": "Reference level"= *0 dBm*
4. "Input and Output > Frequency": "Center frequency" = *2.1175 GHz*
5. "Meas Setup > Scrambling Code" = *0000*
6. "Input and Output > Trigger": "Trigger Source: External Trigger 1"
7. Replace the Composite EVM display by a Peak Code Domain Error display:
   a) Select the "Change window" icon from the Composite EVM window title bar.
   b) Select the "Peak Code Domain Error" result display.
8. "Input and Output > Scale": "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)

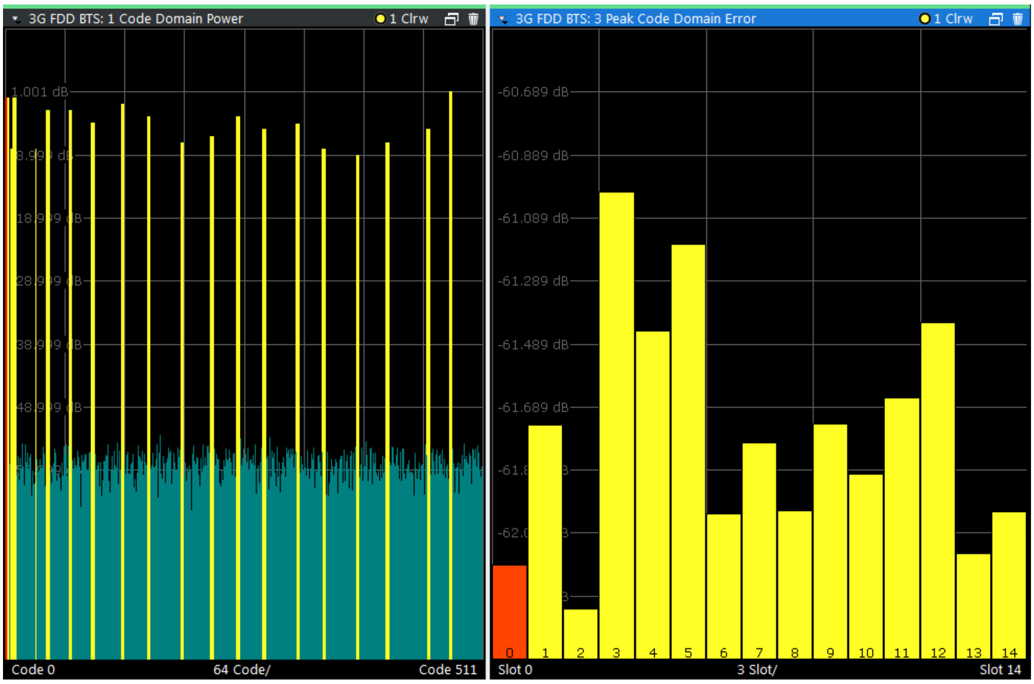



*Figure 8-6: Measurement Example 4: Determining the Peak Code Domain Error*

# 9 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 connected instrument.

## 9.1 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.<br>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.<br>Possible causes are:<br>● Incorrectly sent pilot symbols in the received frame.<br>● Low signal to noise ratio (SNR) of the W-CDMA signal.<br>● 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.<br>● One or more channels are sent with high power ramping. In slots with low relative power to total power, the pilot symbols might be detected incorrectly (check the signal quality by using the symbol constellation display |

# 10 Remote commands for 3GPP FDD measurements

The following commands are required to perform measurements in R&S VSE 3GPP FDD Measurements applications in a remote environment.

It is assumed that the R&S VSE has already been set up for remote control in a network as described in the R&S VSE Base Software User Manual.

### General R&S VSE Remote Commands

The application-independent remote commands for general tasks on the R&S VSE are also available for 3GPP FDD measurements and are described in the R&S VSE User Manual. In particular, this comprises the following functionality:

- Controlling instruments and capturing data
- Managing Settings and Results
- Setting Up the Instrument
- Using the Status Register

### Channel-specific commands

Apart from a few general commands on the R&S VSE, most commands refer to the currently active channel. Thus, always remember to activate a 3GPP FDD channel before starting a remote program for a 3GPP FDD measurement.

After a short introduction, the tasks specific to the 3GPP FDD application are described here:



## 10.1 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, usually, 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, they 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 VSE.

**Remote command examples**

Note that some remote command examples mentioned in this general introduction are possibly not supported by this particular application.

### 10.1.1 Conventions used in descriptions

The following conventions are 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 VSE 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**
  The default unit is 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.

### 10.1.2 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 uppercase 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`.

### 10.1.3 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 do not 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.

### 10.1.4 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.

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.

## 10.1.5 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`.

## 10.1.6 SCPI parameters

Many commands feature one or more parameters.

If a command supports more than one parameter, they are separated by a comma.

**Example:**

`LAYout:ADD:WINDow Spectrum,LEFT,MTABle`

Parameters can have different forms of values.



### 10.1.6.1 Numeric values

Numeric values can be entered in any form, i.e. with sign, decimal point or exponent. For 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. for 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. Sometimes, you can customize the step size with a corresponding command.

**Querying numeric values**

When you query numeric values, the system returns a number. For physical quantities, it applies the basic unit (e.g. Hz for 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`

Sometimes, numeric values are 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 if errors occur.

### 10.1.6.2 Boolean

Boolean parameters represent two states. The "on" state (logically true) is represented by "`ON`" or the 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`

#### 10.1.6.3 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 10.1.2, "Long and short form", on page 126.

**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`

#### 10.1.6.4 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'`

#### 10.1.6.5 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. 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.

## 10.2 Common suffixes

In the R&S VSE 3GPP FDD Measurements application, the following common suffixes are used in remote commands:

*Table 10-1: Common suffixes used in remote commands in the R&S VSE 3GPP FDD Measurements application*

| Suffix | Value range | Description |
|---|---|---|
| <m> | 1 to 4 | Marker |
| <n> | 1 to x | Window (**in the currently selected channel**) |

| Suffix | Value range | Description |
|---|---|---|
| <t> | 1 | Trace |
| <li> | 1 to 8 | Limit line |

## 10.3 Activating 3GPP FDD measurements

3GPP FDD measurements require a special application in the R&S VSE. The common commands for configuring and controlling measurement channels, as well as blocks and sequences, are also used in the R&S VSE 3GPP FDD Measurements application.

They are described in the R&S VSE base software user manual.

## 10.4 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.



**CONFigure:WCDPower[:BTS]:MEASurement** <Type>

Selects the type of 3GPP FDD BTS base station tests.

**Parameters:**

<Type> ACLR | ESPectrum | MCACIr | OBANdwidth | OBWidth | WCDPower | POWer | CCDF | RFCombi | TAERror

**WCDPower**
Code domain power measurement. This selection has the same effect as command `INSTrument:SELect BWCD`

**TAERror**
"Time Alignment Error" measurement

*RST: WCDPower

**Example:** `CONF:WCDP:MEAS TAE`

**Mode:** BTS application only

**Manual operation:** See "Time Alignment Error" on page 34

**CONFigure:WCDPower:MS:MEASurement** <Type>

Selects the 3GPP FDD UE user equipment tests.

**Parameters:**

<Type> ACLR | ESPectrum | MCACIr | OBANdwidth | OBWidth | WCDPower | POWer | CCDF | RFCombi

**WCDPower**
Code domain power measurement. This selection has the same effect as command `INSTrument:SELect MWCD`

*RST: WCDPower

**Example:** `CONF:WCDP:MS:MEAS TAE`

**Mode:** UE application only

## 10.5 Restoring the default configuration (preset)



**SYSTem:PRESet:CHANnel[:EXEC]**

Restores the default software settings in the current channel.

Use `INST:SEL` to select the channel.

**Example:** `INST:SEL 'Spectrum2'`
Selects the channel for "Spectrum2".
`SYST:PRES:CHAN:EXEC`
Restores the factory default settings to the "Spectrum2" channel.

**Usage:** Event

**Manual operation:** See "Preset Channel" on page 52

## 10.6 Configuring code domain analysis and time alignment error measurements

The following commands are required to configure Code Domain Analysis and Time Alignment Error measurements.

## 10.6.1 Signal description

The signal description provides information on the expected input signal.



### 10.6.1.1 BTS signal description

The following commands describe the input signal in BTS measurements.



---

**[SENSe:]CDPower:ANTenna** <Mode>

Activates or deactivates the antenna diversity mode and selects the antenna to be used.

**Parameters:**

<Mode> *RST: OFF

**Example:** `CDP:ANT 1`

**Mode:** BTS application only

**Manual operation:** See "Antenna Diversity" on page 54
See "Antenna Number" on page 54
See "Antenna1 / Antenna2" on page 79

---

**[SENSe:]CDPower:HSDPamode** <State>

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 53

---

**[SENSe:]CDPower:LCODe:SEARch[:IMMediate]**

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.

**Mode:** BTS application only

**Manual operation:** See "Autosearch for Scrambling Code" on page 55

---

**[SENSe:]CDPower:LCODe:SEARch:LIST**

Returns the automatic search sequence (see `[SENSe:]CDPower:LCODe:SEARch[:IMMediate]` on page 133 ) as a comma-separated list of results for each detected scrambling code.

**Parameters:**

<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)

**Mode:** BTS application only

**Manual operation:** See "Scrambling Codes" on page 55

*Table 10-2: 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 54.

**Parameters:**

<State> ON | OFF | 1 | 0
*RST: 0

**Example:** `SENS:CDP:MIMO ON`

**Mode:** BTS application only

**Manual operation:** See "MIMO" on page 54

---

**[SENSe:]CDPower:PCONtrol** <Position>

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 54

### 10.6.1.2 BTS scrambling code

The scrambling code identifies the base station transmitting the signal in BTS measurements.



---

**CONFigure:WCDPower[:BTS]:SCRambling:FORMat** <Type>

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

**Parameters:**
<Type> DEC | HEX

---

**[SENSe:]CDPower:LCODe:DVALue** <ScramblingCode>

Defines the scrambling code in decimal format.

**Parameters:**
<ScramblingCode> *RST: 0

**Example:** `SENS:CDP:LCOD:DVAL 3`
Defines the scrambling code in decimal format.

**Manual operation:** See "Scrambling Code" on page 55
See "Format Hex/Dec" on page 55
See "Format" on page 57

---

**[SENSe:]CDPower:LCODe[:VALue]** <ScramblingCode>

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 55
See "Scrambling Code" on page 56

### 10.6.1.3 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 135
- `[SENSe:]CDPower:HSDPamode` on page 132

**Remote commands exclusive to describing UE signals:**



---

**[SENSe:]CDPower:LCODe:TYPE** <Type>

Switches between long and short scrambling code.

**Parameters:**

<Type> LONG | SHORt

**Example:** `CDP:LCOD:TYPE SHOR`

**Mode:** UE application only

**Manual operation:** See "Type" on page 57

---

**[SENSe:]CDPower:QPSKonly** <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 | 1 | 0

*RST: 0

**Mode:** BTS application only

**Manual operation:** See "QPSK Modulation Only" on page 57

---

**[SENSe:]CDPower:SFACtor** <SpreadingFactor>

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`

## 10.6.2 Configuring data input

The following commands are required to configure data input.

Data output is described in the R&S VSE Base Software User Manual.



### 10.6.2.1 RF input

**Remote commands exclusive to configuring RF input:**



---

**INPut<ip>:ATTenuation:PROTection[:STATe]** <State>

Turns the availability of attenuation levels of 10 dB or less on and off.

**Suffix:**
<ip> 1..n

**Parameters:**
<State> ON | OFF | 1 | 0

**ON | 1**
Attenuation levels of 10 dB or less are not allowed to protect the RF input connector of the connected instrument.

**OFF | 0**
Attenuation levels of 10 dB or less are not blocked. Provide appropriate protection for the RF input connector of the connected instrument yourself.

*RST: 1

**Example:** `INP:ATT:PROT ON`
Turns on the input protection.

---

**INPut:ATTenuation:PROTection:RESet** [<DeviceName>]

Resets the attenuator and reconnects the RF input with the input mixer for the connected instrument 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 VSE base software user manual).

The command works only if the overload condition has been eliminated first.

For details on the protection mechanism, see the instrument's documentation.

**Setting parameters:**
<DeviceName> string
Name of the instrument for which the RF input protection is to be reset.

**Example:** `INP:ATT:PROT:RES 'MyDevice'`

**Manual operation:** See "10 dB Minimum Attenuation" on page 63

---

**INPut<ip>:COUPling<ant>** <CouplingType>

Selects the coupling type of the RF input.

**Suffix:**
<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

**Parameters:**
<CouplingType> AC | DC

**AC**
AC coupling

**DC**
DC coupling

*RST: AC

**Example:** `INP:COUP DC`

**Manual operation:** See "Input Coupling" on page 59

---

**INPut<ip>:DPATh** <DirectPath>

Enables or disables the use of the direct path for frequencies close to 0 Hz.

**Suffix:**
<ip> 1..n

**Parameters:**
<DirectPath> AUTO | OFF

**AUTO | 1**
(Default) the direct path is used automatically for frequencies close to 0 Hz.

**OFF | 0**
The analog mixer path is always used.

**Example:** `INP:DPAT OFF`

**Manual operation:** See "Direct Path" on page 60

---

**INPut<ip>:FILE:ZPADing** <State>

Enables or disables zeropadding for input from an I/Q data file that requires resampling. For resampling, a number of samples are required due to filter settling. These samples can either be taken from the provided I/Q data, or the software can add the required number of samples (zeros) at the beginning and end of the file.

**Suffix:**
<ip> 1..n

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

*RST: 0

**Example:** `INP:FILE:ZPAD ON`

**Manual operation:** See "Zero Padding" on page 65

**INPut<ip>: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 connected instrument to measure the harmonics for a DUT, for example.

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.)

**Suffix:**
<ip> 1..n

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

*RST: 0

**Example:** `INP:FILT:HPAS ON`
Turns on the filter.

**Manual operation:** See "High Pass Filter 1 to 3 GHz" on page 60

**INPut<ip>:FILTer:YIG[:STATe]** <State>

Enables or disables the YIG filter.

**Suffix:**
<ip> 1 | 2
irrelevant

**Parameters:**
<State> ON | OFF | 0 | 1

**Example:** `INP:FILT:YIG OFF`
Deactivates the YIG-preselector.

**Manual operation:** See "YIG-Preselector" on page 60

**INPut<ip>:IMPedance<ant>** <Impedance>

Selects the nominal input impedance of the RF input. In some applications, only 50 Ω are supported.

**Suffix:**
<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

**Parameters:**

<Impedance> 50 | 75

*RST: 50 Ω

Default unit: OHM

**Example:** `INP:IMP 75`

**Manual operation:** See "Impedance" on page 59

---

**INPut<ip>:PRESelection:SET** <Mode>

Selects the preselector mode.

The command is available with the optional preselector.

**Suffix:**

<ip> 1..n

**Parameters:**

<Mode>

**NARRow**
Performs a measurement by automatically applying all available combinations of low and high pass filters consecutively. These combinations all have a narrow bandwidth.

**WIDE**
Performs a measurement by automatically applying all available bandpass filters consecutively. The bandpass filters have a wide bandwidth.

**Manual operation:** See "Preselector Mode" on page 63

---

**INPut<ip>:PRESelection[:STATe]** <State>

Turns the preselector on and off.

**Suffix:**

<ip> 1 | 2
irrelevant

**Manual operation:** See "Preselector State" on page 62

---

**INPut<ip>:RF:CAPMode** <CAPMode>

Determines how data from an oscilloscope is input to the R&S VSE software.

Is only available for connected oscilloscopes.

**Suffix:**

<ip> 1..n

**Parameters:**

<CAPMode> AUTO | IQ | WAVeform

**IQ**
The measured waveform is converted to I/Q data directly on the R&S oscilloscope (requires option K11), and input to the R&S VSE software as I/Q data.

**WAVeform**
The data is input in its original waveform format and converted to I/Q data in the R&S VSE software. No additional options are required on the R&S oscilloscope.

**AUTO**
Uses "I/Q" mode when possible, and "Waveform" only when required by the application (e.g. Pulse measurement).

*RST: IQ

**Example:** `INP:RF:CAPM WAV`

**Manual operation:** See "Capture Mode" on page 61

---

**INPut<ip>:RF:CAPMode:IQ:SRATe** <SamplingRate>

Determines the sample rate used by the connected oscilloscope for I/Q capture mode (see `INPut<ip>:RF:CAPMode` on page 141).

This setting is only available if an R&S oscilloscope is used to obtain the input data.

**Suffix:**
<ip> 1..n

**Parameters:**
<SamplingRate> 20 GHz | 40 GHz

No other sample rate values are allowed.

**20 GHz**
Achieves a higher decimation gain, but reduces the record length by half.
Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).

**40 GHz**
Provides a maximum sample rate.
Only available for R&S RTP13/RTP16 models that support a sample rate of 40 GHz (see data sheet).

*RST: 20 GHz
Default unit: HZ

**Example:**
```
INP:RF:CAPM IQ
INP:RF:CAPM:IQ:SRAT 40 GHZ
```

**Manual operation:** See "Oscilloscope Sample Rate" on page 61

**INPut<ip>:RF:CAPMode:WAVeform:SRATe** <SamplingRate>

Determines the sample rate used by the connected oscilloscope for waveform capture mode (see `INPut<ip>:RF:CAPMode` on page 141).

This setting is only available if an R&S oscilloscope is used to obtain the input data, either directly or via the R&S FSW.

**Suffix:**
<ip> 1..n

**Parameters:**
<SamplingRate> 10 GHz | 20 GHz

No other sample rate values are allowed.

**10 GHz**
Default ; provides maximum record length

**20 GHz**
Achieves a higher decimation gain, but reduces the record length by half.
Only available for R&S oscilloscope models that support a sample rate of 20 GHz (see data sheet).
For R&S oscilloscopes with an analysis bandwidth of 4 GHz or larger, a sample rate of 20 GHZ is always used.

*RST: 10 GHz
Default unit: HZ

**Example:**
```
INP:RF:CAPM WAV
INP:RF:CAPM:WAVE:SRAT 10000000
```

**Manual operation:** See "Oscilloscope Sample Rate" on page 61

**INPut:SELect** <Source>

Selects the signal source for measurements, i.e. it defines which connector is used to input data to the R&S VSE.

If no additional input options are installed, only RF input or file input is supported.

**Parameters:**
<Source>

**RF**
Radio Frequency ("RF INPUT" connector)

**FIQ**
I/Q data file

**AIQ**
Analog Baseband signal (only available with optional "Analog Baseband" interface)

*RST: RF

**Manual operation:** See "Input Type (Instrument / File)" on page 58

**INPut:TYPE** <Input>

The command selects the input path for R&S FSW85 models.

**Parameters:**

<Input>

**INPUT1**
Selects RF input 1.

**INPUT2**
Selects RF input 2.

*RST: INPUT1

**Example:**
//Select input path
`INP:TYPE INPUT1`

**Manual operation:** See "Input 1 / Input 2" on page 59

**INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>** <Type>

Selects an instrument or a file as the source of input provided to the channel.

**Suffix:**

<si> 1 to 99
LTE-MIMO only: input source number

**Parameters:**

<Type> FILE | DEVice | NONE

**FILE**
A loaded file is used for input.

**DEVice**
A configured device provides input for the measurement

**NONE**
No input source defined.

**Manual operation:** See "Input Type (Instrument / File)" on page 58

**INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>:CONFig** <Port>

Configures the port to be used for input on the selected instrument.

Is only available if an oscilloscope is connected.

**Suffix:**

<si> 1 to 99
LTE-MIMO only: input source number

**Parameters:**

<Port>

**INSTrument:BLOCk:CHANnel[:SETTings]:SOURce<si>:TYPE** <Source>

Configures the source of input to be used from the selected instrument.

Not all input sources are supported by all R&S VSE applications.

**Suffix:**

<si> 1 to 99
LTE-MIMO only: input source number

**Parameters:**

<Source> **RF**
Radio Frequency ("RF INPUT" connector)

**'Channel 1' | 'Channel 2' | 'Channel 3' | 'Channel 4'**
Oscilloscope input channel 1, 2, 3, or 4

**'Channel 1,2 (I+Q)'**
I/Q data provided by oscilloscope input channels 1 and 2 (for oscilloscopes with 2 channels only)

**'Channel 1,3 (I+Q)' | 'Channel 2,4 (I+Q)'**
I/Q data provided by oscilloscope input channels 1 and 3, or 2 and 4 (for oscilloscopes with 4 channels only)

**'Channels 1-4 (diff. I+Q)'**
Differential I/Q data provided by oscilloscope input channels (for oscilloscopes with 4 channels only):
Channel 1: I (pos.)
Channel 2: $\bar{I}$ (neg.)
Channel 3: Q (pos.)
Channel 4: $\bar{Q}$ (neg.)

**'Channels 1,3 (Waveform)'**
Waveform data provided by oscilloscope input channels 1 and 3 (for oscilloscopes with 2 channels only)

**'Channels 2,4 (Waveform)'**
Waveform data provided by oscilloscope input channels 2 and 4 (for oscilloscopes with 2 channels only)

**'Channels 1-4 (Waveform)'**
Waveform data provided by oscilloscope input channels 1 to 4 (for oscilloscopes with 4 channels only)

*RST: RF

**Example:** INST:BLOC:CHAN:SOUR:TYPE 'Channel 2,4 (I+Q)'
I/Q data is provided by oscilloscope input channels 2 and 4

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope[:STATe]** <State>

Activates the optional 2 GHz bandwidth extension (R&S FSW-B2000).

**Note**: Manual operation on the connected oscilloscope, or remote operation other than by the R&S VSE, is not possible while the B2000 option is active.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `SYST:COMM:RDEV:OSC ON`

**Manual operation:** See "B2000 State" on page 61

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope:TCPip** <Address>

Defines the TCPIP address or computer name of the oscilloscope connected to the R&S VSE via LAN.

**Note**: The IP address is maintained after a [PRESET], and is transferred between applications.

**Parameters:**
<Address> computer name or IP address

**Example:** `SYST:COMM:RDEV:OSC:TCP '192.0.2.0'`

**Example:** `SYST:COMM:RDEV:OSC:TCP 'FSW43-12345'`

**Manual operation:** See "Oscilloscope IP Address" on page 62

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope:PSMode[:STATe]** <State>

Activates the use of the power splitter inserted between the "IF 2 GHZ OUT" connector of the R&S VSE and the "CH1" and "CH3" input connectors of the oscilloscope. Note that this mode requires an additional alignment with the power splitter.

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

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `SYST:COMM:RDEV:OSC:PSM ON`

**Manual operation:** See "Oscilloscope Splitter Mode" on page 62

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope:SRATe** <Rate>

Determines whether the 10 GHz mode (default) or 20 GHz mode of the connected oscilloscope is used. The 20 GHZ mode achieves a higher decimation gain, but reduces the record length by half.

**Parameters:**

<Rate> 10 GHz | 20 GHz

No other sample rate values are allowed.

*RST: 10 GHz
Default unit: HZ

**Example:**

```
TRAC:IQ:SRAT?
//Result: 100000000
TRAC:IQ:RLEN?
//Result: 3128
SYST:COMM:RDEV:OSC:SRAT 20GHZ
TRAC:IQ:SRAT?
//Result: 200000000
TRAC:IQ:RLEN?
//Result: 1564
```

**Manual operation:** See "Oscilloscope Sample Rate" on page 61

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope:VDEVice?**

Queries whether the connected instrument is supported by the 2 GHz bandwidth extension option(B2000).

**Return values:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `SYST:COMM:RDEV:OSC:VDEV?`

**Usage:** Query only

---

**SYSTem:COMMunicate:RDEVice:OSCilloscope:VFIRmware?**

Queries whether the firmware on the connected oscilloscope is supported by the 2 GHz bandwidth extension (B2000) option.

**Return values:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `SYST:COMM:RDEV:OSC:VFIR?`

**Usage:** Query only

### 10.6.2.2 Using external mixers

The commands required to work with external mixers in a remote environment are described here. Note that these commands require the connected instrument to have an external mixer option installed and an external mixer to be connected to the connected instrument.



#### Basic settings

The basic settings concern general usage of an external mixer.



---

**[SENSe:]MIXer<x>[:STATe]** <State>

Activates or deactivates the use of a connected external mixer as input for the measurement. This command is only available if the optional External Mixer is installed and an external mixer is connected.

**Suffix:**
<x> 1..n
irrelevant

**Parameters:**
<State> ON | OFF | 1 | 0
*RST: 0

**Example:** `MIX ON`

---

**[SENSe:]MIXer<x>:BIAS:HIGH** <BiasSetting>

Defines the bias current for the high (last) range.

Is only available if the external mixer is active (see [SENSe:]MIXer<x>[:STATe] on page 148).

**Suffix:**
<x> 1..n
irrelevant

**Parameters:**
<BiasSetting> *RST: 0.0 A
Default unit: A

**[SENSe:]MIXer<x>:BIAS[:LOW]** <BiasSetting>

Defines the bias current for the low (first) range.

Is only available if the external mixer is active (see [SENSe:]MIXer<x>[:STATe] on page 148).

**Suffix:**

| | | |
|---|---|---|
| <x> | 1..n<br>irrelevant | |

**Parameters:**

| | | |
|---|---|---|
| <BiasSetting> | *RST: | 0.0 A |
| | Default unit: | A |

**[SENSe:]MIXer<x>:LOPower** <Level>

Specifies the LO level of the external mixer's LO port.

**Suffix:**

| | | |
|---|---|---|
| <x> | 1..n<br>irrelevant | |

**Parameters:**

| | | |
|---|---|---|
| <Level> | Range: | 13.0 dBm to 17.0 dBm |
| | Increment: | 0.1 dB |
| | *RST: | 15.5 dBm |
| | Default unit: | DBM |

**Example:** `MIX:LOP 16.0dBm`

### Mixer settings

The following commands are required to configure the band and specific mixer settings.

**[SENSe:]MIXer<x>:FREQuency:HANDover** <Frequency>

Defines the frequency at which the mixer switches from one range to the next (if two different ranges are selected). The handover frequency for each band can be selected freely within the overlapping frequency range.

Is only available if the external mixer is active (see [SENSe:]MIXer<x>[:STATe] on page 148).

**Suffix:**

| | |
|---|---|
| <x> | 1..n<br>irrelevant |

**Parameters:**

| | |
|---|---|
| <Frequency> | Default unit: HZ |

**Example:** `MIX ON`
Activates the external mixer.
`MIX:FREQ:HAND 78.0299GHz`
Sets the handover frequency to 78.0299 GHz.

**[SENSe:]MIXer<x>:FREQuency:STARt**

Sets or queries the frequency at which the external mixer band starts.

**Suffix:**

| | |
|---|---|
| <x> | 1..n<br>irrelevant |

**Example:** `MIX:FREQ:STAR?`
Queries the start frequency of the band.

**[SENSe:]MIXer<x>:FREQuency:STOP**

Sets or queries the frequency at which the external mixer band stops.

**Suffix:**

| | |
|---|---|
| <x> | 1..n<br>irrelevant |

**Example:** `MIX:FREQ:STOP?`
Queries the stop frequency of the band.

**[SENSe:]MIXer<x>:HARMonic:BAND:PRESet**

Restores the preset frequency ranges for the selected standard waveguide band.

**Note:** Changes to the band and mixer settings are maintained even after using the [PRESET] function. Use this command to restore the predefined band ranges.

**Suffix:**

| | |
|---|---|
| <x> | 1..n<br>irrelevant |

**Example:** `MIX:HARM:BAND:PRES`
Presets the selected waveguide band.

**[SENSe:]MIXer<x>:HARMonic:BAND** <Band>

Selects the external mixer band. The query returns the currently selected band.

Is only available if the external mixer is active (see [SENSe:]MIXer<x>[:STATe] on page 148).

**Suffix:**
<x> 1..n
irrelevant

**Parameters:**
<Band> KA | Q | U | V | E | W | F | D | G | Y | J | USER
Standard waveguide band or user-defined band.

*Table 10-3: Frequency ranges for pre-defined bands*

| Band | Frequency start [GHz] | Frequency stop [GHz] |
|---|---|---|
| KA (A) *) | 26.5 | 40.0 |
| Q | 33.0 | 50.0 |
| U | 40.0 | 60.0 |
| V | 50.0 | 75.0 |
| E | 60.0 | 90.0 |
| W | 75.0 | 110.0 |
| F | 90.0 | 140.0 |
| D | 110.0 | 170.0 |
| G | 140.0 | 220.0 |
| J | 220.0 | 325.0 |
| Y | 325.0 | 500.0 |
| USER | 32.18 (default) | 68.22 (default) |
| ***)** The band formerly referred to as "A" is now named "KA". | | |

**[SENSe:]MIXer<x>:HARMonic:HIGH:STATe** <State>

Specifies whether a second (high) harmonic is to be used to cover the band's frequency range.

**Suffix:**
<x> 1..n

**Parameters:**

<State> ON | OFF

*RST: ON

**Example:** `MIX:HARM:HIGH:STAT ON`

---

**[SENSe:]MIXer<x>:HARMonic:HIGH[:VALue]** <HarmOrder>

Specifies the harmonic order to be used for the high (second) range.

**Suffix:**

<x> 1..n
irrelevant

**Parameters:**

<HarmOrder> Range: 2 to 128 (USER band); for other bands: see band definition

**Example:**
```
MIX:HARM:HIGH:STAT ON
MIX:HARM:HIGH 3
```

---

**[SENSe:]MIXer<x>:HARMonic:TYPE** <OddEven>

Specifies whether the harmonic order to be used should be odd, even, or both.

Which harmonics are supported depends on the mixer type.

**Suffix:**

<x> 1..n
irrelevant

**Parameters:**

<OddEven> ODD | EVEN | EODD

**ODD | EVEN | EODD**

*RST: EVEN

**Example:** `MIX:HARM:TYPE ODD`

---

**[SENSe:]MIXer<x>:HARMonic[:LOW]** <HarmOrder>

Specifies the harmonic order to be used for the low (first) range.

**Suffix:**

<x> 1..n
irrelevant

**Example:** `MIX:HARM 3`

---

**[SENSe:]MIXer<x>:IF?**

Queries the intermediate frequency currently used by the external mixer.

**Suffix:**
<x> 1..n
irrelevant

**Example:** `MIX:IF?`

**Example:** See "Programming example: working with an external mixer" on page 155.

**Usage:** Query only

---

**[SENSe:]MIXer<x>:LOSS:HIGH** <Average>

Defines the average conversion loss to be used for the entire high (second) range.

**Suffix:**
<x> 1..n

**Parameters:**
<Average> Range: 0 to 100
*RST: 24.0 dB
Default unit: dB

**Example:** `MIX:LOSS:HIGH 20dB`

---

**[SENSe:]MIXer<x>:LOSS:TABLe:HIGH** <FileName>

Defines the conversion loss table to be used for the high (second) range.

**Suffix:**
<x> 1..n

**Parameters:**
<FileName> String containing the path and name of the file, or the serial number of the external mixer whose file is required. The R&S VSE automatically selects the correct cvl file for the current IF. As an alternative, you can also select a user-defined conversion loss table (`.acl` file).

---

**[SENSe:]MIXer<x>:LOSS:TABLe[:LOW]** <FileName>

Defines the file name of the conversion loss table to be used for the low (first) range.

**Suffix:**
<x> 1..n

**Parameters:**
<FileName> String containing the path and name of the file, or the serial number of the external mixer whose file is required. The R&S VSE automatically selects the correct cvl file for the current IF. As an alternative, you can also select a user-defined conversion loss table (`.acl` file).

**Example:**
```
MIX:LOSS:TABL '101567'
MIX:LOSS:TABL?
//Result:
'101567_MAG_6_B5000_3G5.B5G'
```

---

**[SENSe:]MIXer<x>:LOSS[:LOW]** <Average>

Defines the average conversion loss to be used for the entire low (first) range.

**Suffix:**
<x> 1..n

**Parameters:**
<Average>
Range: 0 to 100
*RST: 24.0 dB
Default unit: dB

**Example:**
```
MIX:LOSS 20dB
```

---

**[SENSe:]MIXer<x>:PORTs** <PortType>

Selects the mixer type.

**Suffix:**
<x> 1..n
irrelevant

**Parameters:**
<PortType> **2 | 3**

**2**
Two-port mixer.

**3**
Three-port mixer.

*RST: 2

**Example:**
```
MIX:PORT 3
```

---

**[SENSe:]MIXer<x>:RFOVerrange[:STATe]** <State>

If enabled, the band limits are extended beyond "RF Start" and "RF Stop" due to the capabilities of the used harmonics.

**Suffix:**
<x> 1..n
irrelevant

**Parameters:**
<State> ON | OFF | 1 | 0
*RST: 0

### Programming example: working with an external mixer

This example demonstrates how to work with an external mixer in a remote environment. It is performed in the Spectrum application in the default layout configuration. Note that without a real input signal and connected mixer, this measurement will not return useful results.

```
//--------------Preparing the instrument -----------
//Reset the instrument
*RST
//Activate the use of the connected external mixer.
SENS:MIX ON
//----------- Configuring basic mixer behavior -------------
//Set the LO level of the mixer's LO port to 15 dBm.
SENS:MIX:LOP 15dBm
//Set the bias current to -1 mA .
SENS:MIX:BIAS:LOW -1mA
//----------- Configuring the mixer and band settings -------------
//Use band "V" to full possible range extent for assigned harmonic (6).
SENS:MIX:HARM:BAND V
SENS:MIX:RFOV ON
//Query the possible range
SENS:MIX:FREQ:STAR?
//Result: 47480000000 (47.48 GHz)
SENS:MIX:FREQ:STOP?
//Result: 138020000000 (138.02 GHz)
//Use a 3-port mixer type
SENS:MIX:PORT 3
//Split the frequency range into two ranges;
//range 1 covers 47.48 GHz GHz to 80 GHz; harmonic 6, average conv. loss of 20 dB
//range 2 covers 80 GHz to 138.02 GHz; harmonic 8, average conv.loss of 30 dB
SENS:MIX:HARM:TYPE EVEN
SENS:MIX:HARM:HIGH:STAT ON
SENS:MIX:FREQ:HAND 80GHz
SENS:MIX:HARM:LOW 6
SENS:MIX:LOSS:LOW  20dB
SENS:MIX:HARM:HIGH 8
SENS:MIX:LOSS:HIGH 30dB
//--------- Activating automatic signal identification functions -----------
//Activate both automatic signal identification functions.
SENS:MIX:SIGN ALL
//Use auto ID threshold of 8 dB.
SENS:MIX:THR 8dB

//--------------Performing the Measurement-----
//Select single sweep mode.
INIT:CONT OFF
//Initiate a basic frequency sweep and wait until the sweep has finished.
INIT;*WAI
//---------------Retrieving Results-------------
//Return the trace data for the input signal without distortions
```

```
//(default screen configuration)
TRAC:DATA? TRACE3
```

### 10.6.2.3 Remote commands for external frontend control

The following commands are available and required only if the optional external frontend control is installed on the connected instrument.

Further commands for external frontend control described elsewhere:

- `INPut:SELect RF`; see `INPut:SELect` on page 143
- `[SENSe<ip>:]FREQuency:CENTer` on page 171
- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>` on page 174
- `INPut<ip>:ATTenuation:AUTO` on page 177
- `INPut<ip>:ATTenuation` on page 176



#### Commands for initial configuration

The following commands are required when you initially set up a measurement with an external frontend on the connected instrument. Note that some commands are not available for all connected instruments, or only as queries.



**[SENSe:]EFRontend:ALIGnment<ch>:FILE** <File>

Selects or queries the touchstone file that contains correction data to compensate for signal losses in the cable occurring at different IF signal frequencies.

**Suffix:**
<ch> 1..n
Currently irrelevant

**Parameters:**
<File> string in double quotes
Path and file name of the correction data file. The file must be in `s2p` format.
If the specified file is not found or does not have the correct format, an error message is returned (`-256, "File name not found"`, `-150, "String data error"`).

**Example:** `EFR:ALIG:FILE "FE44S.s2p"`

---

**[SENSe:]EFRontend:ALIGnment<ch>:STATe** <State>

Activates correction of the IF signal due to cable loss from the frontend to the analyzer. Specify the file with correction data using `[SENSe:]EFRontend:ALIGnment<ch>:FILE` on page 156.

**Suffix:**
<ch> 1..n
Currently irrelevant

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

*RST: 0

---

**[SENSe:]EFRontend:CONNection[:STATe]** <State>

Queries the external frontend connection state in the firmware.

Note: to query the physical connection state of the external frontend, use `[SENSe:]EFRontend:CONNection:CSTate?` on page 158.

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
The connection to the frontend is deactivated temporarily. The frontend is thus available for use elsewhere, for example by a signal generator. The measurement settings on the R&S VSE remain untouched.

**ON | 1**
Frontend connection enabled.
The frontend is reserved for exclusive use by the R&S VSE.

*RST: 0

**Example:**
```
//Global activation of external frontend
EFR ON
//Configure frontend
EFR:CONN:CONF "FE44S","123.456.789"
//Activate exclusive use of frontend by
R&S VSE.
EFR:CONN ON
```

---

**[SENSe:]EFRontend:CONNection:CONFig** <Type>, <IPAddress>[, <DeviceID>, <SymbolicName>]

Configures the connection to the external frontend.

**Parameters:**

<Type> String in double quotes containing the type of frontend to be connected.

<IPAddress> string in double quotes

The IP address or computer name of the frontend connected to the R&S VSE via LAN. The IP address and computer name are indicated on the electronic ink display on the side panel of the frontend.

<DeviceID> string in double quotes

Unique device ID consisting of <type>-<serialnumber>
Not required or relevant for the R&S VSE.

<SymbolicName> string in double quotes

Symbolic name of the external frontend.
Not required or relevant for the R&S VSE.

**Example:**
```
//Global activation of external frontend
EFR ON
//Configure frontend
EFR:CONN:CONF "FE44S","123.456.789"
//Activate exclusive use of frontend by
R&S VSE.
EFR:CONN ON
```

---

**[SENSe:]EFRontend:CONNection:CSTate?**

Queries the status of the physical connection to the external frontend.

**Return values:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Frontend not connected; connection error

**ON | 1**
Frontend connected

**Usage:** Query only

**[SENSe:]EFRontend:FREQuency:BAND:COUNt?**

Queries the number of frequency bands provided by the selected frontend.

**Return values:**

<NoBands> integer

Number of frequency bands

**Example:**
```
//Query number of frequency bands
EFR:FREQ:BAND:COUN?
//Result: 2
```

**Usage:** Query only

**[SENSe:]EFRontend:FREQuency:BAND<b>:LOWer?**

Queries the start of the frequency range supported by the selected frontend frequency band.

**Suffix:**

<b> 1..n

Band for multi-band frontends

Use [SENSe:]EFRontend:FREQuency:BAND:COUNt? on page 159 to determine the number of available bands.

**Return values:**

<StartFreq> Start frequency of the specified band

**Example:**
```
//Query start frequency of second band
EFR:FREQ:BAND2:LOW?
//Result: 24000000000
```

**Usage:** Query only

**[SENSe:]EFRontend:FREQuency:BAND<b>:UPPer?**

Queries the end of the frequency range supported by the selected frontend frequency band.

**Suffix:**

<b> 1..n

Band for multi-band frontends

Use [SENSe:]EFRontend:FREQuency:BAND:COUNt? on page 159 to determine the number of available bands.

**Return values:**

<StopFreq> End frequency of the specified band

**Example:**
```
//Query end frequency of second band
EFR:FREQ:BAND2:UPP?
//Result: 44000000000
```

**Usage:** Query only

**[SENSe:]EFRontend:FREQuency:BCONfig:AUTO** <State>

Determines whether the frequency band of the external frontend is configured automatically or manually.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Uses the frequency band configured by `[SENSe:]EFRontend:FREQuency:BCONfig:SELect` on page 160.

**ON | 1**
Configures the frequency band automatically

*RST: 1

**Example:** //Configures the use of the IF high band manually.
```
EFR:FREQ:BCON:AUTO 0
EFR:FREQ:BCON:SEL "IF HIGH"
```

**[SENSe:]EFRontend:FREQuency:BCONfig:LIST?**

Returns the intermediate frequency (output) range of the external frontend.

**Return values:**

<BandConfigs> string

**"IF LOW"**
A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the R&S VSE.

**"IF HIGH"**
A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the R&S VSE.

**Example:**
```
EFR:FREQ:BCON:LIST?
//Result: "IF HIGH", "IF LOW"
EFR:FREQ:BCON:SEL "IF HIGH"
```

**Usage:** Query only

**[SENSe:]EFRontend:FREQuency:BCONfig:SELect** <BandConfig>

Defines the intermediate frequency (output) range of the external frontend.

**Parameters:**

<BandConfig> **"IF HIGH"**
(R&S FE44S/ R&S FE50DTR)
A higher intermediate frequency is used on the external frontend, resulting in a higher input frequency at the connected instrument.

**"IF LOW"**
(R&S FE44S/ R&S FE50DTR)
A lower intermediate frequency is used on the external frontend, resulting in a lower input frequency at the connected instrument.

**"Spur Optimized"**
(R&S FE170SR/R&S FE110SR only)
The selected IF range avoids unwanted spurious effects.

**"EVM Optimized"**
(R&S FE170SR/R&S FE110SR only)
The selected IF range provides an optimal EVM result.

**"Shared LO"**
(R&S FE170SR/R&S FE110SR only)
Ensures that multiple external frontends (R&S FE170SR/ R&S FE170ST or R&S FE110SR/R&S FE110ST) use the same LO frequencies for upconversion and downconversion.

**Example:**
```
EFR:FREQ:BCON:LIST?
//Result: "IF HIGH", "IF LOW"
EFR:FREQ:BCON:SEL "IF HIGH"
```

---

**[SENSe:]EFRontend:FREQuency:IFRequency:SIDeband?**

Queries the currently used sideband for frequency conversion.

**Return values:**
<Sideband> "USB" | "LSB"

**"USB"**
Upper sideband

**"LSB"**
Lower sideband

**Example:**
```
EFR:FREQ:IFR?
EFR:FREQ:IFR:SID?
```

**Usage:** Query only

---

**[SENSe:]EFRontend:FREQuency:IFRequency[:VALue]?**

Queries the currently used intermediate frequency (IF) for frequency conversion.

**Return values:**
<IFFrequency> numeric

**Example:**
```
EFR:FREQ:IFR?
```

**Usage:** Query only

**[SENSe:]EFRontend:FREQuency:REFerence** <Frequency>

Sets the reference frequency that is used for frequency conversion on the frontend. Depending on the connected type of frontend, different values are available. To determine which reference levels are available, use [SENSe:]EFRontend:FREQuency:REFerence:LIST? on page 162.

**Parameters:**

<Frequency> Default unit: HZ

**Example:**

```
//Query the available reference levels
EFR:FREQ:REF:LIST?
//Result: 10000000,640000000,1000000000
//Use 640 MHz reference
EFR:FREQ:REF 640000000
```

**[SENSe:]EFRontend:FREQuency:REFerence:LIST?**

Queries the available reference signals for the connected frontend type.

**Return values:**

<References> 10000000 | 640000000 | 1000000000

**Example:**

```
//Query the available reference levels
EFR:FREQ:REF:LIST?
//Result: 10000000,640000000,1000000000
//Use 640 MHz reference
EFR:FREQ:REF 640000000
```

**Usage:** Query only

**[SENSe:]EFRontend:IDN?**

Queries the device identifcation information (*IDN?) of the frontend.

**Return values:**

<DevInfo> string without quotes

Rohde&Schwarz,<device type>,<part number>/<serial number>,<firmware version>

**Example:**

```
EFR:IDN?
//Result: Rohde&Schwarz,FE44S,
1234.5678K00/123456,0.8.0
```

**Usage:** Query only

**[SENSe:]EFRontend[:STATe]** <State>

Enables or disables the general use of an external frontend for the application.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
The frontend is disconnected. The application adapts the measurement settings to the common settings supported by the R&S VSE.

**ON | 1**
The R&S VSE allows you to configure and connect an external frontend for the application. The application adapts the available measurement settings to the connected frontend.
The channel bar indicates "Inp: ExtFe".

*RST: 0

**Example:** `EFR ON`

### 10.6.2.4 Working with power sensors

The following commands describe how to work with power sensors.

These commands require the use of a Rohde & Schwarz power sensor. For a list of supported sensors, see the data sheet.



#### Configuring power sensors



---

**SYSTem:COMMunicate:RDEVice:PMETer<p>:CONFigure:AUTO[:STATe]** <State>

Turns automatic assignment of a power sensor to the power sensor index on and off.

**Suffix:**
<p> Power sensor index

**Parameters:**
<State> ON | OFF | 0 | 1

*RST: 1

**Example:** `SYST:COMM:RDEV:PMET:CONF:AUTO OFF`

---

**SYSTem:COMMunicate:RDEVice:PMETer<p>:COUNt?**

Queries the number of power sensors currently connected to the R&S VSE.

**Suffix:**
<p> Power sensor index

**Return values:**
<NumberSensors> Number of connected power sensors.

**Example:** `SYST:COMM:RDEV:PMET:COUN?`

**Usage:** Query only

**SYSTem:COMMunicate:RDEVice:PMETer<p>:DEFine** <Placeholder>, <Type>, <Interface>, <SerialNo>

Assigns the power sensor with the specified serial number to the selected power sensor index (configuration).

The query returns the power sensor type and serial number of the sensor assigned to the specified index.

**Suffix:**

<p> Power sensor index

**Parameters:**

<Placeholder> Currently not used

<Type> Detected power sensor type, e.g. "NRP-Z81".

<Interface> Interface the power sensor is connected to; always "USB"

<SerialNo> Serial number of the power sensor assigned to the specified index

**Example:**

```
SYST:COMM:RDEV:PMET2:DEF '','NRP-Z81','',
'123456'
```

Assigns the power sensor with the serial number '123456' to the configuration "Power Sensor 2".

```
SYST:COMM:RDEV:PMET2:DEF?
```

Queries the sensor assigned to "Power Sensor 2".

Result:

```
'','NRP-Z81','USB','123456'
```

The NRP-Z81 power sensor with the serial number '123456' is assigned to the "Power Sensor 2".

## Configuring power sensor measurements

**CALibration:PMETer<p>:ZERO:AUTO ONCE**

Zeroes the power sensor.

Note that you have to disconnect the signals from the power sensor input before you start to zero the power sensor. Otherwise, results are invalid.

**Suffix:**

<p> Power sensor index

**Example:** `CAL:PMET2:ZERO:AUTO ONCE;*WAI`
Starts zeroing the power sensor 2 and delays the execution of further commands until zeroing is concluded.

**Usage:** Event

**CALCulate<n>:PMETer<p>:RELative[:MAGNitude]** <RefValue>

Defines the reference value for relative measurements.

**Suffix:**

<n> Window

<p> Power sensor index

**Parameters:**

<RefValue> Range: -200 dBm to 200 dBm
*RST: 0
Default unit: DBM

**Example:** `CALC:PMET2:REL -30`
Sets the reference value for relative measurements to -30 dBm for power sensor 2.

**CALCulate<n>:PMETer<p>:RELative[:MAGNitude]:AUTO ONCE**

Sets the current measurement result as the reference level for relative measurements.

**Suffix:**

<n> Window

<p> Power sensor index

**Example:** `CALC:PMET2:REL:AUTO ONCE`
Takes the current measurement value as reference value for relative measurements for power sensor 2.

**Usage:** Event

**CALCulate<n>:PMETer<p>:RELative:STATe** <State>

Turns relative power sensor measurements on and off.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <p> | Power sensor index |

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `CALC:PMET2:REL:STAT ON`
Activates the relative display of the measured value for power sensor 2.

**FETCh:PMETer<p>?**

Queries the results of power sensor measurements.

**Suffix:**
<p> Power sensor index

**Usage:** Query only

**READ:PMETer<p>?**

Initiates a power sensor measurement and queries the results.

**Suffix:**
<p> Power sensor index

**Usage:** Query only

**[SENSe:]PMETer<p>:DCYCle[:STATe]** <State>

Turns the duty cycle correction on and off.

**Suffix:**
<p> Power sensor index

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `PMET2:DCYC:STAT ON`

**[SENSe:]PMETer<p>:DCYCle:VALue** <Percentage>

Defines the duty cycle for the correction of pulse signals.

The power sensor uses the duty cycle in combination with the mean power to calculate the power of the pulse.

**Suffix:**
<p> Power sensor

**Parameters:**
<Percentage> Range: 0.001 to 99.999
*RST: 99.999
Default unit: %

**Example:** `PMET2:DCYC:STAT ON`
Activates the duty cycle correction.
`PMET2:DCYC:VAL 0.5`
Sets the correction value to 0.5%.

**[SENSe:]PMETer<p>:FREQuency** <Frequency>

Defines the frequency of the power sensor.

**Suffix:**
<p> Power sensor index

**Parameters:**
<Frequency> The available value range is specified in the data sheet of the power sensor in use.
*RST: 50 MHz
Default unit: HZ

**Example:** `PMET2:FREQ 1GHZ`
Sets the frequency of the power sensor to 1 GHz.

**[SENSe:]PMETer<p>:FREQuency:LINK** <Coupling>

Selects the frequency coupling for power sensor measurements.

**Suffix:**
<p> Power sensor index

**Parameters:**
<Coupling> **CENTer**
Couples the frequency to the center frequency of the analyzer
**MARKer1**
Couples the frequency to the position of marker 1
**OFF**
Switches the frequency coupling off
*RST: CENTer

**Example:** `PMET2:FREQ:LINK CENT`
Couples the frequency to the center frequency of the analyzer

---

**[SENSe:]PMETer<p>:MTIMe** <Duration>

Selects the duration of power sensor measurements.

**Suffix:**
<p> Power sensor index

**Parameters:**
<Duration> SHORt | NORMal | LONG
*RST: NORMal

**Example:** `PMET2:MTIM SHOR`
Sets a short measurement duration for measurements of stationary high power signals for the selected power sensor.

---

**[SENSe:]PMETer<p>:MTIMe:AVERage:COUNt** <NumberReadings>

Sets the number of power readings included in the averaging process of power sensor measurements.

Extended averaging yields more stable results for power sensor measurements, especially for measurements on signals with a low power, because it minimizes the effects of noise.

**Suffix:**
<p> Power sensor index

**Parameters:**
<NumberReadings> An average count of 0 or 1 performs one power reading.
Range: 0 to 256
Increment: binary steps (1, 2, 4, 8, ...)

**Example:** `PMET2:MTIM:AVER ON`
Activates manual averaging.
`PMET2:MTIM:AVER:COUN 8`
Sets the number of readings to 8.

---

**[SENSe:]PMETer<p>:MTIMe:AVERage[:STATe]** <State>

Turns averaging for power sensor measurements on and off.

**Suffix:**
<p> Power sensor index

**Parameters:**
<State> ON | OFF | 0 | 1
**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `PMET2:MTIM:AVER ON`
Activates manual averaging.

---

**[SENSe:]PMETer<p>:ROFFset[:STATe]** <State>

Includes or excludes the reference level offset of the analyzer for power sensor measurements.

**Suffix:**
<p> Power sensor index

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `PMET2:ROFF OFF`
Takes no offset into account for the measured power.

---

**[SENSe:]PMETer<p>:SOFFset** <SensorOffset>

Takes the specified offset into account for the measured power. Only available if `[SENSe:]PMETer<p>:ROFFset[:STATe]` is disabled.

**Suffix:**
<p> Power sensor index

**Parameters:**
<SensorOffset> Default unit: DB

**Example:** `PMET2:SOFF 0.001`

---

**[SENSe:]PMETer<p>[:STATe]** <State>

Turns a power sensor on and off.

**Suffix:**
<p> Power sensor index

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `PMET1 ON`
Switches the power sensor measurements on.

---

**[SENSe:]PMETer<p>:UPDate[:STATe]** <State>

Turns continuous update of power sensor measurements on and off.

If on, the results are updated even if a single sweep is complete.

**Suffix:**
<p> Power sensor index

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `PMET1:UPD ON`
The data from power sensor 1 is updated continuously.

---

**UNIT<n>:PMETer<p>:POWer** <Unit>

Selects the unit for absolute power sensor measurements.

**Suffix:**
<n> irrelevant

<p> Power sensor index

**Parameters:**
<Unit> DBM | WATT | W | DB | PCT

*RST: DBM

**Example:** `UNIT:PMET:POW DBM`

---

**UNIT<n>:PMETer<p>:POWer:RATio** <Unit>

Selects the unit for relative power sensor measurements.

**Suffix:**
<n> irrelevant

<p> Power sensor index

**Parameters:**
<Unit> DB | PCT

*RST: DB

**Example:** `UNIT:PMET:POW:RAT DB`

## 10.6.3 Frontend configuration

The following commands configure frequency, amplitude and y-axis scaling settings, which represent the "frontend" of the measurement setup.



### 10.6.3.1 Frequency



---

**[SENSe<ip>:]FREQuency:CENTer** <Frequency>

Defines the center frequency.

**Suffix:**
<ip> 1..n

**Parameters:**
<Frequency> The allowed range and $f_{max}$ is specified in the data sheet.

*RST: fmax/2
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" on page 70

---

**[SENSe:]FREQuency:CENTer:STEP** <StepSize>

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<ip>:]FREQuency:CENTer` on page 171.

**Parameters:**
<StepSize> $f_{max}$ is specified in the data sheet.

Range: 1 to fMAX
*RST: 0.1 x span
Default unit: Hz

**Example:** //Set the center frequency to 110 MHz.

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
```

**Manual operation:** See "Center Frequency Stepsize" on page 71

---

**[SENSe:]FREQuency:CENTer:STEP:AUTO** <State>

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<ip>:]FREQuency:OFFSet** <Offset>

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 71.

**Suffix:**

<ip> 1..n

**Parameters:**

<Offset> Range: -1 THz to 1 THz
*RST: 0 Hz
Default unit: HZ

**Example:** `FREQ:OFFS 1GHZ`

**Manual operation:** See "Frequency Offset" on page 71

### 10.6.3.2 Amplitude settings

The following commands are required to configure the amplitude settings in a remote environment.

Useful commands for amplitude settings described elsewhere:

- `INPut<ip>:COUPling<ant>` on page 138
- `INPut<ip>:IMPedance<ant>` on page 140
- `[SENSe<ip>:]ADJust:LEVel` on page 204

**Remote commands exclusive to amplitude settings:**



---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]** <Range>

Defines the display range of the y-axis (for all traces).

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <w> | subwindow<br>Not supported by all applications |
| <t> | irrelevant |
| **Example:** | `DISP:TRAC:Y 110dB` |

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]: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 |
| **Manual operation:** | See "Auto Scale Once" on page 70 |

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision** <Value>

This remote command determines the grid spacing on the Y-axis for all diagrams, where possible.

In spectrum displays, for example, this command is not available.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <w> | subwindow<br>Not supported by all applications |
| <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
Default unit: DBM

**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>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>** <ReferenceLevel>

Defines the reference level (for all traces in all windows).

With a reference level offset ≠ 0, the value range of the reference level is modified by the offset.

**Suffix:**

<n> irrelevant

<w> subwindow
Not supported by all applications

<t> irrelevant

<ant> Input source (for MIMO measurements only)

**Parameters:**

<ReferenceLevel> The unit is variable.

Range: see datasheet
*RST: 0 dBm
Default unit: DBM

**Example:** `DISP:TRAC:Y:RLEV -60dBm`

**Manual operation:** See "Reference Level" on page 67

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel<ant>:OFFSet** <Offset>

Defines a reference level offset (for all traces in all windows).

**Suffix:**

<n> irrelevant

<w> subwindow
Not supported by all applications

<t> irrelevant

<ant> Input source (for MIMO measurements only)

**Parameters:**

| | |
|---|---|
| <Offset> | Range: -200 dB to 200 dB<br>*RST: 0dB<br>Default unit: DB |

**Example:** `DISP:TRAC:Y:RLEV:OFFS -10dB`

**Manual operation:** See "Shifting the Display (Offset)" on page 67

---

**DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum** <Value>

Defines the maximum value on the y-axis in the specified window.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <t> | irrelevant |

**Parameters:**

| | |
|---|---|
| <Max> | numeric value |

**Example:** `DISP:WIND2:TRAC:Y:SCAL:MAX 10`

**Manual operation:** See "Y-Maximum, Y-Minimum" on page 69

---

**DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum** <Value>

Defines the minimum value on the y-axis in the specified window.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <t> | irrelevant |

**Parameters:**

| | |
|---|---|
| <Min> | numeric value |

**Example:** `DISP:WIND2:TRAC:Y:SCAL:MIN -90`

**Manual operation:** See "Y-Maximum, Y-Minimum" on page 69

---

**INPut<ip>:GAIN<ant>:STATe** <State>

Turns the internal preamplifier on the connected instrument on and off. It requires the additional preamplifier hardware option on the connected instrument.

Depending on the connected instrument, the preamplification is defined by `INPut<ip>:GAIN<ant>[:VALue]`.

**Suffix:**

| | |
|---|---|
| <ip> | 1 \| 2<br>irrelevant |

<ant> Input source (for MIMO measurements only)

**Parameters:**
<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

*RST: 0

**Example:**
```
INP:GAIN:STAT ON
INP:GAIN:VAL 15
```
Switches on 15 dB preamplification.

**Manual operation:** See "Preamplifier" on page 68

---

**INPut<ip>:GAIN<ant>[:VALue]** <Gain>

Selects the "gain" if the preamplifier is activated (`INP:GAIN:STAT ON`, see `INPut<ip>:GAIN<ant>:STATe` on page 175).

The command requires the additional preamplifier hardware option.

**Suffix:**
<ip> 1 | 2
irrelevant

<ant> Input source (for MIMO measurements only)

**Parameters:**
<Gain> 15 dB and 30 dB
All other values are rounded to the nearest of these two.
30 dB

Default unit: DB

**Example:**
```
INP:GAIN:STAT ON
INP:GAIN:VAL 30
```
Switches on 30 dB preamplification.

**Manual operation:** See "Preamplifier" on page 68

### 10.6.3.3 Configuring the attenuation



---

**INPut<ip>:ATTenuation** <Attenuation>

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 178).

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.

Is not available if the optional "Digital Baseband" interface is active.

**Suffix:**
<ip> 1..n

**Parameters:**
<Attenuation>
Range: see data sheet
Increment: 5 dB (with optional electr. attenuator: 1 dB)
*RST: 10 dB (AUTO is set to ON)
Default unit: DB

**Example:** `INP:ATT 30dB`
Defines a 30 dB attenuation and decouples the attenuation from the reference level.

**Manual operation:** See "Attenuation Mode / Value" on page 67

---

**INPut<ip>:ATTenuation:AUTO** <State>

Couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S VSE determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

**Suffix:**
<ip> 1..n

**Parameters:**
<State> ON | OFF | 0 | 1
*RST: 1

**Example:** `INP:ATT:AUTO ON`
Couples the attenuation to the reference level.

**Manual operation:** See "Attenuation Mode / Value" on page 67

---

**INPut:EATT** <Attenuation>

Defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see `INPut:EATT:AUTO` on page 178).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

Requires the electronic attenuation hardware option.

**Parameters:**

<Attenuation> attenuation in dB

Range: see data sheet
Increment: 1 dB
*RST: 0 dB (OFF)
Default unit: DB

**Example:**
```
INP:EATT:AUTO OFF
INP:EATT 10 dB
```

**Manual operation:** See "Using Electronic Attenuation" on page 68

---

**INPut:EATT:AUTO** <State>

Turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

Requires the electronic attenuation hardware option.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

*RST: 1

**Example:** `INP:EATT:AUTO OFF`

**Manual operation:** See "Using Electronic Attenuation" on page 68

---

**INPut:EATT:STATe** <State>

Turns the electronic attenuator on and off.

Requires the electronic attenuation hardware option.

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

*RST: 0

**Example:** `INP:EATT:STAT ON`
Switches the electronic attenuator into the signal path.

**Manual operation:** See "Using Electronic Attenuation" on page 68

## 10.6.4 Configuring triggered measurements

The following commands are required to configure a triggered measurement in a remote environment.

Note that the availability of trigger settings depends on the connected instrument.

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.



### 10.6.4.1 Configuring the triggering conditions

The following commands are required to configure a triggered measurement.

Note that the availability of trigger sources depends on the connected instrument.



**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 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
Default unit: S

**TRIGger[:SEQuence]:HOLDoff[:TIME]** <Offset>

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

**Parameters:**

<Offset>
*RST: 0 s
Default unit: S

**Example:** `TRIG:HOLD 500us`

**Manual operation:** See "Trigger Offset" on page 74

**TRIGger[:SEQuence]:IFPower:HOLDoff** <Period>

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).

**Parameters:**

<Period>
Range: 0 s to 10 s
*RST: 0 s
Default unit: S

**Example:** `TRIG:SOUR EXT`
Sets an external trigger source.
`TRIG:IFP:HOLD 200 ns`
Sets the holding time to 200 ns.

**TRIGger[:SEQuence]:IFPower:HYSTeresis** <Hysteresis>

Defines the trigger hysteresis, which is only available for "IF Power" trigger sources.

**Parameters:**

<Hysteresis>
Range: 3 dB to 50 dB
*RST: 3 dB
Default unit: DB

**Example:** `TRIG:SOUR IFP`
Sets the IF power trigger source.
`TRIG:IFP:HYST 10DB`
Sets the hysteresis limit value.

**TRIGger[:SEQuence]:LEVel:BBPower** <Level>

Sets the level of the baseband power trigger.

Is available for the optional "Analog Baseband" interface.

**Parameters:**

<Level>
Range: -50 dBm to +20 dBm
*RST: -20 dBm
Default unit: DBM

**Example:** `TRIG:LEV:BBP -30DBM`

**Manual operation:** See "Trigger Level" on page 74

---

**TRIGger[:SEQuence]:LEVel[:EXTernal<port>]** <TriggerLevel>

Defines the level the external signal must exceed to cause a trigger event.

**Suffix:**

<port>
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:**

<TriggerLevel>
Range: 0.5 V to 3.5 V
*RST: 1.4 V
Default unit: V

**Example:** `TRIG:LEV 2V`

**Manual operation:** See "Trigger Level" on page 74

---

**TRIGger[:SEQuence]:LEVel:IFPower** <TriggerLevel>

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.

**Parameters:**

<TriggerLevel>
For details on available trigger levels and trigger bandwidths, see the data sheet.
*RST: -20 dBm
Default unit: DBM

**Example:** `TRIG:LEV:IFP -30DBM`

---

**TRIGger[:SEQuence]:LEVel:MAPower** <TriggerLevel>

Defines the power level that must be exceeded to cause a trigger event for (offline) input from a file.

**Parameters:**

<TriggerLevel>
For details on available trigger levels and trigger bandwidths, see the data sheet.
Default unit: DBM

**Example:** `TRIG:LEV:MAP -30DBM`

---

**TRIGger[:SEQuence]:LEVel:RFPower** <TriggerLevel>

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
Default unit: DBM

**Example:** `TRIG:LEV:RFP -30dBm`

---

**TRIGger[:SEQuence]:SLOPe** <Type>

**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 74

---

**TRIGger[:SEQuence]:SOURce** <Source>

Selects the trigger source.

Note that the availability of trigger sources depends on the connected instrument.

**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 that this situation is avoided in your remote control programs.

**Parameters:**

<Source>

**IMMediate**
Free Run

**EXTernal**
Trigger signal from the "Trigger Input" connector.

**EXT | EXT2 | EXT3 | EXT4**
Trigger signal from the corresponding "TRIGGER INPUT/ OUTPUT" connector on the connected instrument, or the oscilloscope's corresponding input channel (if not used as an input source).
For details on the connectors see the instrument's Getting Started manual.

**TIME**
Time interval
(For frequency and time domain measurements only.)

**BBPower**
Baseband power
For input from the optional "Analog Baseband" interface.

**MAGNitude**
For (offline) input from a file, rather than an instrument.
The trigger level is specified by TRIGger[:SEQuence]:LEVel:MAPower.

**MAIT**
For trigger information stored as markers in an `.iqx` file.

**MANual**
Only available for a connected R&S RTP:
Any trigger settings in the R&S VSE software are ignored; only trigger settings defined on the connected instrument are considered. Thus, you can use the more complex trigger settings available on an R&S RTP.

*RST: IMMediate

**Example:**
`TRIG:SOUR EXT`
Selects the external trigger input as source of the trigger signal

**Manual operation:**
See "Trigger Source" on page 73
See "Free Run" on page 73
See "External Trigger / Trigger Channel X" on page 73
See "IF Power" on page 73
See "Magnitude (Offline)" on page 73
See "Manual" on page 74

---

**TRIGger[:SEQuence]:TIME:RINTerval** <Interval>

Defines the repetition interval for the time trigger.

**Parameters:**

<Interval> numeric value

Range: 2 ms to 5000 s
*RST: 1.0 s
Default unit: S

**Example:** `TRIG:SOUR TIME`
Selects the time trigger input for triggering.
`TRIG:TIME:RINT 5`
The measurement starts every 5 s.

### 10.6.4.2 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 connected instrument.



---

**OUTPut:TRIGger<tp>:DIRection** <Direction>

Selects the trigger direction for trigger ports that serve as an input as well as an output.

**Suffix:**
<Undefp> irrelevant

<tp>

**Parameters:**
<Direction> INPut | OUTPut

**INPut**
Port works as an input.

**OUTPut**
Port works as an output.

*RST: INPut

**Manual operation:** See "Trigger 1/2/3" on page 74

---

**OUTPut:TRIGger<tp>:LEVel** <Level>

Defines the level of the (TTL compatible) signal generated at the trigger output.

Works only if you have selected a user-defined output with `OUTPut:TRIGger<tp>:OTYPe`.

**Suffix:**
<tp> 1..n
Selects the trigger port to which the output is sent.

**Parameters:**
<Level> **HIGH**
5 V

**LOW**
0 V

*RST: LOW

**Example:** `OUTP:TRIG2:LEV HIGH`

**Manual operation:** See "Level" on page 75

---

**OUTPut:TRIGger<tp>:OTYPe** <OutputType>

Selects the type of signal generated at the trigger output.

**Suffix:**

<tp> 1..n
Selects the trigger port to which the output is sent.

**Parameters:**

<OutputType> **DEVice**
Sends a trigger signal when the R&S VSE 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<tp>:LEVel`.

*RST: DEVice

**Manual operation:** See "Output Type" on page 75

---

**OUTPut:TRIGger<tp>:PULSe:IMMediate**

Generates a pulse at the trigger output.

**Suffix:**

<tp> 1..n
Selects the trigger port to which the output is sent.

**Manual operation:** See "Send Trigger" on page 76

---

**OUTPut:TRIGger<tp>:PULSe:LENGth** <Length>

Defines the length of the pulse generated at the trigger output.

**Suffix:**

<tp> Selects the trigger port to which the output is sent.

**Parameters:**

<Length> Pulse length in seconds.

Default unit: S

**Example:** `OUTP:TRIG2:PULS:LENG 0.02`

**Manual operation:** See "Pulse Length" on page 76

### 10.6.5 Signal capturing

The following commands are required to configure how much and how data is captured from the input signal.

Useful commands for configuring data acquisition described elsewhere:

- [SENSe:]CDPower:FRAMe[:VALue] on page 204

**Remote commands exclusive to signal capturing:**



---

**[SENSe:]CDPower:BASE** <BaseValue>

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 77

---

**[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 77

**[SENSe:]CDPower:IQLength** <CaptureLength>

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 77

**[SENSe:]CDPower:SBANd** <NORMalINVers>

Is used to swap the left and right sideband.

**Parameters:**

<NORMalINVers> NORMal | INVerse
*RST: NORM

**Example:** `CDP:SBAN INV`
Switches the right and left sideband.

**[SENSe:]SWAPiq** <State>

Defines whether or not the recorded I/Q pairs should be swapped (I<->Q) before being processed. Swapping I and Q inverts the sideband.

This is useful if the DUT interchanged the I and Q parts of the signal; then the R&S VSE can do the same to compensate for it.

**Parameters:**

<State> **ON | 1**
I and Q signals are interchanged
Inverted sideband, Q+j*I
**OFF | 0**
I and Q signals are not interchanged
Normal sideband, I+j*Q
*RST: 0

**Manual operation:** See "Swap I/Q" on page 77

**[SENSe:]AVERage<n>:COUNt** <AverageCount>
**[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 capture count of 0 or 1, the R&S VSE performs one single measurement in single measurement mode.
In continuous measurement mode, if the capture count is set to 0, a moving average over 10 measurements is performed.

Range: 0 to 200000
*RST: 0

**Example:**
`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.

**Manual operation:** See "Capture / Average Count" on page 78

## 10.6.6 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 132

**Remote commands exclusive to synchronization:**



---

**[SENSe:]CDPower:UCPich:ANTenna<antenna>:CODE** <CodeNumber>

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 263 for antenna 1.

**Suffix:**
<antenna> 1..n
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 79

**[SENSe:]CDPower:STYPe** <Type>

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 78

### 10.6.7 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 10-4: BTS channel types and their assignment to a numeric parameter value*

| Param. | Channel type | Description |
|---|---|---|
| 0 | DPCH | **D**edicated **P**hysical **Ch**annel of a standard frame |
| 1 | PICH | **P**aging **I**ndication **Ch**annel |
| 2 | CPICH | **C**ommon **Pi**lot **Ch**annel |
| 3 | PSCH | **P**rimary **S**ynchronization **Ch**annel |
| 4 | SSCH | **S**econdary **S**ynchronization **Ch**annel |
| 5 | PCCPCH | **P**rimary **C**ommon **C**ontrol **P**hysical **Ch**annel |
| 6 | SCCPCH | **S**econdary **C**ommon **C**ontrol **P**hysical **Ch**annel |
| 7 | HS_SCCH | HSDPA: **H**igh **S**peed **S**hared **C**ontrol **Ch**annel |
| 8 | HS_PDSCH | HSDPA: **H**igh **S**peed **P**hysical **D**ownlink **S**hared **Ch**annel |
| 9 | CHAN | Channel without any pilot symbols (QPSK modulated) |
| 10 | CPRSD | Dedicated Physical Channel in **compr**e**s**se**d** mode |
| 11 | CPR-TPC | Dedicated Physical Channel in **compr**essed mode<br>**TPC** symbols are sent in the first slot of the gap. |

| Param. | Channel type | Description |
|---|---|---|
| 12 | CPR-SF/2 | Dedicated Physical Channel in **compr**essed mode using<br>half spreading factor (**SF/2**). |
| 13 | CPR-SF/2-TPC | Dedicated Physical Channel in **compr**essed mode using<br>half spreading factor (**SF/2**).<br>**TPC** symbols are sent in the first slot of the gap. |
| 14 | EHICH-ERGCH | HSUPA: **E**nhanced **H**ARQ Hybrid Acknowledgement **I**ndicator **Ch**annel<br>HSUPA: **E**nhanced **R**elative **G**rant **Ch**annel |
| 15 | EAGCH | E-AGCH: **E**nhanced **A**bsolute **G**rant **Ch**annel |
| 16 | SCPICH | **S**econdary **C**ommon **Pi**lot **Ch**annel |

*Table 10-5: 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 |



### 10.6.7.1 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 192
- `CONFigure:WCDPower[:BTS]:CTABle:SELect` on page 194

**Remote commands exclusive to general channel detection:**



**CONFigure:WCDPower[:BTS]:CTABle:COMPare** <State>

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 192). 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 | 1 | 0

**ON | 1**
Predefined channel table compare mode

**OFF | 0**
Normal predefined mode

*RST: 0

**Example:** `CONF:WCDP:CTAB:COMP ON`

**Mode:** BTS application only

**Manual operation:** See "Comparing the Measurement Signal with the Predefined Channel Table" on page 81

---

**CONFigure:WCDPower:MS:CTABle:TOFFset** <arg0>

**Parameters:**

<arg0> PREDefine | MEASurement

**Manual operation:** See "Timing Offset Reference" on page 81

---

**[SENSe:]CDPower:ICTReshold** <ThresholdLevel>

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
Default unit: DB

**Example:** `SENS:CDP:ICTR -100`

**Mode:** BTS application only

**Manual operation:** See "Inactive Channel Threshold (BTS measurements only)" on page 81

### 10.6.7.2 Managing channel tables



---

**CONFigure:WCDPower[:BTS]:CTABle[:STATe]** <State>

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 194.

**Parameters:**

<State> ON | OFF | 1 | 0

*RST: 0

**Example:** `CONF:WCDP:CTAB ON`

**Mode:** BTS application only

**Manual operation:** See "Using Predefined Channel Tables" on page 81

---

**CONFigure:WCDPower[:BTS]:CTABle:CATalog**

Reads out the names of all channel tables stored in the software. The first two result values are global values for all channel tables, the subsequent values are listed for each individual table.

**Parameters:**

| | |
|---|---|
| <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`

**Mode:** BTS application only

**Manual operation:** See "Predefined Tables" on page 82

*Table 10-6: 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` |
| 10712 | File size for channel table 3: 10712 bytes |
| ... | Channel table x: ... |

**CONFigure:WCDPower[:BTS]:CTABle:COPY** <FileName>

Copies one channel table onto another one. The channel table to be copied is selected with command `CONFigure:WCDPower[:BTS]:CTABle:NAME` on page 197.

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'.

**Mode:** BTS application only

**Manual operation:** See "Copying a Table" on page 82

**CONFigure:WCDPower[:BTS]:CTABle:DELete**

Deletes the selected channel table. The channel table to be deleted is selected with the command `CONFigure:WCDPower[:BTS]:CTABle:NAME` on page 197.

**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 82

**CONFigure:WCDPower[:BTS]:CTABle:SELect** <FileName>

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 192.

**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 82

**CONFigure:WCDPower:MS:CTABle[:STATe]** <State>

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 194.

**Parameters:**
<State> ON | OFF | 1 | 0
*RST: 0

**Example:** `CONF:WCDP:CTAB ON`

**Mode:** UE application only

**Manual operation:** See "Using Predefined Channel Tables" on page 81

**CONFigure:WCDPower:MS:CTABle:CATalog**

Reads out the names of all channel tables stored in the software. The first two result values are global values for all channel tables, the subsequent values are listed for each individual table.

**Parameters:**

| | |
|---|---|
| <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) |

**Mode:** UE application only

**Manual operation:** See "Predefined Tables" on page 82

---

**CONFigure:WCDPower:MS:CTABle:COPY** <FileName>

Copies one channel table onto another one. The channel table to be copied is selected with command `CONFigure:WCDPower:MS:CTABle:NAME` on page 197.

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 82

---

**CONFigure:WCDPower:MS:CTABle:DELete**

Deletes the selected channel table. The channel table to be deleted is selected with the command `CONFigure:WCDPower:MS:CTABle:NAME` on page 197.

**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 82

---

**CONFigure:WCDPower:MS:CTABle:SELect** <FileName>

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 194.

**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 82

### 10.6.7.3 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:COMMent** <Comment>

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 197. The values of the table are defined with command `CONFigure:WCDPower[:BTS]:CTABle:DATA` on page 198.

**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 83

---

**CONFigure:WCDPower[:BTS]:CTABle:MTABle**

Creates a completely new channel table according to the current measurement data.

**Example:** `CONF:WCDP:BTS:CTAB:MTAB`

**Usage:** Event

**Manual operation:** See "Creating a New Channel Table from the Measured Signal (Measure Table)" on page 83

---

**CONFigure:WCDPower[:BTS]:CTABle:NAME** <Name>

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 83

---

**CONFigure:WCDPower:MS:CTABle:NAME** <FileName>

Creates a new channel table file or selects an existing channel table in order to copy or delete it.

**Parameters:**

<FileName> *RST: RECENT

**Example:** `CONF:WCDP:CTAB:NAME 'NEW_TAB'`

**Mode:** UE application only

**Manual operation:** See "Name" on page 83

---

**CONFigure:WCDPower:MS:CTABle:COMMent** <Comment>

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 197. The values of the table are defined with command `CONFigure:WCDPower:MS:CTABle:DATA` on page 199.

**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 83

**CONFigure:WCDPower:MS:CTABle:MTABle**

Creates a completely new channel table according to the current measurement data.

**Example:** `CONF:WCDP:MS:CTAB:MTAB`

**Manual operation:** See "Creating a New Channel Table from the Measured Signal (Measure Table)" on page 83

### 10.6.7.4 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** {<CodeClass>, <CodeNumber>}...

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 197 .

**Parameters:**

<CodeClass> Range: 2 to 9

<CodeNumber> Range: 0 to 511

<UseTFCI> 0 | 1

**0**
not used

**1**
used

<TimingOffset> Step width: 256; for code class 9: 512
Range: 0 to 38400

<PilotLength> code class 9: 4
code class 8: 2,4, 8
code class 7: 4, 8
code class 5/6: 8
code class 2/3/4: 16

<ChannelType> For the assignment of channel types to parameters see Table 10-4.

<Status> **0**
not active

**1**
active

<CDP> for queries: CDP relative to total signal power; for settings: CDP absolute or relative

**Example:**
`CONF:WCDP:CTAB:NAME 'NEW_TAB'`
Defines the channel table name.
`CONF:WCDP:CTAB:DATA 8,0,0,0,0,0,1,0.00,8,1,0,0,0,0,1,0.00,7,1,0,256,8,0,1,0.00`

**Mode:** BTS application only

**Manual operation:**
See "Channel Type" on page 84
See "Channel Number (Ch. SF)" on page 85
See "Use TFCI" on page 85
See "Timing Offset" on page 85
See "Pilot Bits" on page 85
See "CDP Relative" on page 85
See "State" on page 86

### 10.6.7.5 Configuring channel details (UE measurements)

The following commands are used to configure individual channels in a predefined channel table in UE measurements.



---

**CONFigure:WCDPower:MS:CTABle:DATA** {<CodeClass>, <NoActChan>, <PilotLength>}...

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 197.

**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

<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 84
See "Channel Number (Ch. SF)" on page 85
See "Pilot Bits" on page 85
See "CDP Relative" on page 85
See "State" on page 86

---

**CONFigure:WCDPower:MS:CTABle:DATA:HSDPcch** <State>

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>}...

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 197.

**Parameters:**

| | |
|---|---|
| <CodeClass> | Code class of channel<br>Range: 2 to 9 |
| <NoActChan> | Number of active channels<br>Range: 0 to 4 |
| <CodeClass> | Code class of channel<br>Range: 2 to 9 |
| <NoActChan> | Number of active channels<br>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:EDPCch** <arg0>

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

## 10.6.8 Automatic settings

Useful commands for adjusting settings automatically described elsewhere:

- `DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE` on page 173
- `[SENSe:]CDPower:LCODe:SEARch[:IMMediate]` on page 133

**Remote commands exclusive to adjusting settings automatically:**



---

**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 | 1 | 0
*RST: 1

**Example:** `CONF:WCDP:ASC:STAT ON`

**Mode:** BTS application only

**CONFigure:WCDPower[:BTS]:MCARier: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 | 1 | 0

*RST: 0

**Example:** `CONF:WCDP:MCAR:STAT ON`

**Mode:** BTS application only

**[SENSe<ip>:]ADJust:ALL**

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

**Suffix:**

<ip> 1..n

**Example:** `ADJ:ALL`

**Manual operation:** See "Adjusting all Determinable Settings Automatically (Auto All)" on page 86

**[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation** <Duration>

To determine the ideal reference level, the R&S VSE performs a measurement on the current input data. This command defines the length of the measurement if `[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE` is set to `MANual`.

**Suffix:**

<ip> 1..n

**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 "Automatic Measurement Time Mode and Value" on page 87

---

**[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation:MODE** <Mode>

To determine the ideal reference level, the R&S VSE performs a measurement on the current input data. This command selects the way the R&S VSE determines the length of the measurement .

**Suffix:**
<ip> 1..n

**Parameters:**
<Mode>

**AUTO**
The R&S VSE determines the measurement length automatically according to the current input data.

**MANual**
The R&S VSE uses the measurement length defined by `[SENSe<ip>:]ADJust:CONFigure:LEVel:DURation` on page 202.

*RST: AUTO

**Manual operation:** See "Automatic Measurement Time Mode and Value" on page 87

---

**[SENSe<ip>:]ADJust:CONFigure:HYSTeresis:LOWer** <Threshold>

**Suffix:**
<ip> 1..n

**Parameters:**
<Threshold>
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 is only adjusted when the signal level falls below 18 dBm.

**Manual operation:** See "Lower Level Hysteresis" on page 88

---

**[SENSe<ip>:]ADJust:CONFigure:HYSTeresis:UPPer** <Threshold>

**Suffix:**
<ip> 1..n

**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 is only adjusted when the signal level rises above 22 dBm.

**Manual operation:** See "Upper Level Hysteresis" on page 88

**[SENSe<ip>:]ADJust:LEVel**

Initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. Thus, the settings of the RF attenuation and the reference level are optimized for the signal level. The R&S VSE is not overloaded and the dynamic range is not limited by an S/N ratio that is too small.

**Suffix:**

<ip> 1..n

**Example:** `ADJ:LEV`

**Manual operation:** See "Setting the Reference Level Automatically (Auto Level)" on page 67

## 10.6.9 Evaluation range

The evaluation range defines which data is evaluated in the result display.



**[SENSe:]CDPower:CODE** <CodeNumber>

Sets the code number. The code number refers to code class 9 (spreading factor 512).

**Parameters:**

<CodeNumber> *RST: 0

**Example:** `SENS:CDP:CODE 30`

**Manual operation:** See "Channel" on page 95

**[SENSe:]CDPower:FRAMe[:VALue]** <Frame>

Defines the frame to be analyzed within the captured data.

**Parameters:**

| | | |
|---|---|---|
| <Frame> | Range: | [0 ... CAPTURE_LENGTH – 1] |
| | *RST: | 1 |

**Example:** `CDP:FRAM:VAL 1`

**Manual operation:** See "Time Alignment Error" on page 34
See "Frame To Analyze" on page 77

---

**[SENSe:]CDPower:SLOT** <SlotNumber>

Selects the (CPICH) slot number to be evaluated.

**Parameters:**

| | | |
|---|---|---|
| <SlotNumber> | *RST: | 0 |

**Example:** `SENS:CDP:SLOT 3`

**Manual operation:** See "(CPICH) Slot" on page 96

---

**[SENSe:]CDPower:MAPPing** <SignalBranch>

Switches between I and Q branches of the signal for all evaluations (if not specified otherwise using `CALCulate<n>:CDPower:MAPPing` on page 205).

**Parameters:**

<SignalBranch> I | Q
*RST: Q

**Example:** `CDP:MAPP Q`

**Mode:** UE application only

**Manual operation:** See "Branch (UE measurements only)" on page 96
See "Selecting a Different Branch for a Window" on page 97

---

**CALCulate<n>:CDPower:MAPPing** <SignalBranch>

Adjusts the mapping for the evaluations "Code Domain Power" and "Code Domain Error Power" in a specific window.

**Suffix:**

<n> 1..n

**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` on page 205 command will be used for evaluation.

*RST: AUTO

**Example:** `CALC:CDP:MAPP AUTO`

**Mode:** UE application only

## 10.6.10 Code domain analysis settings (BTS measurements)

Some evaluations provide further settings for the results. The commands for BTS measurements are described here.



---

**CALCulate<n>: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:**

<n> 1..n

<m> 1..n
Marker

**Parameters:**

<State> ON | OFF | 1 | 0

*RST: 0

**Example:** `CALC:MARK:FUNC:ZOOM ON`

---

**[SENSe:]CDPower:CPB** <Value>

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> *RST: 0

**Example:** `SENS:CDP:CDP 1`

**Manual operation:** See "Constellation Parameter B" on page 99

**[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 | 1 | 0
*RST: 0

**Example:** `SENS:CDP:NORM ON`
Activates the elimination of the I/Q offset.

**Manual operation:** See "Compensate IQ Offset" on page 98

**[SENSe:]CDPower:PDISplay** <Mode>

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 208)

*RST: ABS

**Example:** `SENS:CDP:PDIS ABS`

**Manual operation:** See "Code Power Display" on page 98
See "Code Power Display" on page 100

**[SENSe:]CDPower:PDIFf** <State>

Defines which slot power difference is displayed in the "Power vs Slot" evaluation.

**Parameters:**
<State> ON | OFF | 1 | 0

**ON | 1**
The slot power difference to the previous slot is displayed.

**OFF | 0**
The current slot power of each slot is displayed.

*RST: 0

**Example:** `SENS:CDP:PDIF ON`

**Mode:** BTS application only

**Manual operation:** See "Show Difference to Previous Slot" on page 98

---

**[SENSe:]CDPower:PREFerence** <Mode>

Defines the reference for the relative CDP measurement values.

**Parameters:**

<Mode> TOTal | CPICh | PICH

**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 98

## 10.6.11 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<n>:MARKer<m>:FUNCtion:ZOOM` on page 206
- `[SENSe:]CDPower:NORMalize` on page 207
- `[SENSe:]CDPower:PDISplay` on page 207

**Remote commands exclusive to Code Domain Analysis in UE Measurements:**



---

**[SENSe:]CDPower:ETCHips** <State>

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 µs (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:**

<State> **ON | 1**
Changes of power are expected. Therefore an EVM measurement interval of one slot minus 25 µs (3904 chips) is considered.

**OFF | 0**
Changes of power are not expected. Therefore an EVM measurement interval of one slot (4096 chips) is considered

*RST: 0

**Example:** `SENS:CDP:ETCH ON`

**Manual operation:** See "Eliminate Tail Chips" on page 100

---

**[SENSe:]CDPower:HSLot** <State>

Switches between the analysis of half slots and full slots.

**Parameters:**

<State> ON | OFF | 1 | 0

**ON | 1**
30 (half) slots are evaluated

**OFF | 0**
15 (full) slots are evaluated

*RST: 0

**Example:** `SENS:CDP:HSL ON`

**Mode:** UE application only

**Manual operation:** See "Measurement Interval" on page 99

## 10.6.12 Configuring carrier tables for time alignment measurements

The following commands are required to configure carrier tables for TAE measurements (see Chapter 5.2.2, "Carrier table configuration", on page 90)



---

**[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..n
Carrier in carrier table
The suffix must refer to a carrier already defined in the current table.

<antenna> 1..n
Antenna to be configured or queried

**Parameters:**

<CodeNumber> Scrambling code in decimal format.

Range: 0 to 225
*RST: 0

**Manual operation:** See "Antenna 1: CPICH-Number" on page 94
See "Antenna 2: CPICH-Number" on page 94

---

**[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..n
Carrier in carrier table
The suffix must refer to a carrier already defined in the current table.

<antenna> 1..n
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 94
See "Antenna 2: CPICH-Pattern" on page 94

---

**[SENSe:]TAERror:CARRier<c>:COUNt**

Queries the number of carriers defined in the currently selected carrier table for "Time Alignment Error" measurement.

**Suffix:**

<c> 1..n

**Manual operation:** See "Carrier" on page 93

**[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..n
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
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.

**Manual operation:** See "Deleting a Carrier" on page 92

**[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..n
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.

**Manual operation:** See "Adding a Carrier" on page 92

**[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..n
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 93).

Range: 2.5 MHz to +/- 61.5 MHz
Default unit: HZ

**Manual operation:** See "Frequency Offset" on page 93

---

**[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 135.)

**Suffix:**

<c> 1..n
Carrier in carrier table
The suffix must refer to a carrier already defined in the current table, but not the reference carrier.

**Parameters:**

<ScramblingCode> Scrambling code in decimal format.

*RST: 00

**Manual operation:** See "Scrambling Code" on page 94

---

**[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\`.

**Parameters:**

<Tablenames> Table names as a comma-separated list of strings

**Example:** `TAER:CAT?`
Result: 'COPIED TABLE','NEWTABLE'

**Manual operation:** See "Carrier Tables" on page 90

---

**[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`.

**Manual operation:** See "Deleting a Table" on page 91

---

**[SENSe:]TAERror:NEW**

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`.

**Manual operation:** See "Creating a New Table" on page 90

---

**[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`.

**Manual operation:** See "Selecting a Table" on page 90

---

**[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`.

**Manual operation:** See "Saving the Table" on page 92

## 10.7 Configuring the result display

The commands required to configure the screen display in a remote environment are described here.



### 10.7.1 Global layout commands

The following commands are required to change the evaluation type and rearrange the screen layout across measurement channels as you do in manual operation.

For compatibility with other Rohde & Schwarz Signal and Spectrum Analyzers, the layout commands described in Chapter 10.7.2, "Working with windows in the display", on page 218 are also supported. Note, however, that the commands described there only allow you to configure the layout within the *active* measurement channel.



**LAYout:GLOBal:ADD[:WINDow]?** <ExChanName>,<ExWinName>,<Direction>,<NewChanName>,<NewWinType>

Adds a window to the display next to an existing window. The new window may belong to a different channel than the existing window.

To replace an existing window, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

**Parameters:**

<ExChanName> string
Name of an existing channel

<ExWinName> string
Name of the existing window within the <ExChanName> channel 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 `LAYout:GLOBal:IDENtify[:WINDow]?` query.

<Direction> LEFT | RIGHt | ABOVe | BELow | TAB
Direction the new window is added relative to the existing window.
**TAB**
The new window is added as a new tab in the specified existing window.

<NewChanName> string
Name of the channel for which a new window is to be added.

<NewWinType> string
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:**
```
LAYout:GLOBal:ADD:WINDow? 'IQ
Analyzer','1',RIGH,'IQ Analyzer2','FREQ'
```
Adds a new window named 'Spectrum' with a Spectrum display to the right of window 1 in the channel 'IQ Analyzer'.

**Usage:** Query only

*Table 10-7: <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 |

| Parameter value | Window type |
|---|---|
| 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 |
| SCONst | Symbol Constellation |
| SEVM | Symbol EVM |
| SMERror | Symbol Magnitude Error |
| SPERror | Symbol Phase Error |

**LAYout:GLOBal:CATalog[:WINDow]?**

Queries the name and index of all active windows from top left to bottom right for each active channel. The result is a comma-separated list of values for each window, with the syntax:

<ChannelName_1>: <WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

..

<ChannelName_m>: <WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

**Return values:**

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.

<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:GLOB:CAT?`
Result:
`IQ Analyzer: '1',1,'2',2`
`Analog Demod: '1',1,'4',4`
For the I/Q Analyzer channel, two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).
For the Analog Demodulation channel, two windows are displayed, named '1' (at the top or left), and '4' (at the bottom or right).

**Usage:** Query only

---

**LAYout:GLOBal:IDENtify[:WINDow]?** <ChannelName>,<WindowName>

Queries the **index** of a particular display window in the specified channel.

**Note**: to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

**Parameters:**

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.

**Query parameters:**

<WindowName> String containing the name of a window.

**Return values:**

<WindowIndex> Index number of the window.

**Example:**
```
LAYout:GLOBal:ADD:WINDow? IQ,'1',RIGH,
'Spectrum',FREQ
```
Adds a new window named 'Spectrum' with a Spectrum display to the right of window 1.

**Example:**
```
LAYout:GLOBal:IDENtify? 'IQ Analyzer',
'Spectrum'
```
Result:
```
2
```
Window index is: 2.

**Usage:** Query only

---

**LAYout:GLOBal:REMove[:WINDow]** <ChannelName>, <WindowName>

**Setting parameters:**

<ChannelName>

<WindowName>

**Usage:** Setting only

---

**LAYout:GLOBal:REPLace[:WINDow]** <ExChannelName>, <WindowName>, <NewChannelName>, <WindowType>

**Setting parameters:**

<ExChannelName>

<WindowName>

<NewChannelName>

<WindowType>

**Usage:** Setting only

### 10.7.2 Working with windows in the display

Note that the suffix <n> always refers to the window *in the currently selected channel*.

The following commands are required to change the evaluation type and rearrange the screen layout for a channel as you do in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected channel.

Note that the suffix <n> always refers to the window *in the currently selected channel*.

To configure the layout of windows across channels, use the Chapter 10.7.1, "Global layout commands", on page 214.



---

**LAYout:ADD[:WINDow]?** <WindowName>, <Direction>, <WindowType>

Adds a window to the display in the active channel.

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.

**Query 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 `LAYout:CATalog[:WINDow]?` 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.
Note that the window type must be valid for the active channel. To create a window for a different channel, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

**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 19
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 "Magnitude Error vs Chip" on page 26
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 33

*Table 10-8: <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" |

| Parameter value | Window type |
|---|---|
| PSLot | "Power vs. Slot" |
| PSYMbol | "Power vs. Symbol" |
| RSUMmary | "Result Summary" |
| SCONst | "Symbol Constellation" |
| SEVM | "Symbol EVM" |
| SMERror | "Symbol Magnitude Error" |
| SPERror | "Symbol Phase Error" |

**LAYout:CATalog[:WINDow]?**

Queries the name and index of all active windows in the active 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>

To query the name and index of all windows in all channels, use the `LAYout:GLOBal:CATalog[:WINDow]?` command.

**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>

Queries the **index** of a particular display window in the active channel.

**Note**: to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

To query the index of a window in a different channel, use the `LAYout:GLOBal:IDENtify[:WINDow]?` command.

**Query parameters:**

<WindowName> String containing the name of a window.

**Return values:**

<WindowIndex> Index number of the window.

**Example:** `LAY:IDEN:WIND? '2'`
Queries the index of the result display named '2'.
Response:
`2`

**Usage:** Query only

---

**LAYout:MOVE[:WINDow]** <WindowName>, <WindowName>, <Direction>

**Setting parameters:**

<WindowName> String containing the name of an existing window that is to be moved.
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 channel, use the `LAYout:CATalog[:WINDow]?` query.

<WindowName> String containing the name of an existing window the selected window is placed next to or replaces.
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 channel, use the `LAYout:CATalog[:WINDow]?` query.

<Direction> LEFT | RIGHt | ABOVe | BELow | REPLace
Destination the selected window is moved to, relative to the reference window.

**Example:** `LAY:MOVE '4','1',LEFT`
Moves the window named '4' to the left of window 1.

**Example:** `LAY:MOVE '1','3',REPL`
Replaces the window named '3' by window 1. Window 3 is deleted.

**Usage:** Setting only

---

**LAYout:REMove[:WINDow]** <WindowName>

Removes a window from the display in the active channel.

**Setting 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:** Setting only

**LAYout:REPLace[:WINDow]** <WindowName>,<WindowType>

Replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window in the active channel while keeping its position, index and window name.

To add a new window, use the `LAYout:ADD[:WINDow]?` command.

**Setting 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 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 218 for a list of available window types.
Note that the window type must be valid for the active channel. To create a window for a different channel, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

**Example:** `LAY:REPL:WIND '1',MTAB`
Replaces the result display in window 1 with a marker table.

**Usage:** Setting only

**LAYout:WINDow<n>:ADD?** <Direction>,<WindowType>

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. Unlike `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.

Is always used as a query so that you immediately obtain the name of the new window as a result.

**Suffix:**

<n> Window

**Query parameters:**

<Direction> LEFT | RIGHt | ABOVe | BELow

<WindowType> Type of measurement window you want to add.
See `LAYout:ADD[:WINDow]?` on page 218 for a list of available window types.
Note that the window type must be valid for the active channel. To create a window for a different channel, use the `LAYout:GLOBal:ADD[:WINDow]?` command.

**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?**

Queries the **name** of a particular display window (indicated by the <n> suffix) in the active 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**

Removes the window specified by the suffix <n> from the display in the active channel.

The result of this command is identical to the `LAYout:REMove[:WINDow]` command.

To remove a window in a different channel, use the `LAYout:GLOBal:REMove[:WINDow]` command.

**Suffix:**
<n> Window

**Example:** `LAY:WIND2:REM`
Removes the result display in window 2.

**Usage:** Event

---

**LAYout:WINDow<n>:REPLace** <WindowType>

Changes the window type of an existing window (specified by the suffix <n>) in the active channel.

The effect 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

**Setting parameters:**
<WindowType> Type of measurement window you want to replace another one with.
See `LAYout:ADD[:WINDow]?` on page 218 for a list of available window types.
Note that the window type must be valid for the active channel. To create a window for a different channel, use the `LAYout:GLOBal:REPLace[:WINDow]` command.

**Example:** `LAY:WIND2:REPL MTAB`
Replaces the result display in window 2 with a marker table.

**Usage:** Setting only

## 10.7.3 General window commands

The following commands are required to work with windows, independently of the application.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel*.



---

**DISPlay:FORMat** <Format>

Determines which tab is displayed.

**Parameters:**
<Format>
**SPLit**
Displays the MultiView tab with an overview of all active channels
**SINGle**
Displays the measurement channel that was previously focused.
*RST: SING

**Example:** `DISP:FORM SPL`

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:SELect**

Sets the focus on the selected result display window.

This window is then the active window.

For measurements with multiple results in subwindows, the command also selects the subwindow. Use this command to select the (sub)window before querying trace data.

**Suffix:**

<n> Window

<w> subwindow
Not supported by all applications

**Example:** //Put the focus on window 1
`DISP:WIND1:SEL`

**Example:** //Put the focus on subwindow 2 in window 1
`DISP:WIND1:SUBW2:SEL`

## 10.8 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 10.6.7, "Channel detection", on page 189.

**Specific commands:**



### 10.8.1 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** <ResultType>

Queries the result of a time alignment measurement for the selected frame (see `[SENSe:]CDPower:FRAMe[:VALue]` on page 204).

For details on the measurement see Chapter 3.2, "Time alignment error measurements", on page 33.

The results are provided as a comma-separated list of values for each carrier.

**Suffix:**

<n> 1..n
Window

<m> 1..n
Marker

**Parameters:**

<ResultType> TAERror

Returns the time offset between the two antenna signals in chips.

<Ant1State> 0 | 1

Synchronization state for antenna 1

**0**
No Sync

**1**
OK

<Ant2Delay> numeric value

Time delay for the carrier at antenna 2, relative to the reference carrier 0

Default unit: chips

<Ant2State> 0 | 1

Synchronization state for antenna 2

**0**
No Sync

**1**
OK

**Example:** `CALC:MARK:FUNC:TAER:RES? TAER`
Result for multi-carrier measurement with 2 carriers:
`-548.517578,0,-2017.237915,0,-3423.261230,0`
where:
`-548.517578`: time delay of the antenna 2 signal for carrier 0, relative to the antenna 1 signal for carrier 0
`0`: sync state of antenna 2 for carrier 0
`-2017.237915`: time delay of the antenna 1 signal of carrier 1, relative to the antenna 1 signal for carrier 0
`0`: sync state of antenna 1 for carrier 1
`-3423.261230`: time delay of the antenna 2 signal of carrier 1, relative to the antenna 2 signal for carrier 0
`0`: sync state of antenna 2 for carrier 1

**Example:** `CALC:MARK:FUNC:TAER:RES? TAER`
Result for single-carrier measurement:
`-548.517578`
This is the time delay of the antenna 2 signal relative to the antenna 1 signal.

**Mode:** BTS application only

**Manual operation:** See "Time Alignment Error" on page 34

**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> | Window |
| <m> | Marker |

**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

**Example:** `CALC:MARK:FUNC:WCDP:MS:RES? PTOT`

**Usage:** Query only

**Mode:** UE application only

**Manual operation:** See "Code Domain Power" on page 21

---

**CALCulate<n>:MARKer<m>:FUNCtion:WCDPower[:BTS]:RESult** <Measurement>

Queries the measured and calculated results of the 3GPP FDD BTS code domain power measurement.

**Suffix:**

<n> 1..n
Window

<m> 1..n
Marker

**Parameters:**

<Measurement> PTOTal | FERRor | TFRame | TOFFset | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance | MTYPe | RHO | PSYMbol | ACHannels | MPIC | RCDerror | ARCDerror | IOFFset | QOFFset

The parameter specifies the required evaluation method.

**ACHannels**
Number of active channels

**ARCDerror**
relative code domain error averaged over all channels with modulation type 64QAM

**CDPabsolute**
code domain power absolute

**CDPRelative**
code domain power relative

**CERRor**
chip rate error

**CHANnel**
channel number

**CSLot**
channel slot number

**EVMPeak**
error vector magnitude peak

**EVMRms**
error vector magnitude RMS

**FERRor**
frequency error in Hz

**IOFFset**
imaginary part of the I/Q offset

**IQIMbalance**
I/Q imbalance

**IQOFfset**
I/Q offset

**MACCuracy**
composite EVM

**MPIC**
average power of inactive channels

**MTYPe**
modulation type:
2 – QPSK
4 – 16 QAM
5 – 64 QAM
15 – NONE

**PCDerror**
peak code domain error

**PSYMbol**
number of pilot bits

**PTOTal**
total power

**QOFFset**
real part of the I/Q offset

**RCDerror**
relative code domain error

**RHO**
rho value for every slot

**SRATe**
symbol rate

**TFRame**
trigger to frame

**TOFFset**
timing offset

**Example:** `CALC:MARK:FUNC:WCDP:RES? PTOT`

**Mode:** BTS application only

**Manual operation:** See "Code Domain Power" on page 21

## 10.8.2 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 238).

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.



### 10.8.2.1 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 132) :

***Table 10-9: Bit values and numbers without HS-DPCCH channels***

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

The values and number of the bits including HS-DPCCH channels (see [SENSe:]CDPower:HSDPamode on page 132) are as follows:

***Table 10-10: Bit values and numbers including HS-DPCCH channels***

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

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

### 10.8.2.2 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**

### 10.8.2.3 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:<br>0b00-0d0: CC9 is inactive.<br>0b01-0d1: CC9 channel belongs to an active code channel.<br>0b11-0d3: CC9 channel belongs to an active code channel; sent pilot symbols are incorrect |

The channels are sorted by code number.

### 10.8.2.4 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 238.

### 10.8.2.5 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.

### 10.8.2.6 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)

### 10.8.2.7 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.

### 10.8.2.8 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>

### 10.8.2.9 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.

### 10.8.2.10 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)

### 10.8.2.11 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>

### 10.8.2.12 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.

### 10.8.2.13 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)

### 10.8.2.14 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:

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

### 10.8.2.15 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 [µs]>,

<EVM peak channel [%]>,

<EVM mean channel [%]>,

<code class>,

<channel number>,

<power abs. channel [dB]>,

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

<timing offset [chips]>,

<number of pilot bits>

<I/Q offset [%]>,

<I/Q imbalance [%]>

### 10.8.2.16 Symbol constellation

When the trace data for this evaluation is queried, the real and the imaginary branches are transferred:

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

The number of level values depends on the spreading factor:

| Spreading factor | Number of level values |
|---|---|
| 512 | 5 |
| 256 | 10 |
| 128 | 20 |
| 64 | 40 |

| Spreading factor | Number of level values |
|---|---|
| 32 | 80 |
| 16 | 160 |
| 8 | 320 |
| 4 | 640 |

### 10.8.2.17 Symbol EVM

When the trace data for this evaluation is queried, the real and the imaginary branches are transferred:

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

The number of level values depends on the spreading factor:

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

### 10.8.2.18 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:

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

### 10.8.2.19 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:

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

### 10.8.3 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 238
- `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]? PWCDp`
- `TRACe<n>[:DATA]? TPVSlot`

---

**FORMat[:DATA]** <Format>[, <BitLength>]

Selects the data format that is used for transmission of trace data from the R&S VSE to the controlling computer.

Note that the command has no effect for data that you send to the R&S VSE. The R&S VSE 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 can be.

**REAL**
Floating-point numbers (according to IEEE 754) in the "definite length block format".

<BitLength>

Length in bits for floating-point results

**16**
16-bit floating-point numbers.
Compared to `REAL,32` format, half as many numbers are returned.

**32**
32-bit floating-point numbers
For I/Q data, 8 bytes per sample are returned for this format setting.

**64**
64-bit floating-point numbers
Compared to `REAL,32` format, twice as many numbers are returned.

**Example:** `FORM REAL,32`

---

**TRACe<n>[:DATA]** <ResultType>

Reads trace data from the R&S VSE.

For details on reading trace data for other than code domain measurements refer to the `TRACe:DATA` command in the base unit description.

**Suffix:**

<n> Window

**Parameters:**

<ResultType> ATRace1 | ATRace2 | ATRace3 | ATRace4 | FINal1 | TRACe1 | TRACe2 | TRACe3 | TRACe4 | ABITstream | ABITstream1 | ABITstream2 | ABITstream3 | ABITstream4 | PWCDp | CWCDp | CTABle | TPVSlot | LIST

The individual results are described in Chapter 10.8.2, "Measurement results for TRACe<n>[:DATA]? TRACE<n>", on page 230.

---

**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 10.8.2, "Measurement results for TRACe<n>[:DATA]? TRACE<n>", on page 230.

**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 "Magnitude Error vs Chip" 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 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 33

---

**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 218).

The output format is identical to that of the `TRAC:DATA? TRAC` command for an activated "Bitstream" evaluation (see Chapter 10.8.2, "Measurement results for TRACe<n>[:DATA]? TRACE<n>", on page 230). 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 19

**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).

**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.

<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)

**Example:** `TRAC:DATA? CTABle`
Returns a list of channel information, including the pilot length and channel state.

**Usage:** Query only

**Manual operation:** See "Channel Table" on page 19
See "Code Domain Power" 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> **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.

<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 Table 10-4.
Range: 0 … 16

<ModType> Modulation type of the code channel at the selected channel slot

**2**
QPSK

**4**
16 QAM

**15**
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]? 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> **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.

<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

**Example:** `TRAC:DATA? PWCDp`
Returns a list of channel information, including the pilot length.

**Usage:** Query only

**Mode:** BTS application only

**Manual operation:** 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

### 10.8.4 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 VSE User Manual.

**MMEMory:STORe<n>:FINal** <FileName>

Exports the marker peak list to a file.

The file format is *.dat.

**Suffix:**

<n> 1..n
Window

**Parameters:**

<FileName> String containing the path and name of the target file.

<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>

Exports trace data from the specified window to an ASCII file.

You cannot query trace data resulting from encrypted file input.

Trace export is only available for RF measurements.

For details on the file format, see "Reference: ASCII File Export Format" in the R&S VSE base software 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 1,'C:\TEST.ASC'`
Stores trace 1 from window 1 in the file `TEST.ASC`.

**FORMat:DEXPort:DSEParator** <Separator>

Selects the decimal separator for data exported in ASCII format.

**Parameters:**

<Separator> POINt | COMMa

**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.

**Manual operation:** See "Decimal Separator" on page 102

---

**FORMat:DEXPort:HEADer** <State>

If enabled, additional instrument and measurement settings are included in the header of the export file for result data. If disabled, only the pure result data from the selected traces and tables is exported.

Trace data resulting from encrypted file input cannot be queried.

**Parameters:**
<State> ON | OFF | 0 | 1
*RST: 1

**Manual operation:** See "Include Instrument & Measurement Settings" on page 102

---

**FORMat:DEXPort:TRACes** <Selection>

Selects the data to be included in a data export file (see `MMEMory:STORe<n>:TRACe` on page 245).

Trace data resulting from encrypted file input cannot be queried.

**Parameters:**
<Selection> SINGle | ALL

**SINGle**
Only a single trace is selected for export, namely the one specified by the `MMEMory:STORe<n>:TRACe` command.

**ALL**
Selects all active traces and result tables (e.g. "Result Summary", marker peak list etc.) in the current application for export to an ASCII file.
The <trace> parameter for the `MMEMory:STORe<n>:TRACe` command is ignored.
*RST: SINGle

**Manual operation:** See "Export all Traces and all Table Results" on page 102

# 10.9 Analysis

The following commands define general result analysis settings concerning the traces and markers.



## 10.9.1 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>][:SUBWindow<w>]:TRACe<t>:MODE** <Mode>

Selects the trace mode. If necessary, the selected trace is also activated.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <w> | subwindow<br>Not supported by all applications |
| <t> | Trace |

**Parameters:**

<Mode>

**WRITe**
(default:) Overwrite mode: the trace is overwritten by each sweep.

**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 VSE 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 VSE 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 101

---

**DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe]** <State>

Turns a trace on and off.

The measurement continues in the background.

**Suffix:**

<n> Window

<w> subwindow
Not supported by all applications

<t> Trace

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `DISP:TRAC3 ON`

## 10.9.2 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.



### 10.9.2.1 Individual marker settings

**CALCulate<n>:MARKer<m>[:STATe]** <State>

Turns markers on and off. If the corresponding marker number is currently active as a delta marker, it is turned into a normal marker.

**Suffix:**

<n> Window

<m> Marker

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `CALC:MARK3 ON`
Switches on marker 3.

**Manual operation:** See "Marker 1/ Delta 1/ Delta 2/.../Delta 4" on page 104
See "Marker State" on page 104
See "Marker Type" on page 104

**CALCulate<n>:MARKer<m>:X** <Position>

Moves a marker to a specific 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:**

<n> Window

<m> Marker

**Parameters:**

<Position> Numeric value that defines the marker position on the x-axis.
The unit depends on the result display.

Range: The range depends on the current x-axis range.
Default unit: Hz

**Example:** `CALC:MARK2:X 1.7MHz`
Positions marker 2 to frequency 1.7 MHz.

**Manual operation:** See "Marker Table" on page 26
See "Marker 1/ Delta 1/ Delta 2/.../Delta 4" on page 104
See "X-value" on page 104

---

**CALCulate<n>:MARKer<m>:Y?**

Queries the result at the position of the specified marker.

**Suffix:**

| | |
|---|---|
| <n> | 1..n |
| <m> | 1..n |

**Return values:**

| | |
|---|---|
| <Result> | Default unit: DBM |

**Usage:** Query only

**Manual operation:** See "Marker Table" on page 26
See "Marker 1/ Delta 1/ Delta 2/.../Delta 4" on page 104

---

**CALCulate<n>:MARKer<m>:AOFF**

Turns off all markers.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <m> | Marker |

**Example:** `CALC:MARK:AOFF`
Switches off all markers.

**Manual operation:** See "All Markers Off" on page 105

---

**CALCulate<n>:DELTamarker<m>[:STATe]** <State>

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker turns on delta marker 1.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <m> | Marker |

**Parameters:**

<State> ON | OFF | 0 | 1

**OFF | 0**
Switches the function off

**ON | 1**
Switches the function on

**Example:** `CALC:DELT2 ON`
Turns on delta marker 2.

**Manual operation:** See "Marker 1/ Delta 1/ Delta 2/.../Delta 4" on page 104
See "Marker State" on page 104
See "Marker Type" on page 104

---

**CALCulate<n>:DELTamarker<m>:AOFF**

Turns off *all* delta markers.

**Suffix:**

<n> Window

<m> irrelevant

**Example:** `CALC:DELT:AOFF`
Turns off all delta markers.

---

**CALCulate<n>:DELTamarker<m>:X** <Position>

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:**

<n> Window

<m> Marker

**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 "Marker 1/ Delta 1/ Delta 2/.../Delta 4" on page 104
See "X-value" on page 104

---

**CALCulate<n>:DELTamarker<m>:X:RELative?**

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

**Return values:**

<Position> Position of the delta marker in relation to the reference marker.

**Example:** `CALC:DELT3:X:REL?`
Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

**Usage:** Query only

**Manual operation:** See "Marker 1/ Delta 1/ Delta 2/.../Delta 4" on page 104

---

**CALCulate<n>:DELTamarker<m>:Y?**

Queries the result at the position of the specified delta marker.

**Suffix:**

<n> 1..n

<m> 1..n

**Return values:**

<Result> Result at the position of the delta marker.
The unit is variable and depends on the one you have currently set.
Default unit: DBM

**Usage:** Query only

**Manual operation:** See "Marker 1/ Delta 1/ Delta 2/.../Delta 4" on page 104

### 10.9.2.2 General marker settings



---

**DISPlay[:WINDow<n>]:MTABle** <DisplayMode>

Turns the marker table on and off.

**Suffix:**

<n> irrelevant

**Parameters:**

<DisplayMode>

**ON | 1**
Turns on the marker table.

**OFF | 0**
Turns off the marker table.

**AUTO**
Turns on the marker table 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 105

### 10.9.2.3 Positioning the marker

This chapter contains remote commands necessary to position the marker on a trace.



#### Positioning normal markers

The following commands position markers on the trace.



**CALCulate<n>:MARKer<m>:FUNCtion:CPICh**

Sets the marker to channel 0.

Is only available in "Code Domain Power" and "Code Domain Error Power" evaluations.

**Suffix:**

<n> 1..n
Window

<m> 1..n
Marker

**Example:** `CALC:MARK:FUNC:CPIC`

**Manual operation:** See "Marker To CPICH" on page 107

**CALCulate<n>:MARKer<m>:FUNCtion:PCCPch**

Sets the marker to the position of the PCCPCH.

Is only available in code domain power and code domain error power evaluations.

**Suffix:**

<n> 1..n
Window

<m> 1..n
Marker

**Example:** `CALC:MARK:FUNC:PCCP`

**Manual operation:** See "Marker To PCCPCH" on page 108

**CALCulate<n>:MARKer<m>:MAXimum:LEFT**

Moves a marker to the next positive peak.

The search includes only measurement values to the left of the current marker position.

**Suffix:**

<n> Window

<m> Marker

**Manual operation:** See "Search Next Peak" on page 107

**CALCulate<n>:MARKer<m>:MAXimum:NEXT**

Moves a marker to the next positive peak.

**Suffix:**

<n> Window

<m> Marker

**Manual operation:** See "Search Next Peak" on page 107

**CALCulate<n>:MARKer<m>:MAXimum[:PEAK]**

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

**Manual operation:** See "Peak Search" on page 107

**CALCulate<n>:MARKer<m>:MAXimum:RIGHt**

Moves a marker to the next positive peak.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n> Window

<m> Marker

**Manual operation:** See "Search Next Peak" on page 107

**CALCulate<n>:MARKer<m>:MINimum:LEFT**

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n> Window

<m> Marker

**Manual operation:** See "Search Next Minimum" on page 107

---

**CALCulate<n>:MARKer<m>:MINimum:NEXT**

Moves a marker to the next minimum peak value.

**Suffix:**

<n> Window

<m> Marker

**Manual operation:** See "Search Next Minimum" on page 107

---

**CALCulate<n>:MARKer<m>:MINimum[:PEAK]**

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

**Manual operation:** See "Search Minimum" on page 107

---

**CALCulate<n>:MARKer<m>:MINimum:RIGHt**

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

<n> Window

<m> Marker

**Manual operation:** See "Search Next Minimum" on page 107

### Positioning delta markers

The following commands position delta markers on the trace.

**CALCulate<n>:DELTamarker<m>:FUNCtion:CPICh**

Sets the delta marker to channel 0.

Is only available in "Code Domain Power" and "Code Domain Error Power" evaluations.

**Suffix:**

<n> Window

<m> Marker

**Example:** `CALC:DELT2:FUNC:CPIC`

**CALCulate<n>:DELTamarker<m>:FUNCtion:PCCPch**

Sets the delta marker to the position of the PCCPCH.

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**

Moves a delta marker to the next positive peak value.

The search includes only measurement values to the left of the current marker position.

**Suffix:**

<n> Window

<m> Marker

**Manual operation:** See "Search Next Peak" on page 107

**CALCulate<n>:DELTamarker<m>:MAXimum:NEXT**

Moves a marker to the next positive peak value.

**Suffix:**

<n> 1..n
Window

<m> 1..n
Marker

**Manual operation:** See "Search Next Peak" on page 107

**CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]**

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

**Manual operation:** See "Peak Search" on page 107

**CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt**

Moves a delta marker to the next positive peak value on the trace.

The search includes only measurement values to the right of the current marker position.

**Suffix:**
<n> Window

<m> Marker

**Manual operation:** See "Search Next Peak" on page 107

**CALCulate<n>:DELTamarker<m>:MINimum:LEFT**

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**
<n> Window

<m> Marker

**Manual operation:** See "Search Next Minimum" on page 107

**CALCulate<n>:DELTamarker<m>:MINimum:NEXT**

Moves a marker to the next minimum peak value.

**Suffix:**
<n> Window

<m> Marker

**Manual operation:** See "Search Next Minimum" on page 107

**CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]**

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 |

**Manual operation:** See "Search Minimum" on page 107

**CALCulate<n>:DELTamarker<m>:MINimum:RIGHt**

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

**Suffix:**

| | |
|---|---|
| <n> | Window |
| <m> | Marker |

**Manual operation:** See "Search Next Minimum" on page 107

## 10.10 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 VSE (depending on the measurement type).

For details on the common R&S VSE status registers refer to the description of remote control basics in the R&S VSE User Manual.

*RST does not influence the status registers.

The `STATus:QUEStionable:SYNC` register contains application-specific information about synchronization errors or errors during pilot symbol detection.

*Table 10-11: Status error bits in STATus:QUEStionable:SYNC register for 3GPP FDD applications*

| Bit | Definition |
|---|---|
| 0 | Not used. |
| 1 | Frame Sync failed<br>This bit is set when synchronization is not possible within the application.<br>Possible reasons:<br>• Incorrectly set frequency<br>• Incorrectly set level<br>• Incorrectly set scrambling code<br>• Incorrectly set values for Q-INVERT or SIDE BAND INVERT<br>• Invalid signal at input<br>• Antenna 1 synchronization is not possible ("Time Alignment Error" measurements, 3GPP FDD BTS only) |
| 2 | For "Time Alignment Error" measurements (3GPP FDD BTS only): bit is set if antenna 2 synchronization is not possible;<br>Otherwise: not used. |
| 3 to 4 | Not used. |
| 5 | Incorrect Pilot Symbol<br>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.<br>Possible reasons:<br>• Incorrectly sent pilot symbols in the received frame.<br>• Low signal to noise ratio (SNR) of the W-CDMA signal.<br>• 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.<br>• One or more channels are sent with high power ramping. In slots with low relative power to total power, the pilot symbols might be detected incorrectly (check the signal quality by using the symbol constellation display). |
| 6 to 14 | Not used. |
| 15 | This bit is always 0. |



**STATus:QUEStionable:SYNC[:EVENt]?** <ChannelName>

Reads out the EVENt section of the status register.

The command also 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.

**Usage:** Query only

**STATus:QUEStionable:SYNC:CONDition?** <ChannelName>

Reads out the CONDition section of the 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.

**Usage:** Query only

**STATus:QUEStionable:SYNC:ENABle** <BitDefinition>, <ChannelName>

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:**

<BitDefinition> 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>]

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:**

<BitDefinition> 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.

**Parameters:**

<BitDefinition> 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.

## 10.11 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** <Evaluation>

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 10.7.2, "Working with windows in the display", on page 218).

**Suffix:**
<n> 1..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 10-12: <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" |
| *) Use [SENS:]CDP:PDIS ABS \| REL subsequently to change the scaling | | |

| String Parameter | Enum Parameter | Evaluation |
|---|---|---|
| 'XPOW:CDP'<br>'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" |
| 'XTIMe:CDP:CHIP:MAGNitu-de' | 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:PHA-Se' | PECHip | "Phase Error vs Chip" |
| 'XTIM:CDP:PVSLot'<br>'XTIM:CDP:PVSLot:ABSolute' | PSLot | "Power vs Slot" (absolute scaling) |
| '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:SYM-Bol:EVM:MAGNitude' | SMERror | "Symbol Magnitude Error" |
| 'XTIMe:CDPower:SYM-Bol: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 VSE 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 VSE programs use `[SENSe<ip>:]ADJust:LEVel` on page 204.

**[SENSe:]CDPower:PRESet**

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 VSE programs use `SYSTem:PRESet:CHANnel[:EXEC]` on page 131.

---

**[SENSe:]CDPower:UCPich:CODE** <CodeNumber>

Sets the code number of the user defined CPICH used for signal analysis.

Only applies to antenna 1.

Note that this command is maintained for compatibility reasons only. Use `[SENSe:]CDPower:UCPich:ANTenna<antenna>:CODE` on page 188 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:ANTenna<antenna>:PATTern** <arg0>

Defines which pattern is used for signal analysis for the user-defined CPICH (see `[SENSe:]CDPower:UCPich:ANTenna<antenna>[:STATe]` on page 263).

**Note**: this command is equivalent to the command `[SENSe:]CDPower:UCPich:ANTenna<antenna>:PATTern` on page 263 for antenna 1.

**Suffix:**

<antenna> 1..n
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 79

---

**[SENSe:]CDPower:UCPich:ANTenna<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:ANTenna<antenna>[:STATe] on page 263 for antenna 1.

**Suffix:**

<antenna> 1..n
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:ANTenna<antenna>:CODE on page 188.

*RST: 0

**Example:** `SENS:CDP:CPIC:ANT2:STAT 1`

**Mode:** BTS application only

**Manual operation:** See "CPICH Mode" on page 79

---

**[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 263.

Only applies to antenna 1.

Note that this command is maintained for compatibility reasons only. Use [SENSe:]CDPower:UCPich:ANTenna<antenna>:CODE on page 188 for new remote control programs.

**Parameters:**

<State> ON | OFF | 1 | 0
*RST: 0

**Example:** `SENS:CDP:UCP ON`

**Mode:** BTS application only

---

**[SENSe:]CDPower:QINVert** <State>

This command inverts the Q-branch of the signal.

Note that this command is maintained for compatibility reasons only. Use the [SENSe:]SWAPiq command for new remote control programs.

**Parameters:**

ON | OFF | 1 | 0 *RST: 0

## 10.12 Programming examples (R&S VSE-K72)

The following programming examples are based on the measurement examples described in Chapter 8, "Measurement examples", on page 112 for manual operation.

The measurements are performed using the following devices and accessories:

- The R&S VSE with option R&S VSE-K72: 3GPP FDD measurements
- An R&S FSW Signal and Spectrum Analyzer
- A Vector Signal Generator R&S SMW200A 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

**Prerequisites in the R&S VSE software**

It is assumed an R&S FSW named 'MyFSW' is connected and configured for input to the R&S VSE software.

(See the R&S VSE Base Software User Manual).

Only the commands required to control the R&S VSE-K72 application and the analyzer are provided, not the signal generator.

**Test setup**

1. Connect the RF A output of the R&S SMW200A to the input of the connected instrument.
2. Connect the reference input ([REF INPUT]) on the rear panel of the connected instrument 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 connected instrument ([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 | BS 1 |

| Setting | value |
|---|---|
| Digital standard - State | ON |
| Scrambling code | 0000 |

The following measurements are described:



## 10.12.1 Measurement 1: measuring the relative code domain power

```
//-----------Preparing the measurement ------------
//Reset the instrument
*RST
DEVice:DELete:ALL

//******************************************************
//********** Configure instrument connections **********
//******************************************************
//Configure connection to MyFSW at 123.456.789.100 using VSI11 protocol
DEV:CRE 'MyFSW','123.456.789.100',VXI11;*WAI
//Query the network address of MyFSW
DEV:TARG? 'MyFSW'
//Result: '123.456.789.100'
//Query connection state to MyFSW
DEV:STAT? 'MyFSW'
//Result: 1 (connection established)
//Query information on MyFSW
//Installed hardware?
DEV:INFO:HWIN? 'MyFSW'
//Instrument ID?
DEV:INFO:IDN? 'MyFSW'
//Installed options?
DEV:INFO:OPT? 'MyFSW'
//Define the use of an external reference on MyFSW
DEV:EXTR:SOUR 'MyFSW',EXT
//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//---------- Configure measurement ----------------------
//Replace the default channel by a 3GPP FDD BTS channel named "BTSMeasurement"
INST:CRE:REPL 'IQ Analyzer',BWCD,'BTSMeasurement'
//Set the reference level to 10 dBm
DISP:TRAC:Y:SCAL:RLEV 10
//Set the center Frequency to 2.1175 GHz
```

```
FREQ:CENT 2.1175 GHz
//Optimize the scaling of the y-axis for the current measurement
DISP:TRAC:Y:SCAL:AUTO ONCE
//Stops continuous sweep
INIT:CONT OFF
//Set the number of sweeps to be performed to 100
SWE:COUN 100
//Start a new measurement with 100 sweeps and wait for the end
INIT;*WAI
//Retrieve the relative code domain power
CALC:MARK:FUNC:WCDP:BTS:RES? CDPR
//Result: 0 [dB]
//Retrieve the trace data of the code domain power measurement
TRAC:DATA? TRACE1
//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,
// [...]

//---------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 10-13: 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 10-14: 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 |

| Code class | Channel no. | Abs. power level [dBm] | Rel. power level [%] | Timing offset [chips] |
|---|---|---|---|---|
| +1.000000000 | +8.000000000 | +7.800000000E +001 | -2.856664085E +001 | -2.726147461E +001 |
| ... | ... | | | |

## 10.12.2 Measurement 2: triggered measurement of relative code domain power

Note that this example assumes the instrument 'MyFSW' is configured as described in Chapter 10.12.1, "Measurement 1: measuring the relative code domain power", on page 266.

```
//--------- Preparing the measurement ------------------------
//Reset the instrument
*RST
//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//Replace the default channel by a 3GPP FDD BTS channel named "BTSMeasurement"
INST:CRE:REPL 'IQ Analyzer',BWCD,'BTSMeasurement'

//Set the reference level to 10 dBm
DISP:TRAC:Y:SCAL:RLEV 10
//Set the center Frequency to 2.1175 GHz
FREQ:CENT 2.1175 GHz
//Change the scrambling code on the analyzer to 0000
CDP:LCOD:DVAL 0000
//Set the trigger source to the external trigger
//(TRIGGER INPUT connector)
TRIG:SOUR EXT
//Optimize the scaling of the y-axis for the current measurement
DISP:TRAC:Y:SCAL:AUTO ONCE

//-----Performing the measurement -----------------
//Stop continuous sweep
INIT:CONT OFF
//Set the number of sweeps to be performed to 100
SWE:COUN 100
//Start a new measurement with 100 sweeps and wait for the end
INIT;*WAI
//Retrieve the trigger to frame (the offset between trigger event and
// start of first captured frame)
CALC:MARK:FUNC:WCDP:BTS:RES? TFR
//Result: 0.00599987013 [ms]

//------- Compensating a delay of the trigger event to the first captured frame -------
```

```
//Change the trigger offset to 100 us (=trigger to frame value)
TRIG:HOLD 100 us
//Retrieve the trigger to frame value
CALC:MARK:FUNC:WCDP:BTS:RES? TFR
//Result: 0.00599987013 [ms]
```

### 10.12.3 Measurement 3: measuring the composite EVM

Note that this example assumes the instrument 'MyFSW' is configured as described in Chapter 10.12.1, "Measurement 1: measuring the relative code domain power", on page 266.

```
//--------- Preparing the measurement ------------------------
//Reset the instrument
*RST
//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//Replace the default channel by a 3GPP FDD BTS channel named "BTSMeasurement"
INST:CRE:REPL 'IQ Analyzer',BWCD,'BTSMeasurement'
//Set the reference level to 10 dBm
DISP:TRAC:Y:SCAL:RLEV 10
//Set the center frequency to 2.1175 GHz
FREQ:CENT 2.1175 GHz
//Set the trigger source to the external trigger
TRIG:SOUR EXT
//(TRIGGER INPUT connector)
//Replace the second measurement window (Result Summary) by Composite EVM evaluation
LAY:REPL '2','XTIM:CDP:MACC'
//Optimize the scaling of the y-axis for the Composite EVM measurement
DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE

//-----Performing the measurement -----------------
//Stop continuous sweep
INIT:CONT OFF
//Set the number of sweeps to be performed to 100
SWE:COUN 100
//Start a new measurement with 100 sweeps and wait for the end
INIT;*WAI
//Retrieve the trace data of the composite EVM measurement
TRAC2:DATA? TRACE1
//Result: +0.000000000,+5.876136422E-001,
//+1.000000000,+5.916179419E-001,
//+2.000000000,+5.949081182E-001,
//[...]
```

*Table 10-15: Trace results for Composite EVM measurement*

| (CPICH) Slot number | EVM |
|---|---|
| 0 | +5.876136422E-001 |
| 1 | +5.916179419E-001 |
| 2 | +5.949081182E-001 |
| ... | ... |

## 10.12.4 Measurement 4: determining the peak code domain error

Note that this example assumes the instrument 'MyFSW' is configured as described in Chapter 10.12.1, "Measurement 1: measuring the relative code domain power", on page 266.

```
//--------- Preparing the measurement ------------------------
//Reset the instrument
*RST
//Assign MyFSW as input source for default channel 1
INST:BLOC:CHAN:SETT:SOUR DEV
INST:BLOC:CHAN:SETT:DEV 'MyFSW'

//Replace the default channel by a 3GPP FDD BTS channel named "BTSMeasurement"
INST:CRE:REPL 'IQ Analyzer',BWCD,'BTSMeasurement'
//Set the reference level to 10 dBm
DISP:TRAC:Y:SCAL:RLEV 10
//Set the center frequency to 2.1175 GHz
FREQ:CENT 2.1175 GHz
//Set the trigger source to the external trigger
//(TRIGGER INPUT connector)
TRIG:SOUR EXT
//Replace the second measurement window (Result Summary) by the
//Peak Code Domain Error evaluation
LAY:REPL '2','XTIM:CDP:ERR:PCD'
//Optimize the scaling of the y-axis for the Composite EVM measurement
DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE

//-----Performing the measurement -----------------
//Stop continuous sweep
INIT:CONT OFF
//Set the number of sweeps to be performed to 100
SWE:COUN 100
//Start a new measurement with 100 sweeps and wait for the end
INIT;*WAI
//Retrieve the trace data of the Peak Code Domain Error measurement
TRAC2:DATA? TRACE1
//Result: +0.000000000,-6.730751038E+001,
//+1.000000000,-6.687619019E+001,
```

```
//+2.000000000,-6.728615570E+001,
// [...]
```

***Table 10-16: Trace results for Peak Code Domain Error measurement***

| Slot number | Peak Error |
|---|---|
| 0 | -6.730751038E+001 |
| 1 | -6.687619019E+001 |
| 2 | -6.728615570E+001 |
| ... | ... |

# Annex

# A Reference



## A.1 Menu reference

Most functions in the R&S VSE are available from the menus.



### A.1.1 Common R&S VSE menus

The following menus provide **basic functions for all applications**:



#### A.1.1.1 File menu

The "File" menu includes all functionality directly related to any file operations, printing or setting up general parameters.

For a description of these functions see the "Data Management" chapter in the R&S VSE base software user manual.

| Menu item | Correspond-ing icon in toolbar | Description |
|---|---|---|
| Save |  | Saves the current software configuration to a file |
| Recall |  | Recalls a saved software configuration from a file |
| Save IQ Recording | - | Saves the recorded I/Q data from a measurement channel to a file |
| Recall IQ Recording | - | Loads the recorded I/Q data from a file |
| Measurement Group > | - | Configures measurement channels and groups |
| > New Group | - | Inserts a new group in the measurement sequence |
| > Rename Group | - | Changes the name of the selected group |

| Menu item | Corresponding icon in toolbar | Description |
|---|---|---|
| > New Measurement Channel | - | Inserts a new channel in the selected group |
| > Replace Measurement Channel | - | Replaces the currently selected channel by the selected application. |
| > Rename Measurement Channel | - | Changes the name of the selected channel. |
| > Delete Current Measurement Channel | - | Deletes the currently selected channel. |
| > Measurement Group Setup | - | Displays the "Measurement Group Setup" tool window. |
| Instruments > | - | Configures instruments to be used for input to the R&S VSE software |
| > New | - | Creates a new instrument configuration |
| > Search | - | Searches for connected instruments in the network |
| > Delete All | - | Deletes all current instrument configurations |
| > Setup | - | Hides or displays the "Instrument" tool window |
| Preset > | - | Restores stored settings |
| > Selected Channel | - | Restores the default software configuration for an individual channel |
| > All | - | Restores the default software configuration globally for the entire software |
| > All & Delete Instruments | | Restores the default software configuration globally for the entire software and deletes all instrument configurations |
| > Reset VSE Layout | - | Restores the default layout of windows, toolbars etc. in the R&S VSE |
| Preferences > | - | Configures global software settings |
| > General | - | |
| > Displayed Items | - | Hides or shows individual screen elements |
| > Theme & Color | - | Configures the style of individual screen elements |
| > Network & Remote | - | Configures the network settings and remote access to or from other devices |
| > Recording | - | Configures general recording parameters |
| Print | - | Opens "Print" dialog to print selected measurement results |
| Exit | - | Closes the R&S VSE |

### A.1.1.2 Window menu

The "Window" menu allows you to hide or show individual windows.

| Menu item | Correspond-ing icon in toolbar | Description |
|---|---|---|
| Player | - | Displays the "Player" tool window to recall I/Q data recordings |
| Instruments | - | Displays the "Instruments" window to configure input instruments |
| Measurement Group Setup | - | Displays the "Measurement Group Setup" window to configure a measurement sequence |
| New Window > |  | Inserts a new result display window for the selected measure-ment channel |
| Channel Information > | - | Displays the channel bar with global channel information for the selected measurement channel |
| Active Windows > | - | Selects a result display as the active window; the corresponding channel is also activated |

### A.1.1.3 Help menu

The "Help" menu provides access to help, support and licensing functions.

| Menu item | Correspond-ing icon in toolbar | Description |
|---|---|---|
| Help | ? | Opens the Online help window |
| License | - | Licensing, version and options information |
| Support | - | Support functions |
| Register VSE | - | Opens the Rohde & Schwarz support page (http://www.rohde-schwarz.com/support) in a browser for registration. |
| Online Support | - | Opens the default web browser and attempts to establish an Internet connection to the Rohde & Schwarz product site. |
| About | - | Software version information |

## A.1.2 3GP FDD measurements menus

The following menus are only available if a 3GP FDD measurement channel is selected.

### A.1.2.1 Edit menu

The "Edit" menu contains functions for processing the temporarily stored current measurement results.

| Menu item | Corresponding icon in toolbar | Description |
| --- | --- | --- |
| Trace Export | - | Stores the currently selected trace in the active window to an ASCII file. |
| Copy to Clipboard | - | Copies the graphical measurement results (ASCII data) to the Windows clipboard for further processing. |

### A.1.2.2 Input & output menu

The "Input & Output" menu provides functions to configure the input source, frontend parameters and output settings for the measurement.

This menu is application-specific.

***Table A-1: "Input & Output" menu items for 3GP FDD Measurements***

| Menu item | Description |
| --- | --- |
| Amplitude | Chapter 5.1.4.1, "Amplitude settings", on page 65 |
| Scale | Chapter 5.1.4.2, "Y-axis scaling", on page 69 |
| Frequency | Chapter 5.1.4.3, "Frequency settings", on page 70 |
| Trigger | Chapter 5.1.5, "Trigger settings", on page 72 |
| Input Source | Chapter 5.1.3, "Input source settings", on page 57 |
| Output | R&S VSE Base Software User Manual |

### A.1.2.3 Meas setup menu

The "Meas Setup" menu provides access to most measurement-specific settings, as well as bandwidth, sweep and auto configuration settings, and the configuration "Overview" window.

This menu is application-specific.

***Table A-2: "Meas Setup" menu items for 3GP FDD Measurements***

| Menu item | Description |
| --- | --- |
| Select Measurement | Chapter 3, "Measurements and result display", on page 15 |
| Capture | "Capture / Average Count" on page 78 |
| Signal Description | Chapter 5.1.2, "Signal description", on page 52 |
| Scrambling Code | Chapter 5.1.2.2, "BTS scrambling code", on page 54 |
| Signal Capture | Chapter 5.1.6, "Signal capture (data acquisition)", on page 76 |

| Menu item | Description |
|---|---|
| Sync | Chapter 5.1.7, "Synchronization (BTS measurements only)", on page 78 |
| Channel Detection | Chapter 5.1.8, "Channel detection", on page 79 |
| Code Domain Settings | Chapter 6.2, "Code domain settings (BTS measurements)", on page 97 |
| Evaluation Range | Chapter 6.1, "Evaluation range", on page 95 |
| Expert mode | For Rohde & Schwarz oscilloscopes only:<br>Configuration directly on the instrument, see the R&S VSE Base Software User Manual. |
| User Correction | User-defined frequency response correction, see the R&S VSE Base Software User Manual. |
| Overview | Chapter 5.1.1, "Configuration overview", on page 51 |

### A.1.2.4 Trace menu

The "Trace" menu provides access to trace-specific functions.

See Chapter 6.4, "Traces", on page 100

This menu is application-specific.

*Table A-3: "Trace" menu items for 3GP FDD Measurements*

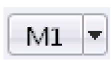
| Menu item | Description |
|---|---|
| Clear Write<br>Max Hold<br>Min Hold<br>Average<br>View | Defines the trace mode, see "Trace Mode" on page 101 |
| Trace ... | Opens the "Traces" configuration dialog box, see Chapter 6.4, "Traces", on page 100 |

### A.1.2.5 Marker menu

The "Marker" menu provides access to marker-specific functions.

This menu is application-specific.

*Table A-4: "Marker" menu items for 3GP FDD Measurements*

| Menu item | Corresponding icon in toolbar | Description |
|---|---|---|
| Select marker <x> |  | "Marker 1/ Delta 1/ Delta 2/.../Delta 4" on page 104 |
| All Markers Off |  | "All Markers Off" on page 105 |
| CPICH | - | "Marker To CPICH" on page 107 |

| Menu item | Correspond-ing icon in toolbar | Description |
|---|---|---|
| PCCPCH | - | "Marker To PCCPCH" on page 108 |
| Marker... | | Chapter 6.6.1, "Individual marker settings", on page 103 |
| Search | - | Chapter 6.6.3, "Marker search settings", on page 106 |

### A.1.2.6 Limits menu

The "Limits" menu does not contain any functions for 3GP FDD measurements.

## A.2 Reference of toolbar functions

Common functions can be performed via the icons in the toolbars.

Individual toolbars can be hidden or displayed.

**Hiding and displaying a toolbar**

1. Right-click any toolbar or the menu bar.

   A context menu with a list of all available toolbars is displayed.

2. Select the toolbar you want to hide or display.

   A checkmark indicates that the toolbar is currently displayed.

   The toolbar is toggled on or off.

Note that some icons are only available for specific applications. Those functions are described in the individual application's User Manual.

#### General toolbars

The following functions are generally available for all applications:

#### "Main" toolbar

For a description of these functions see the R&S VSE base software user manual.

*Table A-5: Functions in the "Main" toolbar*

| Icon | Description |
|---|---|
| | Overview: Displays the configuration overview for the current measurement channel |
| | Save: Saves the current software configuration to a file |

| Icon | Description |
|---|---|
|  | Recall: Recalls a saved software configuration from a file |
|  | Save I/Q recording: Stores the recorded I/Q data to a file |
|  | Recall I/Q recording: Loads recorded I/Q data from a file |
|  | Print immediately: prints the current display (screenshot) as configured |
|  | Add Window: Inserts a new result display window for the selected measurement channel |
|  | MultiView mode: displays windows for all active measurement channels (disabled: only windows for currently selected channel are displayed) |

### "Control" toolbar

For a description of these functions see the R&S VSE base software user manual.

*Table A-6: Functions in the "Control" toolbar*

| Icon | Description |
|---|---|
|  | Selects the currently active channel |
|  | Capture: performs the selected measurement |
|  | Pause: temporarily stops the current measurement |
|  | Continuous: toggles to continuous measurement mode for next capture |
|  | Single: toggles to single measurement mode for next capture |
|  | Record: performs the selected measurement and records the captured data and results |
|  | Refresh: Repeats the evaluation of the data currently in the capture buffer without capturing new data (VSA application only). |

### "Help" toolbar

For a description of these functions see the R&S VSE base software user manual.

*Table A-7: Functions in the "Help" toolbar*

| Icon | Description |
|---|---|
|  | Help (+ Select): allows you to select an object for which context-specific help is displayed (not available in standard Windows dialog boxes or measurement result windows) |
|  | Help: displays context-sensitive help topic for currently selected element |

### Application-specific toolbars

The following toolbars are application-specific; not all functions shown here may be available in each application:

### "Zoom" toolbar

For a description of these functions see the R&S VSE base software user manual.

*Table A-8: Functions in the "Zoom" toolbar*

| Icon | Description |
|---|---|
| | Normal mouse mode: the cursor can be used to select (and move) markers in a zoomed display |
| | Zoom mode: displays a dotted rectangle in the diagram that can be expanded to define the zoom area |
| | Multiple zoom mode: multiple zoom areas can be defined for the same diagram |
| 1:1 | Zoom off: displays the diagram in its original size |

*Table A-9: Functions in the "Marker" toolbar*

| Icon | Description |
|---|---|
| | Place new marker |
| | Percent Marker (CCDF only) |
| M1 | Select marker |
| | Marker type "normal" |
| | Marker type "delta" |
| | Global peak |
| | Absolute peak<br>(Currently only for GSM application) |
| | Next peak to the left |
| | Next peak to the right |
| | Next peak up (for spectrograms only: search in more recent frames) |
| | Next peak down (for spectrograms only: search in previous frames) |
| | Global minimum |
| | Next minimum left |

| Icon | Description |
|---|---|
|  | Next minimum right |
| | Next min up (for spectrograms only: search in more recent frames) |
| | Next min down (for spectrograms only: search in previous frames) |
|  | Set marker value to center frequency |
|  | Set reference level to marker value |
|  | All markers off |
|  | Marker search configuration |
|  | Marker configuration |

*Table A-10: Functions in the "AutoSet" toolbar*

| Icon | Description |
|---|---|
|  | Refresh measurement results (R&S VSE VSA and OFDM VSA applications only) |
|  | Auto level |
|  | Auto frequency |
| | Auto trigger (R&S VSE GSM application only) |
| | Auto frame (R&S VSE GSM application only) |
| | Auto search (R&S VSE 3GPP FDD application only) |
| | Auto scale (R&S VSE 3GPP FDD + Pulse applications only) |
| | Auto scale all (R&S VSE 3GPP FDD + Pulse applications only) |
|  | Auto all |
|  | Configure auto settings |

# List of Remote Commands (3GPP FDD)

# Index

## Symbols

## D



## E

## T

## U



## W



## X



## Y