R&S®FPS-K76/K77
TD-SCDMA Measurements Options
User Manual

1176.9029.02 ─ 04

Test & Measurement

User Manual

ROHDE&SCHWARZ

This manual applies to the following R&S®FPS models with firmware version 1.50 and higher:

- R&S®FPS4 (1319.2008K04)
- R&S®FPS7 (1319.2008K07)
- R&S®FPS13 (1319.2008K13)
- R&S®FPS30 (1319.2008K30)
- R&S®FPS40 (1319.2008K40)

The following firmware options are described:

- R&S FPS-K76 (1321.4379.02)
- R&S FPS-K77 (1321.4385.02)

The software contained in this product uses several valuable open source software packages. For information, see the "Open Source Acknowledgment" on the user documentation CD-ROM (included in delivery).
Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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The following abbreviations are used throughout this manual: R&S®FPS is abbreviated as R&S FPS. "R&S FPS-K76 and R&S FPS-K77" are abbreviated as "R&S FPS-K76/-K77".

Contents

1 Preface

1.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

2 Welcome to the TD-SCDMA Applications

The TD-SCDMA applications add functionality to the R&S FPS to perform code domain analysis or power measurements according to the TD-SCDMA standard.

R&S FPS-K76 performs **B**ase **T**ransceiver **S**tation (**BTS**) measurements (for downlink signals).

In particular, the TD-SCDMA applications feature:

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

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

Installation

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

2.1 Starting the TD-SCDMA Application

The TD-SCDMA measurements require a special application on the R&S FPS.

To activate the TD-SCDMA applications

► Select the MODE key.

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

A Code Domain Analysis measurement is started immediately with the default settings. It can be configured in the TD-SCDMA "Overview" dialog box, which is displayed when you select the "Overview" softkey from any menu (see Chapter 6.2.1, "Configuration Overview", on page 47).

Multiple Measurement Channels and Sequencer Function

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

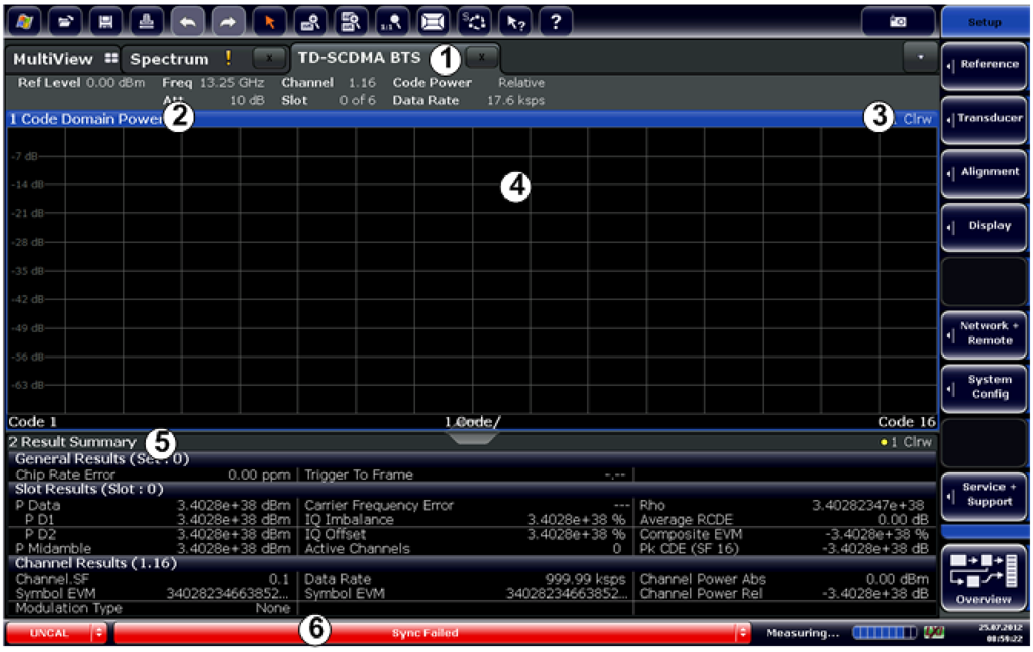
Only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided.

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

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

2.2 Understanding the Display Information

The following figure shows a measurement diagram during a TD-SCDMA BTS measurement. All different information areas are labeled. They are explained in more detail in the following sections.



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

MSRA operating mode

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

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

Channel bar information

In TD-SCDMA applications, when performing Code Domain Analysis, the R&S FPS screen display deviates from the Spectrum application. For Frequency and time domain measurements, the familiar settings are displayed (see the R&S FPS Getting Started manual).

Table 2-1: Hardware settings displayed in the channel bar in TD-SCDMA 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)
Slot	Slot of the (CPICH) channel
Code Power	Power result mode: ● Absolute ● Relative to total power of the data parts of the signal
Symbol Rate	Symbol rate of the current channel

Window title bar information

For each diagram, the header provides the following information:

Figure 2-1: Window title bar information in TD-SCDMA applications

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

Diagram footer information

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

- Start slot/symbol/code
- slot/symbol/code per division
- Stop slot/symbol/code

Status bar information

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

3 Measurements and Result Display

The TD-SCDMA applications provide several different measurements for signals according to the TD-SCDMA standard. The main and default measurement is Code Domain Analysis. In addition to the code domain power measurements specified by the TD-SCDMA standard, the TD-SCDMA applications offer measurements with predefined settings in the frequency and time domain, e.g. channel power or power vs time measurements.

Evaluation methods

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

Evaluation range

You can restrict evaluation to a specific channel, frame or slot, depending on the evaluation method. See Chapter 7.1, "Evaluation Range", on page 85.

3.1 Code Domain Analysis

Access: "Overview" > "Select Measurement" > "Code Domain Analyzer"

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

A signal section containing at least two TD-SCDMA subframes is recorded for analysis and then searched through to find the start of the first subframe. If a subframe start is found in the signal, the code domain power analysis is performed for the selected slot. 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 TD-SCDMA applications provide the peak code domain error measurement and composite EVM specified by the TD-SCDMA 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 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 (data parts only). By default, the power relative to the total signal is displayed.

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

Remote command:

`CONF:CDP[:BTS]:MEAS CDP`, see `CONFigure:CDPower:MEASurement` on page 110

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 slot and channel (code) 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 individually.

Table 3-1: General and slot-specific code domain power results in the Result Summary

Parameter	Description
Chip Rate Error	The chip rate error in ppm. A large chip rate error results in symbol errors and, therefore, in possible synchronization errors for code domain measurements. This measurement result is also valid if the application could not synchronize to the TD-SCDMA signal.
Trigger to Frame	The time difference between the beginning of the recorded signal section to the start of the first slot. For triggered measurements, this difference is identical with the time difference of frame trigger (+ trigger offset) and the start of the first slot. If synchronization of the analyzer and input signal fails, the value of "Trigger to Frame" is not significant. For non-triggered measurements, no result is available.
P Data	Average power of the slot's data parts (total and for each data part)
P Midamble	Power of the slot's midamble
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 slot (see also "Synchronization fails" on page 95)
IQ Offset	DC offset of the signal in the selected slot in %
IQ Imbalance	I/Q imbalance of signals in the selected slot in %
Active Channels	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.
RHO	Quality parameter RHO for each slot. According to the TD-SCDMA standard, Rho is the normalized, correlated power between the measured and the ideally generated reference signal.

Parameter	Description
Average RCDE	Average Relative Code Domain Error over all channels. The Average RCDE is calculated according to release 8 of the standard.
Composite EVM	The error vector magnitude (EVM) over the total signal in the selected slot. The EVM is the root of the ratio of the mean error power to the power of an ideally generated reference signal. See also "Composite EVM" on page 16
Pk CDE (15 ksps)	The Peak Code Domain Error projects the difference between the measured signal and the ideal reference signal onto the spreading factor in the selected slot (see "Peak Code Domain Error" on page 18). The symbol rate, from which the spreading factor can be determined, is indicated in brackets.

The channel-specific results are displayed in the Result Summary, the Channel Table, or both.

Table 3-2: Channel-specific code domain power results

Parameter	Description
Channel Type	Detected type of channel (see Table 4-4)
Ch.SF	Channel number including the spreading factor (in the form <Channel>.<SF>).
SymRate[ksps]	Symbol rate at which the data in the channel is transmitted (in ksps)
Symbol EVM	RMS and peak EVM values per symbol (see "Symbol EVM" on page 22)
Mod	Modulation type (QPSK, 8PSK, 16QAM or 64QAM)
Power [dBm]	Channel power, absolute
Power [dB]	Channel power, relative to total power of the data parts of the signal
MA.shift	Midamble shift For channels, this is the shift of the associated midamble if a common or default midamble assignment is detected (see Chapter 4.4, "Data Fields and Midambles", on page 39)
ΔMid1/2	The power offset between the midamble and the sum power of its channels in data part 1 or 2, respectively. The TD-SCDMA specifications require that the midamble and its channels must have the same power. These parameters show if a common or default midamble assignment is detected (see Chapter 4.4, "Data Fields and Midambles", on page 39).

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. All evaluation methods available for the selected TD-SCDMA measurement are displayed in the evaluation bar in SmartGrid mode.

The selected evaluation also affects the results of the trace data query (see Chapter 10.9.3, "Measurement Results for TRACe<n>[:DATA]? TRACE<n>", on page 165).

Bitstream

The Bitstream evaluation displays the demodulated bits of a selected channel for a given slot.

2 Bitstream Table

	0	2	4	6	8	10	12	14	16	18	20	22	24
0	00	00	10	00	00	00	00	01	11	10	11	11	11
26	10	11	00	11	01	11	10	11	00	10	01	00	01
52	10	01	01	01	00	10	00	11	10	10	01	11	01
78	10	11	01	10	10								
104													
130													

Figure 3-1: Bitstream display for TD-SCDMA BTS measurements

Depending on the spreading factor (symbol rate) of the channel, a slot can contain a minimum of 44 and a maximum of 704 symbols. Depending on the modulation type, a symbol consists of 2 to 6 bits (see Table 4-8).

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

Remote command:

`LAY:ADD? '1',RIGH, BITS`, see `LAYout:ADD[:WINDow]?` on page 145

`TRACe<n>[:DATA]?` on page 161

Channel Table

The Channel Table evaluation displays the detected channels and the results of the code domain power measurement. The measurement evaluates the total signal over the selected slot. The Channel Table can contain a maximum of 16 entries, which corresponds to the 16 codes that can be assigned for a spreading factor of 16.

The sort order of the table is configurable (see "Channel Table Sort Order" on page 87). It can be sorted:

- By code number, starting with midambles, then control channels, then data channels
  By midamble, where all channels are listed below the midamble they belong to

2 Channel Table • 1 Clrw

Channel Type	Ch.SF	SymRate [ksps]	Mod	Power [dBm]	Power [dB]	MA. shift	ΔMiD1 [dB]	ΔMiD2 [dB]
DPCH	1.16	17.6	QPSK	-13.92	-11.49	---	---	---
DPCH	2.16	17.6	QPSK	-18.83	-16.40	---	---	---
DPCH	3.16	52.8	64QAM	-23.61	-21.18	---	---	---
DPCH	6.16	17.6	QPSK	-8.76	-6.33	---	---	---
DPCH	7.16	17.6	QPSK	-13.81	-11.39	---	---	---
DPCH	8.16	17.6	QPSK	-18.79	-16.36	---	---	---
DPCH	9.16	17.6	QPSK	-23.87	-21.44	---	---	---
DPCH	11.16	52.8	64QAM	-23.59	-21.16	---	---	---
DPCH	12.16	17.6	QPSK	-23.86	-21.44	---	---	---
DPCH	13.16	52.8	64QAM	-23.63	-21.20	---	---	---
DPCH	14.16	17.6	QPSK	-8.77	-6.34	---	---	---
DPCH	15.16	17.6	QPSK	-8.76	-6.33	---	---	---
DPCH	16.16	17.6	QPSK	-13.89	-11.47	---	---	---

Figure 3-2: Channel Table display for TD-SCDMA BTS measurements

By default, only active channels are included in the display; to include inactive channels, see "Channel Table Configuration" on page 13. Inactive channels are marked with dashes in the "Channel Type", "SymRate" and "Modulation" columns.

For details on the displayed results, see Table 3-2.

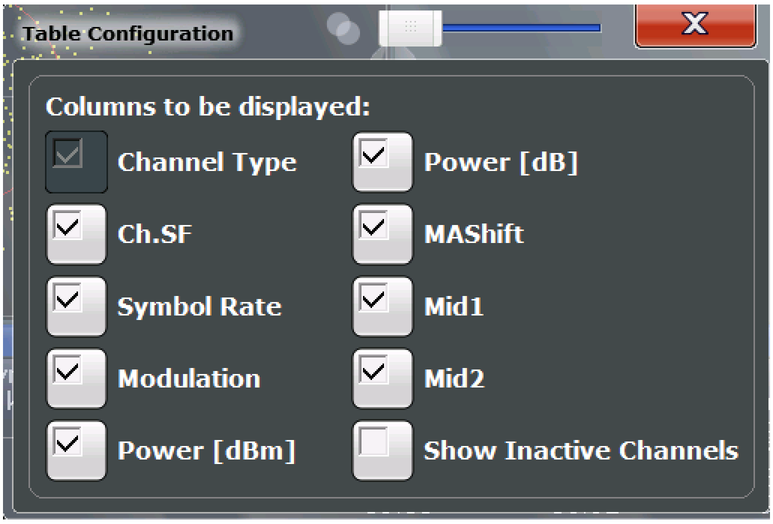
Remote command:

`LAY:ADD? '1',RIGH, CTABle`, see `LAYout:ADD[:WINDow]?` on page 145

`TRACe<n>[:DATA]?` on page 161

Channel Table Configuration ← Channel Table

You can configure which parameters are displayed in the Channel Table by selecting the table header. A "Table Configuration" dialog box is displayed in which you can select the columns to be displayed.

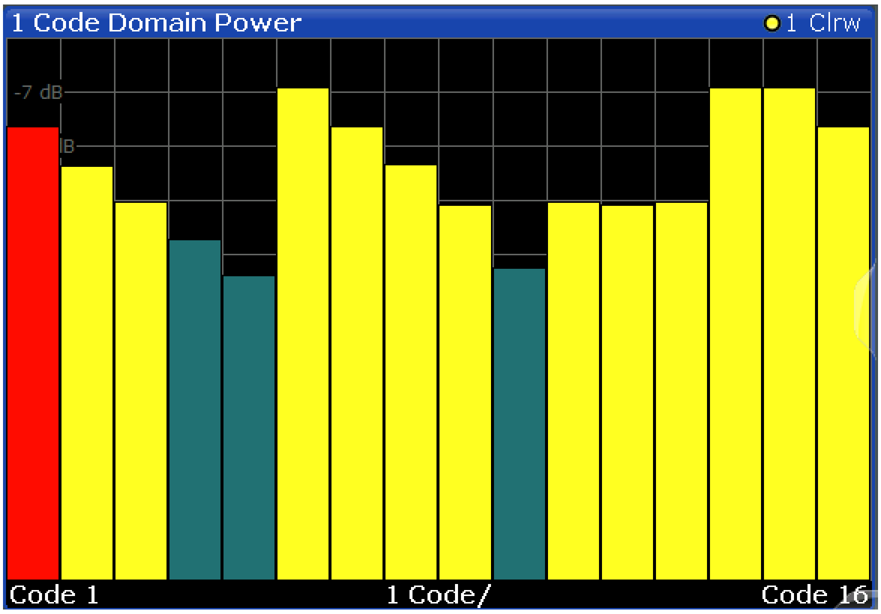


By default, only active channels are displayed. To display all channels, including the inactive ones, enable the "Show Inactive Channels" option.

For details on the displayed results , see Table 3-2.

Code Domain Power

The Code Domain Power evaluation shows the power of all possible codes in the selected slot in the total signal. Channel detection is based on a power threshold (see Chapter 4.3, "Channels and Codes", on page 36). Thus, it is important that all codes have a similar power level (no more than 1.5 dB difference to the average power in the slot). Thus, the scaling of the code domain power is relative to the average power of the data parts in the specified slot in the total signal by default. The x-axis shows the possible codes 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.



The codes are displayed using the following colors:

- **Yellow**: detected channels
- **Red**: selected channel (if a channel is made up of more than one code, all codes that belong to the channel are red)
- **Green**: no channel detected

Remote command:

`LAY:ADD? '1',RIGH, CDPower`, see `LAYout:ADD[:WINDow]?` on page 145

`CALC:MARK:FUNC:CDP:RES? CDP`, see `CALCulate<n>:MARKer:FUNCtion:CDPower:RESult?` on page 157

`TRACe<n>[:DATA]?` on page 161

Code Domain Error Power

The Code Domain Error Power is the difference in power between the measured and an ideally generated reference signal. The number of codes corresponds to the spreading factor. The y-axis shows the error power for each code. Since it is an error power (as opposed to the measured power), both active and inactive channels can be analyzed at a glance.

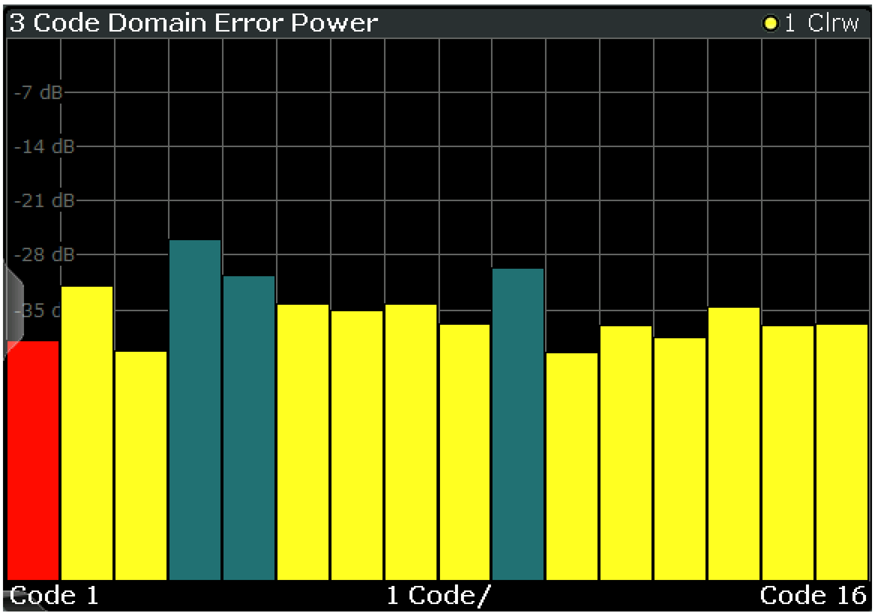


Figure 3-3: Code Domain Error Power Display for TD-SCDMA BTS measurements

The codes are displayed using the following colors:

- **Yellow**: detected channels
- **Red**: selected channel (if a channel is made up of more than one code, all codes that belong to the channel are red)
- **Green**: no channel detected

Remote command:

`LAY:ADD? '1',RIGH, CDEPower`, see `LAYout:ADD[:WINDow]?` on page 145

`TRACe<n>[:DATA]?` on page 161

Composite Constellation

In the Composite Constellation result display, the constellation points of the 864 chips are displayed for the specified slot. This data is determined inside the DSP even before the channel search. Thus, it is not possible to assign constellation points to channels. The constellation points are displayed normalized with respect to the total power.

Note: The red circle indicates the value "1"

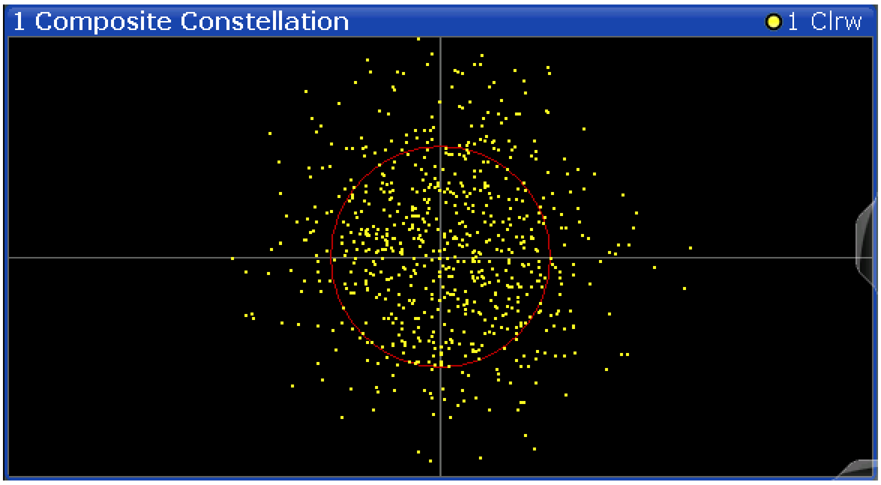


Figure 3-4: Composite Constellation display for TD-SCDMA BTS measurements

Remote command:
`LAY:ADD? '1',RIGH, CCONst`, see `LAYout:ADD[:WINDow]?` on page 145
`TRACe<n>[:DATA]?` on page 161

Composite EVM

The Composite EVM evaluation determines the error vector magnitude (EVM) over the total signal. The EVM is the root of the ratio of the mean error power to the power of an ideally generated reference signal. To calculate the mean error power, the root mean square average of the real and imaginary parts of the signal is used. The EVM is shown in %. This evaluation is useful to determine the modulation accuracy.

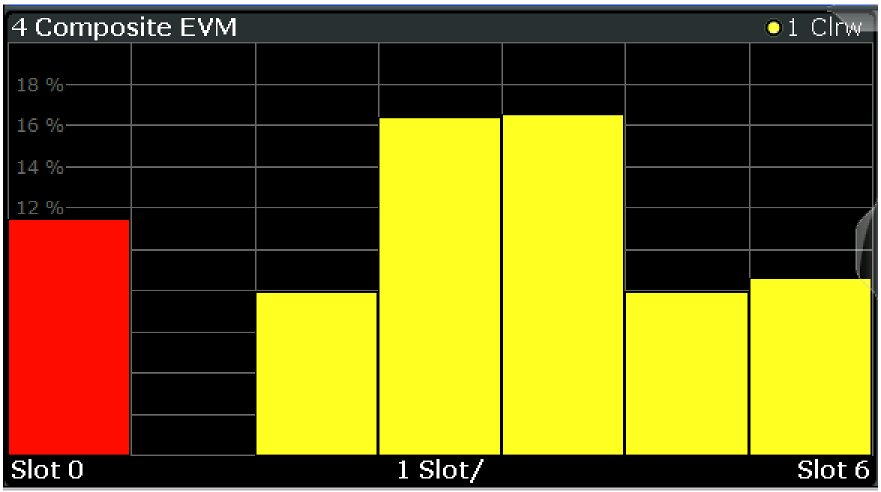


Figure 3-5: Composite EVM display for TD-SCDMA BTS measurements

The result display shows the composite EVM values per slot.

The slots are displayed according to the detected channels using the following colors:

- **Yellow**: active channel
- **Red**: selected channel (if a channel is made up of more than one code, all codes that belong to the channel are red)

- **None**: no active channels

Only the channels detected as being active are used to generate the ideal reference signal. Due to low power, for example, a channel may not be detected as being active. In this case, the difference between the test signal and the reference signal - and therefore the composite EVM - is very large.

Distortions also occur if unassigned codes are wrongly given the status of "active channel". To obtain reliable measurement results, select an adequate channel threshold.

Remote command:
`LAY:ADD? '1',RIGH, CEVM`, see `LAYout:ADD[:WINDow]?` on page 145
`TRACe<n>[:DATA]?` on page 161

Mag 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

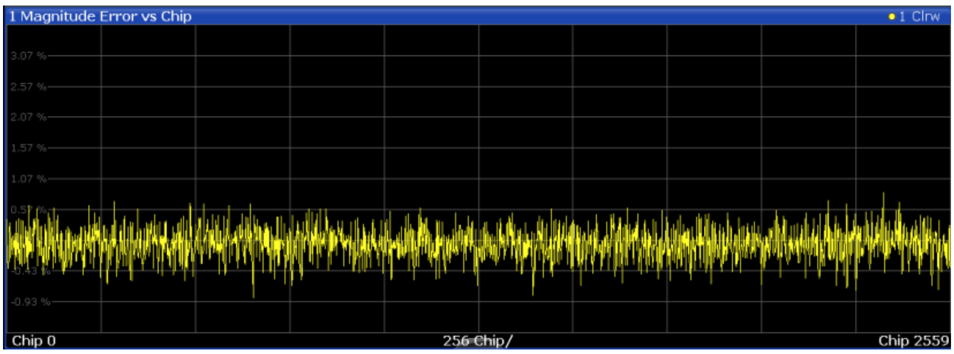


Figure 3-6: Magnitude Error vs Chip display for TD-SCDMA BTS measurements

Remote command:
LAY:ADD? '1',RIGH, MECHip, see LAYout:ADD[:WINDow]? on page 145
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 92).

4 Marker Table

Wnd	Type	Reference	Trace	X-Value	Y-Value
2	M1		1	1.304 GHz	-123.1 dBm
2	D2	M1	1	1.6 GHz	-0.4 dB
2	D3	M1	1	1.8 GHz	-1.53 dB
2	D4	M1	1	1.952 GHz	-1.01 dB

Remote command:
LAY:ADD? '1',RIGH, MTAB, see LAYout:ADD[:WINDow]? on page 145
Results:
CALCulate<n>:MARKer<m>:X on page 175
CALCulate<n>:MARKer<m>:Y? on page 172

Peak Code Domain Error
The Peak Code Domain Error is defined as the maximum value for the Code Domain Error for all codes.

In line with the TD-SCDMA specifications, the error is calculated:

- Between the measurement signal and the ideal reference signal
- For a given slot
- For each *active* code
- For any of the supported spreading codes

For inactive slots (containing no active channels), no results are available as no reference power is available.

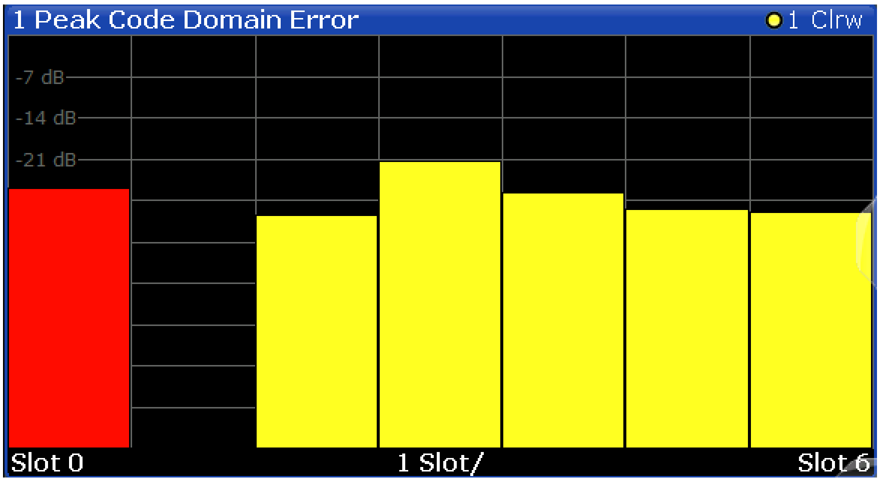


Figure 3-7: Peak Code Domain Error display for TD-SCDMA BTS measurements

The result display shows the peak error values per slot.

The slots are displayed according to the detected channels using the following colors:
- **Yellow**: active channel

- **Red**: selected channel (if a channel is made up of more than one code, all codes that belong to the channel are red)
- **None**: no active channels

Only the channels detected as being active are used to generate the ideal reference signal. If a channel is not detected as being active, e.g. due to low power, the difference between the test signal and the reference signal is too large. The result display therefore shows a peak code domain error that is too high for all slots.

Distortions also occur if unassigned codes are wrongly given the status of "active channel". To obtain reliable measurement results, select an adequate channel threshold.

Remote command:
`LAY:ADD? '1',RIGH, PCDerror`, see `LAYout:ADD[:WINDow]?` on page 145
`TRACe<n>[:DATA]?` on page 161

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°.

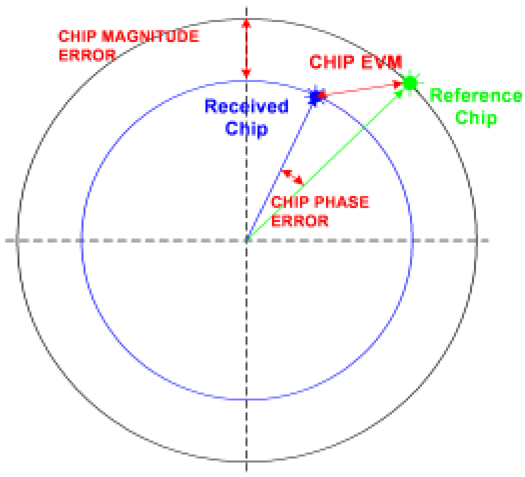


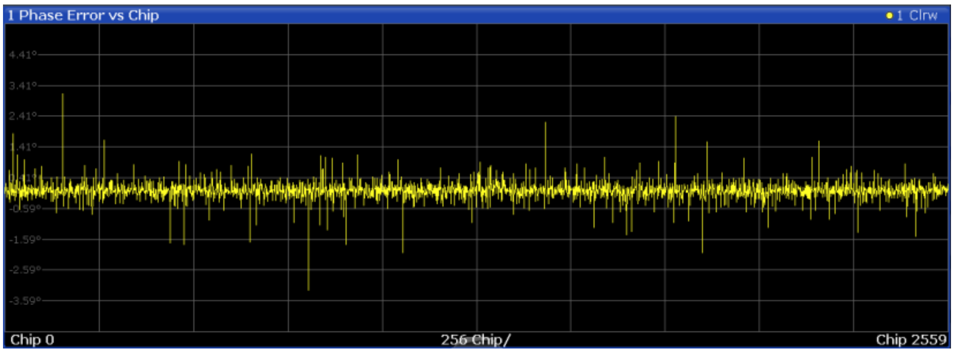
Figure 3-8: Calculating the magnitude, phase and vector error per chip

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

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 145
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 data parts of the signal. The measurement evaluates a single channel over all slots.

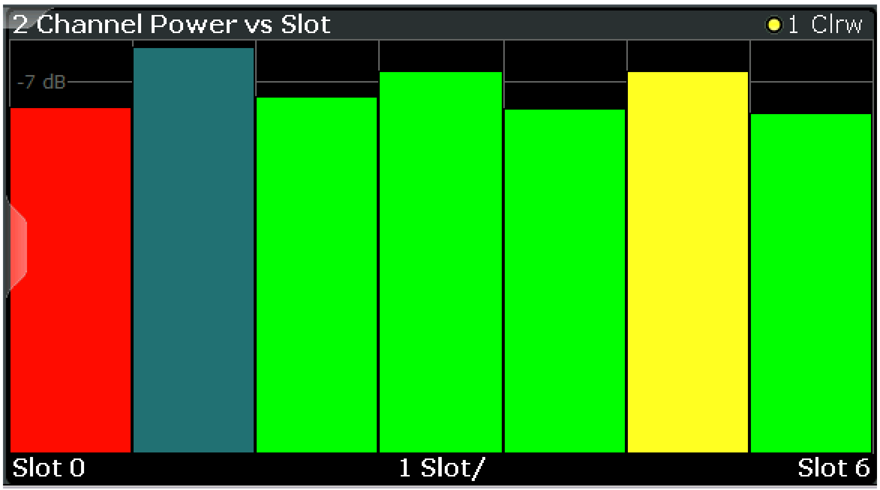


Figure 3-9: Power vs Slot Display for TD-SCDMA BTS measurements

The slots are displayed according to the detected channels using the following colors:
- **Yellow**: active channel
- **Green**: channel with alias power (power results from channels with a different code class)
- **Cyan**: inactive channel
- **Red**: selected channel (if a channel is made up of more than one code, all codes that belong to the channel are red)

Remote command:
`LAY:ADD? '1',RIGH, PSLot`, see `LAYout:ADD[:WINDow]?` on page 145
`TRACe<n>[:DATA]?` on page 161

Power vs Symbol

The Power vs Symbol evaluation shows the power measured for each symbol in the selected channel and the selected slot. The power is not averaged here.

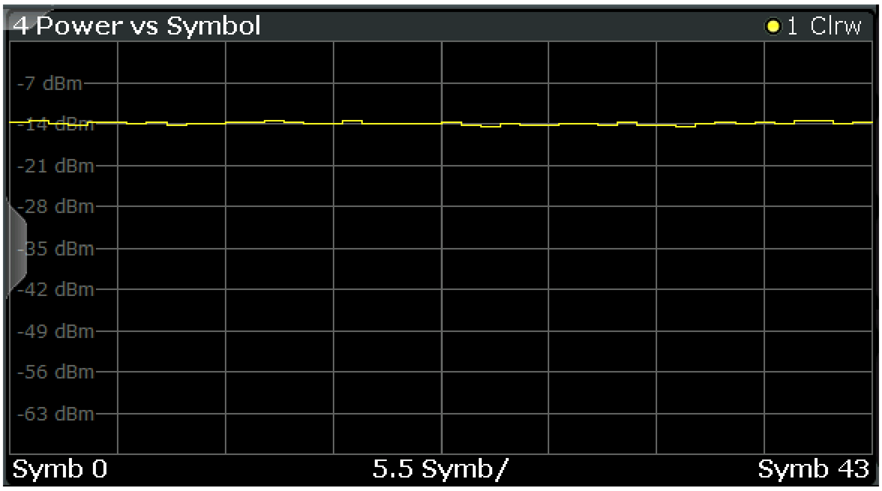


Figure 3-10: Power vs Symbol display for TD-SCDMA BTS measurements

Depending on the spreading factor (symbol rate) of the channel, a slot can contain a minimum of 44 and a maximum of 704 symbols (see Table 4-8).

Remote command:
`LAY:ADD? '1',RIGH, PSYMbol`, see `LAYout:ADD[:WINDow]?` on page 145
`TRACe<n>[:DATA]?` on page 161

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 10.

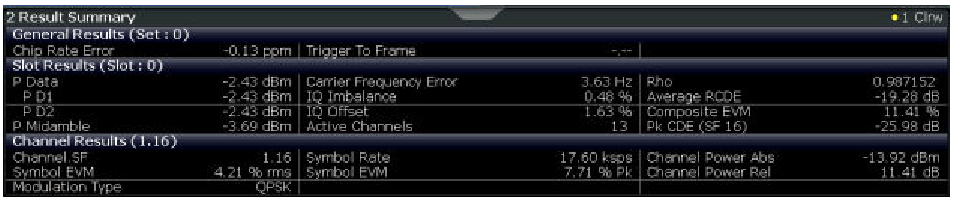


Figure 3-11: Result Summary display for TD-SCDMA BTS measurements

Remote command:
`LAY:ADD? '1',RIGH, RSUMmary`, see `LAYout:ADD[:WINDow]?` on page 145
`TRACe<n>[:DATA]?` on page 161
`CALCulate<n>:MARKer:FUNCtion:CDPower:RESult?` on page 157

Symbol Constellation

The Symbol Constellation evaluation shows all modulated symbols of the selected channel and the selected slot.

Note: The red circle indicates the value "1"

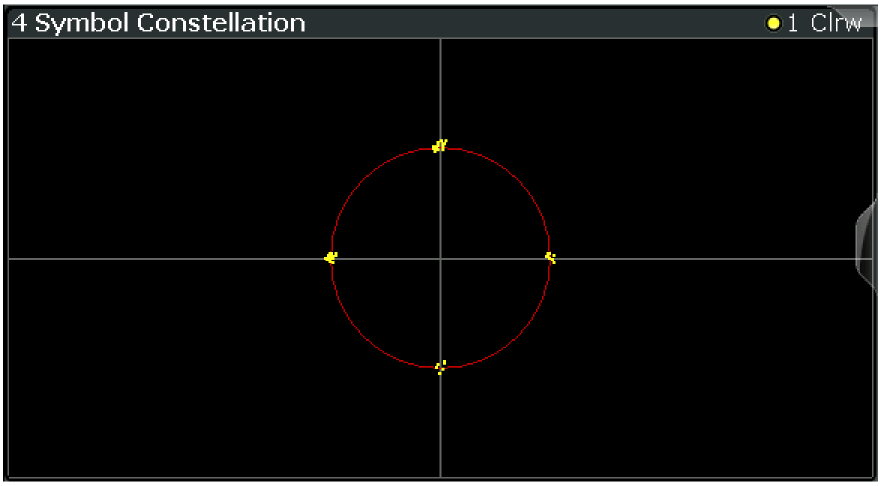


Figure 3-12: Symbol Constellation display for TD-SCDMA BTS measurements

Remote command:
`LAY:ADD? '1',RIGH, SCONst`, see `LAYout:ADD[:WINDow]?` on page 145
`TRACe<n>[:DATA]?` on page 161

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 depends on the symbol rate (or spreading factor) of the channel (see Table 4-8).

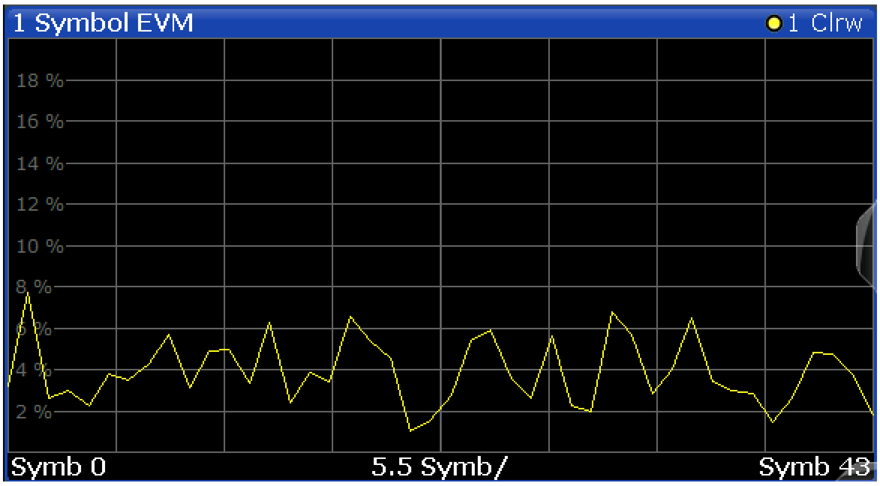


Figure 3-13: Symbol EVM display for TD-SCDMA BTS measurements

Remote command:
`LAY:ADD? '1',RIGH, SEVM`, see `LAYout:ADD[:WINDow]?` on page 145
`TRACe<n>[:DATA]?` on page 161

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.

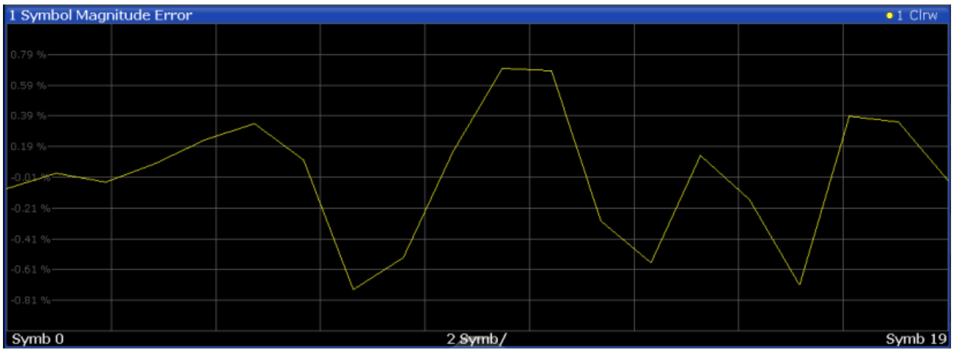


Figure 3-14: Symbol Magnitude Error display for TD-SCDMA BTS measurements

Remote command:
`LAY:ADD? '1',RIGH, SMERror`, see `LAYout:ADD[:WINDow]?` on page 145
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.

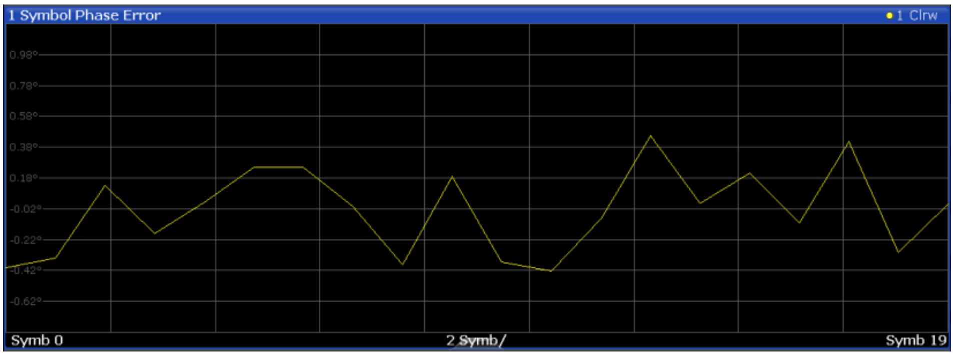


Figure 3-15: Symbol Phase Error display for TD-SCDMA BTS measurements

Remote command:
`LAY:ADD? '1',RIGH, SPERror`, see `LAYout:ADD[:WINDow]?` on page 145
TRACe<n>[:DATA]? TRACE<1...4>

3.1.3 CDA Measurements in MSRA Operating Mode

The TD-SCDMA BTS application can also be used to analyze data in MSRA operating mode.

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

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

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

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

3.2 Frequency and Time Domain Measurements

Access: "Overview" > "Select Measurement"

In addition to the Code Domain Analysis measurements, the TD-SCDMA applications also provide some frequency and time domain measurements as defined in the TD-SCDMA standard. Frequency and time domain measurements are identical to the corresponding measurements in the base unit, but configured according to the requirements of the TD-SCDMA standard.

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

MSRA operating mode
Frequency and time domain measurements are not available in MSRA operating mode.
For details on the MSRA operating mode, see the R&S FPS MSRA User Manual.

3.2.1 Measurement Types and Results in the Frequency and Time Domain

Access: "Overview" > Select Measurement

The TD-SCDMA applications provide the following frequency and time domain measurements:

Power vs Time

Access: "Overview" > "Select Measurement" > "Power vs Time"

The Power vs Time measurement checks the signal power in the time domain against a transmission power mask defined by the TD-SCDMA specification (*"transmit ON/OFF power time mask"*). This measurement is meant to ensure that each burst remains within a tight power range, i.e. rises and falls very quickly.

For **downlink** measurements, the power in the slots reserved for the uplink transmission must quickly fall to the low value. It must then quickly rise to high again in the slots for downlink transmission. Thus, the slots of interest in downlink Power vs Time measurements are **slot 1** to the slot indicated by the ***Switching Point***, in which the **OFF** power is checked.

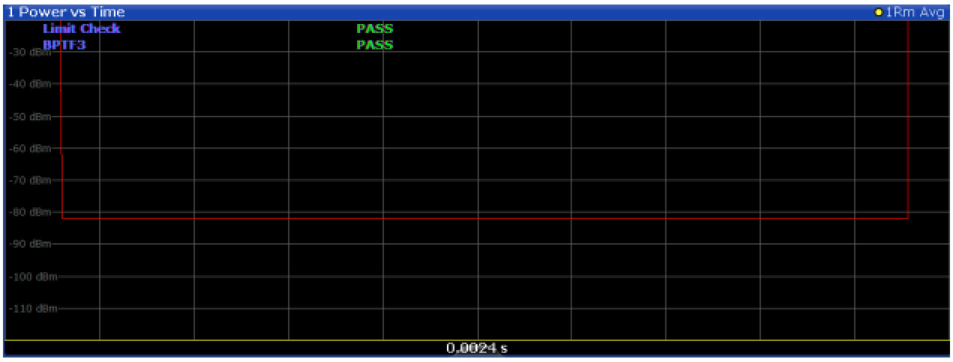


Figure 3-16: Power vs Time diagram for TD-SCDMA BTS application

In the TD-SCDMA **UE application**, it is assumed that only one uplink device is checked during one measurement. Furthermore, it is assumed that each uplink device uses only a single slot for transmission. Thus, for uplink measurements, only one slot is checked against the transmit mask. Since the TD-SCDMA UE application has no information which slot is being used, it assumes the first slot in which a burst is detected to be slot 1, the first slot for uplink transmission. In this slot, the power must quickly rise to the high value, and quickly fall back to low at the end. Thus, the slot of interest in **uplink** Power vs Time measurements is **slot 1**, which cannot be changed, and in which the **ON** power is checked.

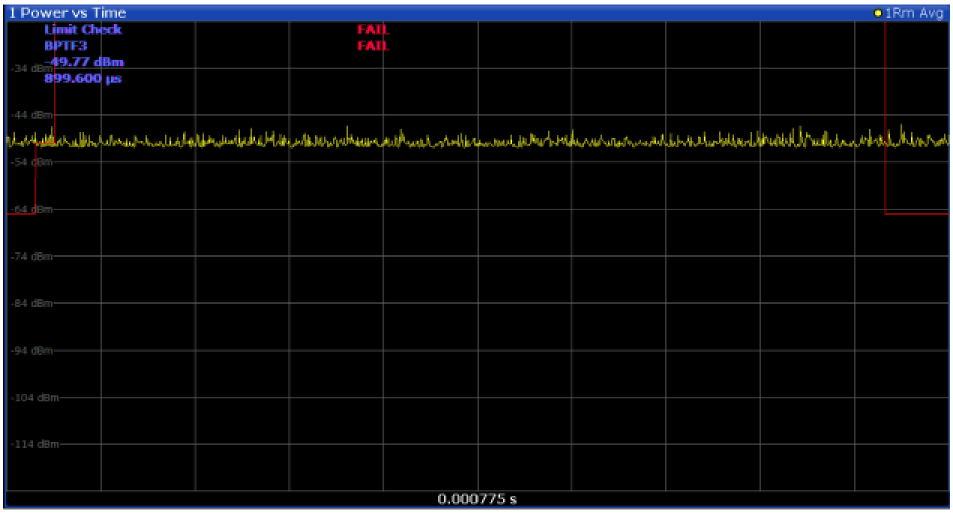


Figure 3-17: Power vs Time diagram for TD-SCDMA UE application

To perform the power check, the TD-SCDMA application must synchronize the transmit mask to the current signal, as the mask is defined relative to a slot start.

The application measures the power in the defined number of subframes in the time domain and calculates the average power in the slots of interest. It then compares the averaged power of the signal against the mask for allowed transmission power.

The mask consists of four defined intervals:

- Before the burst
- During fall time
- During the low time
- During the rise time

Note: For UE measurements, the ON power is checked, thus the mask is defined for the following intervals:

- Before the burst
- During the rise time
- During the high time
- During fall time

As a result, the power vs time trace is displayed. The result of the limit check (Pass/Fail) is also indicated in the diagram.

The numeric results are provided in the List Evaluation result display (see "List Evaluation" on page 32).

For details, see Chapter 6.3.1, "Power vs Time", on page 76.

Remote command:
`CONF:CDP[:BTS]:MEAS PVT`, see `CONFigure:CDPower:MEASurement` on page 110
Querying results:
`TRAC:DATA? TRACE1`, see `TRACe<n>[:DATA]?` on page 161
`CALCulate<n>:LIMit<k>:FAIL?` on page 170
`CONFigure:CDPower[:BTS]:PVTime:LIST:RESult?` on page 159

Power

Access: "Overview" > "Select Measurement" > "Power"

The Power measurement determines the TD-SCDMA signal channel power. The R&S FPS measures the signal power in a single channel with a bandwidth of 1.2288 MHz. The results are based on the root mean square.

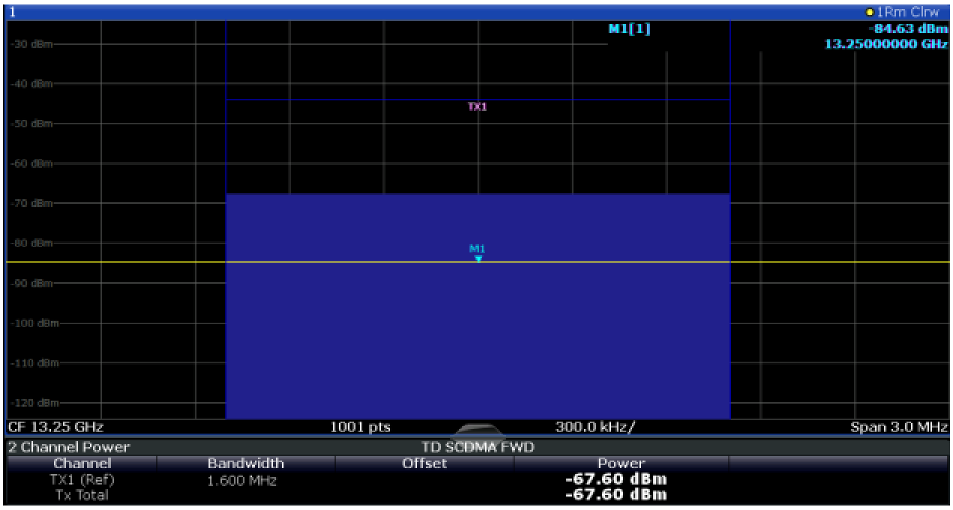


Figure 3-18: Signal channel power measurement in TD-SCDMA BTS application

For details, see Chapter 6.3.2, "Signal Channel Power Measurements", on page 79.

Remote command:

`CONF:CDP[:BTS]:MEAS POW`, see `CONFigure:CDPower:MEASurement` on page 110

Querying results: `CALC:MARK:FUNC:POW:RES? CPOW`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 170

`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 170

Channel Power ACLR

Access: "Overview" > "Select Measurement" > "Channel Power ACLR"

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

The measurement range can be adapted to a slot range of the current TD-SCDMA signal.

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

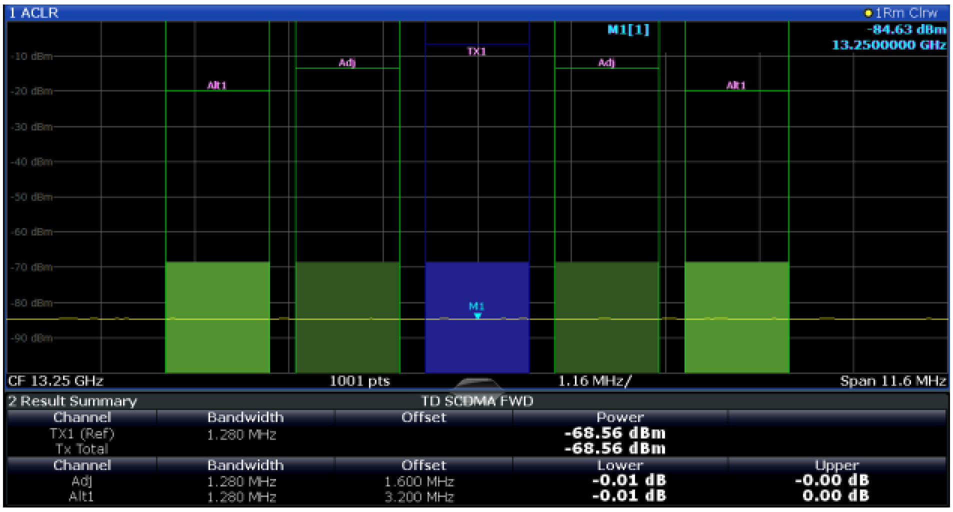


Figure 3-19: ACLR measurement in TD-SCDMA BTS application

For details, see Chapter 6.3.3, "Channel Power (ACLR) Measurements", on page 80.

Remote command:
`CONF:CDP[:BTS]:MEAS ACLR`, see `CONFigure:CDPower:MEASurement` on page 110
Querying results:
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 170
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 170

Spectrum Emission Mask
Access: "Overview" > "Select Measurement" > "Spectrum Emission Mask"

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

For details, see Chapter 6.3.4, "Spectrum Emission Mask", on page 81.

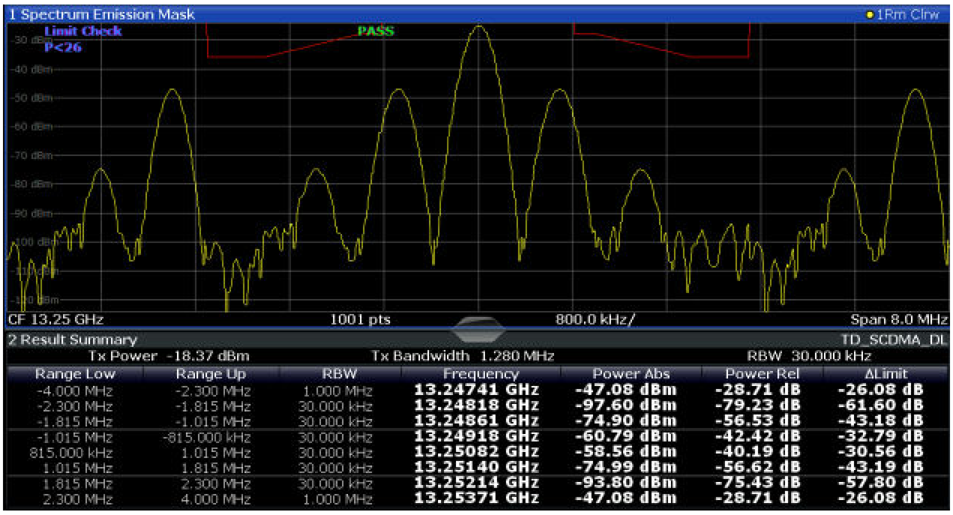


Figure 3-20: SEM measurement results for TD-SCDMA BTS measurement

Remote command:
`CONF:CDP[:BTS]:MEAS ESP`, see `CONFigure:CDPower:MEASurement` on page 110
Querying results:
`CALC:MARK:FUNC:POW:RES? CPOW`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 170
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 170
`CALCulate<n>:LIMit<k>:FAIL?` on page 170

Occupied Bandwidth
Access: "Overview" > "Select Measurement" > "OBW"

The Occupied Bandwidth measurement determines the bandwidth that the signal occupies.

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

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

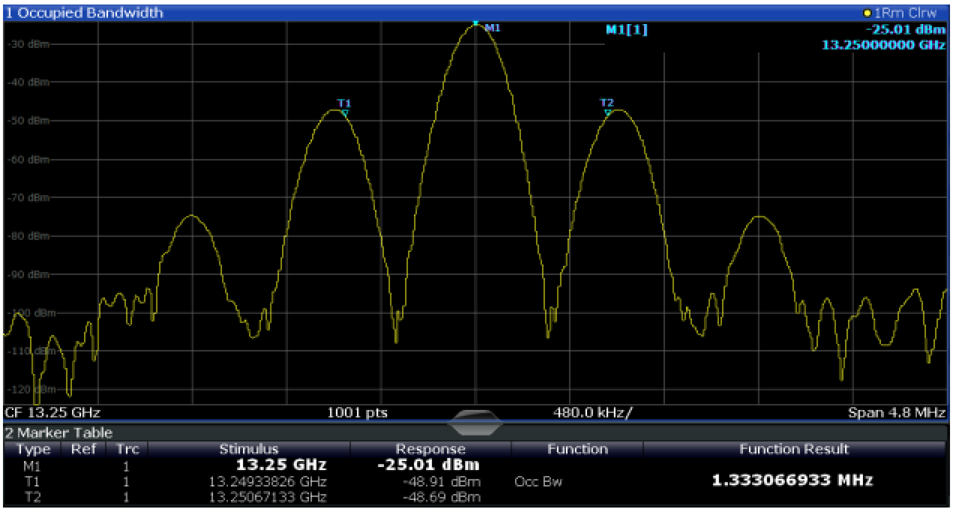


Figure 3-21: Occupied bandwidth measurement in TD-SCDMA BTS application

For details, see Chapter 6.3.5, "Occupied Bandwidth", on page 82.

Remote command:
`CONF:CDP[:BTS]:MEAS OBAN`, see `CONFigure:CDPower:MEASurement` on page 110
Querying results:
`CALC:MARK:FUNC:POW:RES? OBW`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 170
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 170

CCDF
Access: "Overview" > "Select Measurement" > "CCDF"

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

For details, see Chapter 6.3.6, "CCDF", on page 83.

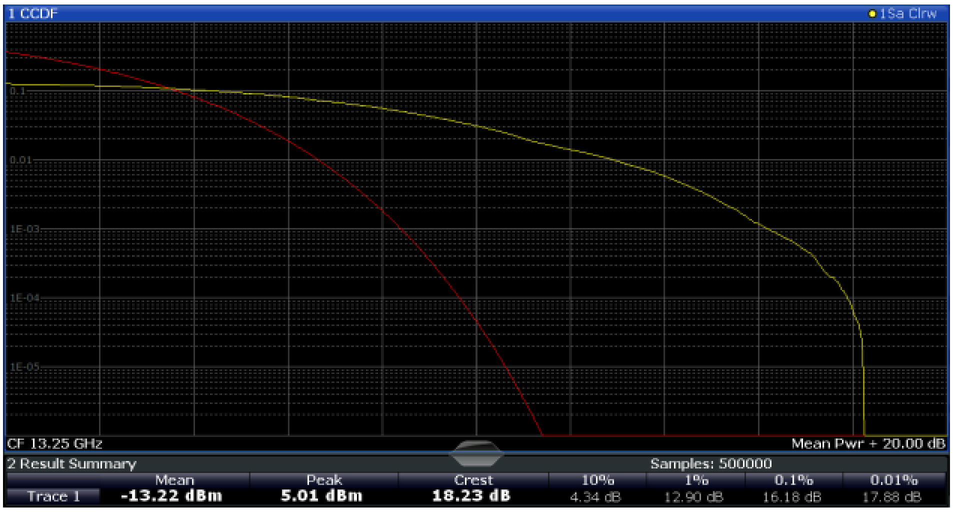


Figure 3-22: CCDF measurement results for TD-SCDMA BTS measurements

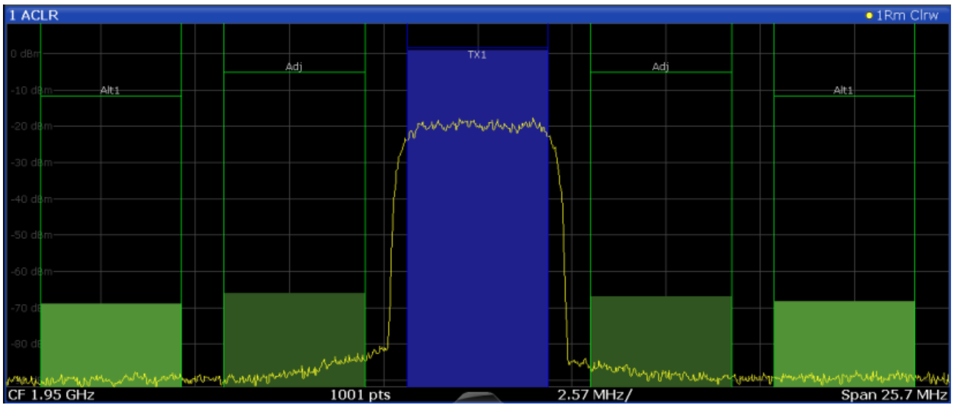
Remote command:
`CONF:CDP[:BTS]:MEAS CCDF`, see `CONFigure:CDPower:MEASurement` on page 110
Querying results:
`CALCulate<n>:STATistics:RESult<t>?` on page 172

3.2.2 Evaluation Methods for Frequency and Time Measurements

Access: "Overview" > "Display Config"

The evaluation methods for frequency and time domain measurements are identical to those in the Spectrum application.

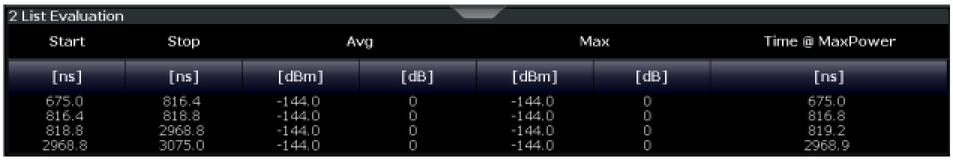
Diagram
Displays a basic level vs. frequency or level vs. time diagram of the measured data to evaluate the results graphically. This is the default evaluation method. Which data is displayed in the diagram depends on the "Trace" settings. Scaling for the y-axis can be configured.



Remote command:
`LAY:ADD? '1',RIGH, DIAG`, see `LAYout:ADD[:WINDow]?` on page 145
Results:

List Evaluation

The list evaluation provides the numerical results for the **Power vs Time** measurement.



2 List Evaluation

Start	Stop	Avg		Max		Time @ MaxPower
[ns]	[ns]	[dBm]	[dB]	[dBm]	[dB]	[ns]
675.0	816.4	-144.0	0	-144.0	0	675.0
816.4	818.8	-144.0	0	-144.0	0	816.8
818.8	2968.8	-144.0	0	-144.0	0	819.2
2968.8	3075.0	-144.0	0	-144.0	0	2968.9

The List Evaluation displays the following information:

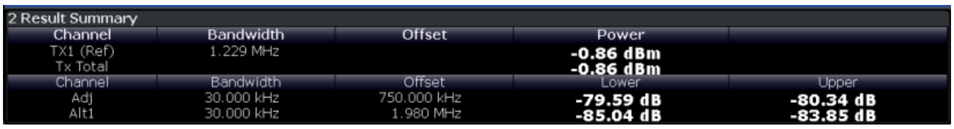
Column	Description
Start / Stop	Start and stop time of the individual time intervals of the Emission Envelope Mask (in ns)
Avg	Average power measured in mask interval
Max	Maximum power measured in mask interval
Time @ MaxPower	The exact point in time when the maximum power occurred

For details, see Chapter 6.3.1, "Power vs Time", on page 76.

Remote command:
`LAY:ADD? '1',RIGH, LEV`, see `LAYout:ADD[:WINDow]?` on page 145

Result Summary

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



2 Result Summary

Channel	Bandwidth	Offset	Power	
TX1 (Ref)	1.229 MHz		-0.86 dBm	
Tx Total			-0.86 dBm	
Channel	Bandwidth	Offset	Lower	Upper
Adj	30.000 kHz	750.000 kHz	-79.59 dB	-80.34 dB
Alt1	30.000 kHz	1.980 MHz	-85.04 dB	-83.85 dB

Remote command:
`LAY:ADD? '1',RIGH, RSUM`, see `LAYout:ADD[:WINDow]?` on page 145

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 92).

4 Marker Table

Wnd	Type	Reference	Trace	X-Value	Y-Value
2	M1		1	1.304 GHz	-123.1 dBm
2	D2	M1	1	1.6 GHz	-0.4 dB
2	D3	M1	1	1.8 GHz	-1.53 dB
2	D4	M1	1	1.952 GHz	-1.01 dB

Remote command:
`LAY:ADD? '1',RIGH, MTAB`, see `LAYout:ADD[:WINDow]?` on page 145
Results:
`CALCulate<n>:MARKer<m>:X` on page 175
`CALCulate<n>:MARKer<m>:Y?` on page 172

Marker Peak List

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

2 Marker Peak List

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

Remote command:
`LAY:ADD? '1',RIGH, PEAK`, see `LAYout:ADD[:WINDow]?` on page 145
Results:
`CALCulate<n>:MARKer<m>:X` on page 175
`CALCulate<n>:MARKer<m>:Y?` on page 172

4 Measurement Basics

Some background knowledge on basic terms and principles used in TD-SCDMA measurements is provided here for a better understanding of the required configuration settings.

4.1 Short Introduction to TD-SCDMA

Many communication standards, such as WCDMA or cdma2000, distribute the data from different users to different frequencies within a specific band (FDD mode). As opposed to these standards, TD-SCDMA distributes the data in *time* (TDD mode). Furthermore, the mentioned FDD-based standards require two distinct frequency bands for uplink (to the base station) and downlink (from the base station) communication. Whereas TD-SCDMA can adjust the number of time slots (and thus the data rate) used for downlink or uplink dynamically, according to the current traffic requirements. The available time slots can be distributed flexibly either to several users, or to a single user requiring a higher data rate. This is a benefit especially when transmitting Internet data, as usually more data is downloaded than uploaded.

Distributing the data in time also means the TD-SCDMA standard can use the same carrier frequency for both uplink and downlink.

4.2 Frames, Subframes and Slots

The structure of a typical TD-SCDMA signal is shown in Figure 4-1.

A TD-SCDMA signal is divided into *frames* with a length of 10 ms each. The frames are further divided into two *subframes*, with a length of 5 ms each. For the physical communication layer, mostly the subframes are of interest.

Each subframe consists of seven *slots*, named TS0 to TS6. Furthermore, a "Downlink Pilot Time Slot" (DwPTS) and an "Uplink Pilot Time Slot" (UpPTS), which are required to transmit synchronization codes. Between the two synchronization areas, a guard period of 75 µs is inserted. Each slot has a length of 0.675 ms.

The first slot (TS0) of a subframe is always reserved for downlink, the second slot (TS1) is always reserved for uplink. The *switching point* indicates the time after which subsequent slots are available for downlink again. The system is informed about the current location of the switching point by higher layers.

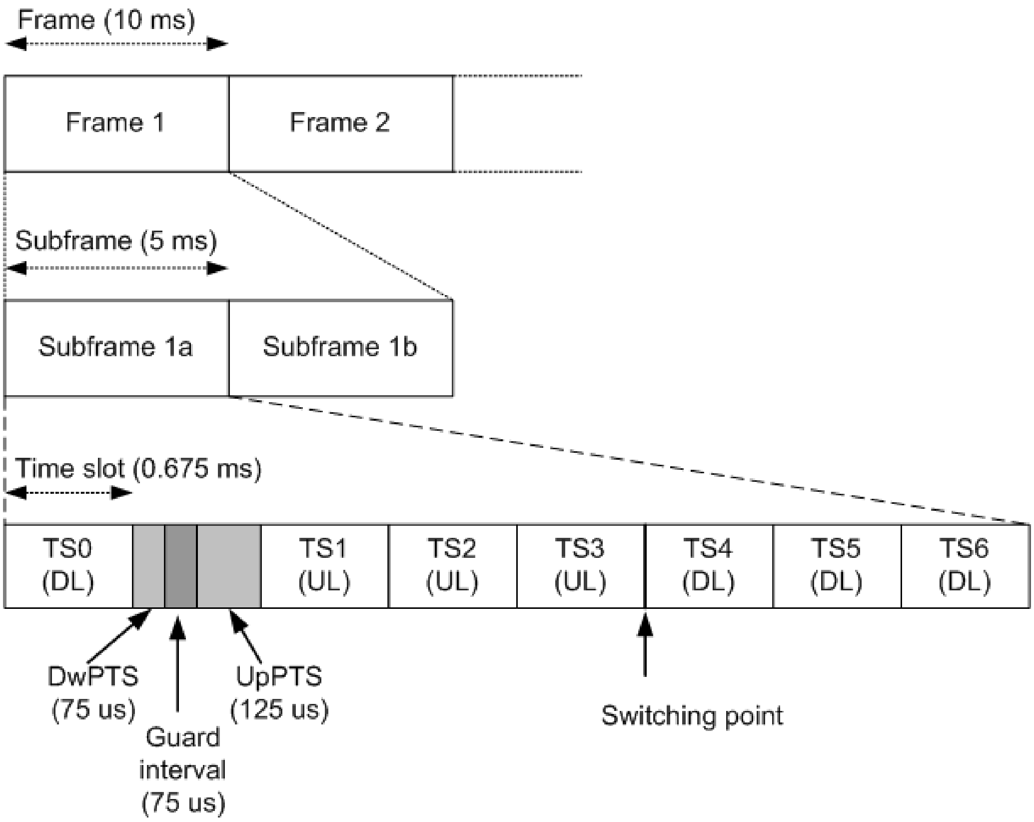


Figure 4-1: TD-SCDMA signal structure

Synchronization

The individual channels in the input signal must be synchronized to detect timing offsets in the slot spacings. To do so, either slot 0 (BTS mode) or slot 1 (UE mode), or the "Downlink Pilot Time Slot" (DwPTS) or "Uplink Pilot Time Slot" (UpPTS) can be used.

In UE mode, if the UpPTS is used for synchronization, you must define the SYNC-UL code to be used. This code depends on the used scrambling code as indicated in the following table.

Table 4-1: Possible SYNC-UL codes depending on scrambling code

Code Group	Scrambling Code	Sync -UL Code
Group 1	0 to 3	0 to 7
Group 2	4 to 7	8 to 15
...	...	...
Group 32	124 to 127	248 to 255

4.3 Channels and Codes

Within each time slot, up to 16 code channels can be transmitted. Each channel is spread over one to 16 codes (also referred to as *channelization codes*), depending on the code class of the channel. The code class specifies the spreading factor of the channel and thus the number of possible channels per slot.

Table 4-2: Relationship between code class, channels and spreading factor

Code class	Spreading factor = No. channels per slot
0	1
1	2
2	4
3	8
4	16

Chips

The user data is spread to code channels across the available bandwidth using the spreading factor before transmission. The spread bits are referred to as *chips*. Each slot consists of 864 chips. The chips are transferred at a rate of 1.28 Megachips per second (Mcps).

Active and inactive codes/slots

During code domain analysis, the power in the selected slot in the captured subframes is measured to detect active channels. If the total power in the slot does not exceed a threshold, the slot is considered to be inactive. Otherwise, the slot is analyzed to detect channels.

To do so, the data in the slot is unscrambled according to the defined scrambling code and carrier (= center) frequency. Then, all possible spreading sequences are applied to the unscrambled data, defining the individual channels. Each despread channel whose power exceeds the channel threshold is considered to be active. The reference signal is then generated according to the active channels only.

If the power threshold for inactive channels is not set correctly, power from supposedly inactive channels contributes to the peak code domain error, leading to false results.

To determine the correct threshold, the Code Domain Power evaluation is a useful instrument (see "Code Domain Power" on page 14).

4.3.1 Special Channels

To control the data transmission between the sender and the receiver, specific symbols must be included in the transmitted data. This data is included in special data channels defined by the 3GPP standard which use fixed codes in the code domain. Thus, the receiver can easily them.

Table 4-3: Special channels in TD-SCDMA signals

Name	Description	Slot No.	Spreading factor (SF)	Code No. (1...SF)
P-CCPCH1	**P**rimary **c**ommon **c**ontrol **p**hysical **ch**annel 1	0	16	1
P-CCPCH2	**P**rimary **c**ommon **c**ontrol **p**hysical **ch**annel 2	0	16	2

Other special control channels do not have a fixed code, but are identified by higher layers.

The user data is contained in the **D**edicated **P**hysical **Ch**annel (DPCH).

The detected type of the channel is indicated in the Channel Table evaluation according to the following assignment:

Table 4-4: Available channel types in TD-SCDMA signals

No.	Channel type
0	Inactive
1	Midamble
2	DPCH (user data)

4.3.2 Channel Characteristics

The spreading factor used by a channel determines the data rate. Based on a subframe length of 5 ms, the bits per slot can be calculated.

The modulation used to transmit the user data determines how many bits are required for each symbol, and thus the maximum number of symbols per slot. Thus, the symbol rate depends on the used modulation and the data rate. The following tables show the relationships:

Table 4-5: Number of symbols per slot depending on spreading factor

Spreading factor	Number of symbols
16	44
8	88
4	176
2	352
1	704

Table 4-6: Number of bits per symbol depending on modulation

Modulation	Number of bits per symbol
QPSK	2
8PSK	3
16QAM	4
64QAM	6

Table 4-7: Number of bits per slot depending on modulation and spreading factor

SF	Modulation			
	QPSK	8PSK	16QAM	64QAM
	Number of bits			
16	88	132	176	264
8	176	264	352	528
4	352	528	704	1056
2	704	1056	1408	2112
1	1408	2112	2816	4224

Table 4-8: Channel parameters and their dependencies

Spreading Factor	Symbols / Slot	QPSK		8PSK		16QAM		64QAM	
		Bits per Slot	ksps	Bits per slot	ksps	Bits per slot	ksps	Bits per slot	ksps
1	704	1408	281.6	2112	422.4	2816	563.2	4224	844.8
2	352	704	140.8	1056	211.2	1408	281.6	2112	422.4
4	176	352	70.4	528	105.6	704	140.8	1056	211.2
8	88	176	35.2	264	52.8	352	70.4	528	105.6
16	44	88	17.6	132	26.4	176	35.2	264	52.8

Channel notation

Channels are generally indicated by their channel number and spreading factor (in the form <Channel>.<SF>).

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.

The specified channel is selected and marked in red in the corresponding result displays, if active. If no spreading factor is specified, the spreading factor 16 is assumed. For inactive (unused) channels, the code based on the spreading factor 16 is highlighted.

Example: Enter *4.8*

Channel 4 is marked at spreading factor 8 (35.2 ksps) if the channel is active, otherwise code 7 at spreading factor 16.

4.4 Data Fields and Midambles

Each slot consists of 864 chips, of which 704 are used to transmit data. The data is divided into two data fields with 352 chips each. The *midamble* (consisting of the remaining 144 chips) is located between the two data fields. A guard period of 16 chips completes the slot.

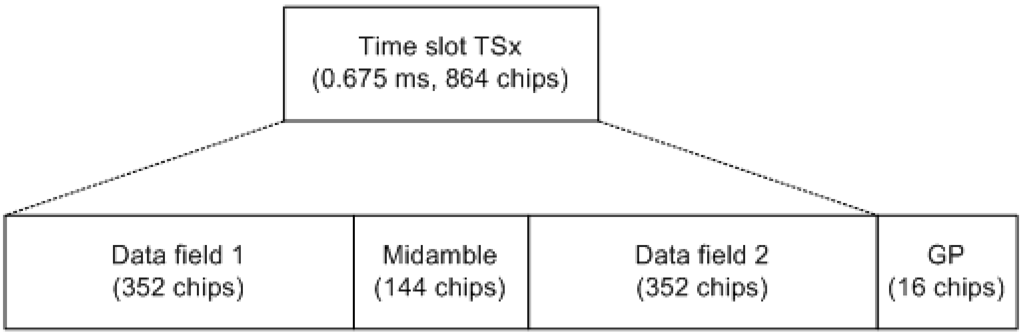


Figure 4-2: TD-SCDMA slot structure

Midamble shifts

The midamble is a known symbol sequence which can be used to synchronize the signal in the slot, and to distinguish the data from individual users in a single slot. Different users can be distinguished by their different time shifts of the same basic midamble sequence. For each midamble shift, the known symbol sequence is rotated cyclically by a defined number of chips. The maximum number of possible *midamble shifts* defines the maximum number of possible users in a single slot.

Each user is thus identified by a particular time slot and a particular code on a particular carrier frequency.

Midamble assignment

A midamble is assigned to each code channel by the transmission side. Different methods of assigning midambles to code channels are available.

- **Default midamble assignment**
  Specific midambles are assigned to each channelization code according to a standard-specific rule
- **User-specific midamble assignment**
  Each code channel is assigned an individual midamble code; higher communication layers must determine which midamble belongs to which channelization code
- **Common midamble assignment**
  All code channels share a common midamble

The midamble to be inserted between the data fields in a slot is generated by superimposing the individual midambles of the codes.

The TD-SCDMA specifications require that the power of the midamble and the power of the data fields for a single slot must be identical. When using the default midamble assignment, this means that each individual midamble is transmitted with the same power as its assigned channelization code. For common midamble assignment, this means the (single) midamble is transmitted with the same power as the data fields. For user-specific assignment, the individual midambles are not known at this stage.

The parameters ΔMid1/2 in the Channel Table results show the power offset of the midamble to the data fields 1 or 2 for each channel (see Table 3-2).

4.5 CDA Measurements in MSRA Operating Mode

The TD-SCDMA BTS application can also be used to analyze data in MSRA operating mode.

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

Data coverage for each active application

Generally, if a signal contains multiple data channels for multiple standards, separate applications are used to analyze each data channel. Thus, it is of interest to know which application is analyzing which data channel. The MSRA Master display indicates the data covered by each application, restricted to the channel bandwidth used by the corresponding standard (for TD-SCDMA: 1.6 MHz), by vertical blue lines labeled with the application name.

Analysis interval

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

In the TD-SCDMA BTS application, the analysis interval is determined automatically. It depends on the selected channel/ slot / set to analyze, which is defined for the evaluation range, and on the result display. The analysis interval cannot be edited directly in the TD-SCDMA BTS application, but is changed automatically when you change the evaluation range.

Analysis line

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

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

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

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

5 I/Q Data Import and Export

Baseband signals mostly occur as so-called complex baseband signals, i.e. a signal representation that consists of two channels; the in phase (I) and the quadrature (Q) channel. Such signals are referred to as I/Q signals. The complete modulation information and even distortion that originates from the RF, IF or baseband domains can be analyzed in the I/Q baseband.

Importing and exporting I/Q signals is useful for various applications:

- Generating and saving I/Q signals in an RF or baseband signal generator or in external software tools to analyze them with the R&S FPS later
- Capturing and saving I/Q signals with an RF or baseband signal analyzer to analyze them with the R&S FPS or an external software tool later

As opposed to storing trace data, which may be averaged or restricted to peak values, I/Q data is stored as it was captured, without further processing. The data is stored as complex values in 32-bit floating-point format. Multi-channel data is not supported. The I/Q data is stored in a format with the file extension `.iq.tar`.

For a detailed description see the R&S FPS I/Q Analyzer and I/Q Input User Manual.

An application note on converting Rohde & Schwarz I/Q data files is available from the Rohde & Schwarz website:
1EF85: Converting R&S I/Q data files

Export only in MSRA mode

In MSRA mode, I/Q data can only be exported to other applications; I/Q data cannot be imported to the MSRA Master or any MSRA applications.

5.1 Import/Export Functions

Access: "Save" / "Open" icon in the toolbar > "Import" / "Export"

The R&S FPS provides various evaluation methods for the results of the performed measurements. However, you may want to evaluate the data with further, external applications. In this case, you can export the measurement data to a standard format file (ASCII or XML). Some of the data stored in these formats can also be re-imported to the R&S FPS for further evaluation later, for example in other applications.

The following data types can be exported (depending on the application):

- Trace data
- Table results, such as result summaries, marker peak lists etc.

I/Q data can only be imported and exported in applications that process I/Q data, such as the I/Q Analyzer or optional applications.

See the corresponding user manuals for those applications for details.

These functions are only available if no measurement is running.

In particular, if Continuous Sweep / Run Cont is active, the import/export functions are not available.

Import
Access: "Save/Recall" > Import

Provides functions to import data.

Importing I/Q data is not possible in MSRA operating mode.

I/Q Import ← Import
Opens a file selection dialog box to select an import file that contains I/Q data. This function is only available in single sweep mode and only in applications that process I/Q data, such as the I/Q Analyzer or optional applications.

Note that the I/Q data must have a specific format as described in the R&S FPS I/Q Analyzer and I/Q Input User Manual.

Input from I/Q data files is imported as it was stored, including any correction factors, for example from transducers or SnP files. Any currently configured correction factors at the time of import, however, are not applied.

Remote command:
`MMEMory:LOAD:IQ:STATe` on page 183

Export
Access: "Save/Recall" > Export

Opens a submenu to configure data export.

I/Q Export ← Export
Opens a file selection dialog box to define an export file name to which the I/Q data is stored. This function is only available in single sweep mode.

Note: MSRA operating mode. Importing I/Q data is not possible in MSRA operating mode.

Note: Storing large amounts of I/Q data (several Gigabytes) can exceed the available (internal) storage space on the R&S FPS. In this case, it can be necessary to use an external storage medium.

Note: Secure user mode.

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the R&S FPS User Manual.

Remote command:
MMEMory:STORe<n>:IQ:STATe on page 184
MMEMory:STORe<n>:IQ:COMMent on page 183

6 Configuration

The TD-SCDMA applications provide several different measurements for signals according to the TD-SCDMA application. The main and default measurement is Code Domain Analysis. In addition to the code domain power measurements specified by the TD-SCDMA standard, the TD-SCDMA options offer measurements with predefined settings in the frequency and time domain, e.g. channel power or power vs time measurements.

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

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

Selecting the measurement type

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

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

6.1 Result Display Configuration

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

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

Up to 16 evaluation methods can be displayed simultaneously in separate windows. The TD-SCDMA evaluation methods are described in Chapter 3.1.2, "Evaluation Methods for Code Domain Analysis", on page 11.

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

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

6.2 Code Domain Analysis

Access: MODE > "TD-SCDMA BTS"/"TD-SCDMA UE"

TD-SCDMA measurements require special applications on the R&S FPS.

When you activate a TD-SCDMA application the first time, a set of parameters is passed on from the currently active application:

- Center frequency and frequency offset
- Reference level and reference level offset
- Attenuation

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

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

The "Span", "Bandwidth", "Lines", and "Marker Functions" menus are not available for Code Domain Analysis in TD-SCDMA applications.

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

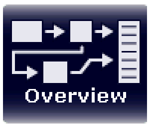
Importing and Exporting I/Q Data

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

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

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

6.2.1 Configuration Overview



Access: all menus

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

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 frequency and time domain measurements, see Chapter 6.3, "Frequency and Time Domain Measurements", on page 75.

For Code Domain Analysis measurements, the "Overview" provides quick access to the following configuration dialog boxes (listed in the recommended order of processing):

The "Signal Description" button indicated in the "Overview" is not required for TD-SCDMA measurements.

1. "Select Measurement"
   See Chapter 3, "Measurements and Result Display", on page 9
2. "Input/ Frontend"
   See Chapter 6.2.2, "Data Input and Output Settings", on page 49
3. (Optionally:) "Trigger"
   See Chapter 6.2.4, "Trigger Settings", on page 57
4. "Signal Capture"
   See Chapter 6.2.5, "Signal Capture (Data Acquisition)", on page 62
5. "Synchronization"
   See Chapter 6.2.7, "Synchronization", on page 64
6. "Channel Detection"
   See Chapter 6.2.8, "Channel Detection", on page 66
7. "Analysis"
   See Chapter 7, "Analysis", on page 85
8. "Display Configuration"
   See Chapter 6.1, "Result Display Configuration", on page 45

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

Do not confuse the "Preset Channel" button with the PRESET *key*, which restores the entire instrument to its default values and thus closes **all channels** on the R&S FPS (except for the default channel)!

Remote command:
`SYSTem:PRESet:CHANnel[:EXEC]` on page 110

Select Measurement
Selects a different measurement to be performed.

See Chapter 3, "Measurements and Result Display", on page 9.

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

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

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

6.2.2 Data Input and Output Settings

Access: INPUT / OUTPUT

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

6.2.2.1 Input Source Settings

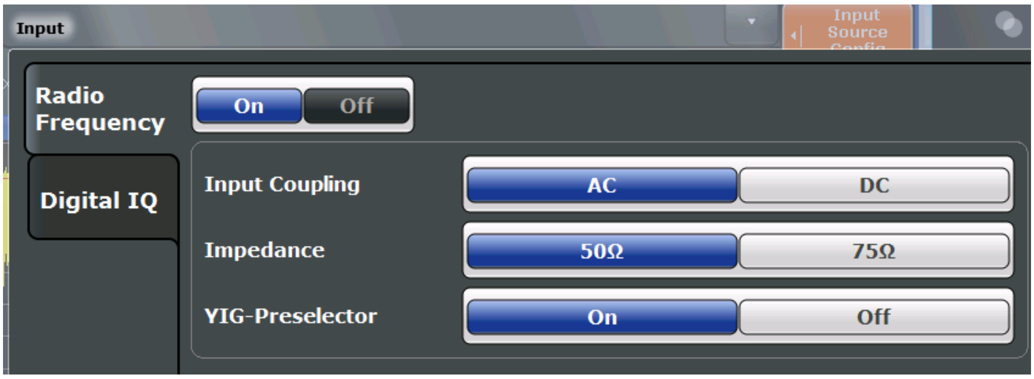
Access: "Overview" > "Input/Frontend" > "Input Source"

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

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

Radio Frequency Input

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



Radio Frequency State

Activates input from the RF INPUT connector.

Remote command:
`INPut:SELect` on page 113

Input Coupling

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

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

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

Remote command:
`INPut:COUPling` on page 112

Impedance

For some measurements, the reference impedance for the measured levels of the R&S FPS 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 52).

Remote command:
`INPut:IMPedance` on page 113

YIG-Preselector

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

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

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

Remote command:
`INPut:FILTer:YIG[:STATe]` on page 112

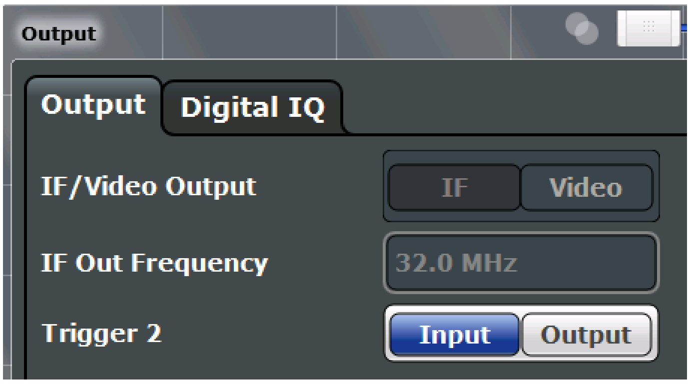
6.2.2.2 Output Settings

Access: INPUT/OUTPUT > "Output"

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

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

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



Noise Source Control
The R&S FPS provides a connector (NOISE SOURCE CONTROL) with a 28 V voltage supply for an external noise source. By switching the supply voltage for an external noise source on or off in the firmware, you can activate or deactivate the device as required.

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

In this case, you can first connect an external noise source (whose noise power level is known in advance) to the R&S FPS and measure the total noise power. From this value you can determine the noise power of the R&S FPS. Then when you measure the power level of the actual DUT, you can deduct the known noise level from the total power to obtain the power level of the DUT.

Remote command:
`DIAGnostic:SERVice:NSOurce` on page 113

6.2.3 Frontend Settings

Access: "Overview" > "Input / Frontend"

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

6.2.3.1 Amplitude Settings

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

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

Reference Level

Defines the expected maximum reference level. Signal levels above this value may not be measured correctly. This is indicated by an "IF Overload" status display.

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

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

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 117

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 FPS 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 FPS must handle. Do not rely on the displayed reference level (internal reference level = displayed reference level - offset).

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` on page 118

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

Setting the Reference Level Automatically (Auto Level) ← Reference Level
Automatically determines a reference level which ensures that no overload occurs at the R&S FPS for the current input data. At the same time, the internal attenuators are adjusted so the signal-to-noise ratio is optimized, while signal compression and clipping are minimized.

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

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

You can change the measurement time for the level measurement if necessary (see "Changing the Automatic Measurement Time (Meastime Manual)" on page 75).

Remote command:
`[SENSe:]ADJust:LEVel` on page 138

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

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

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

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

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

Remote command:
INPut:ATTenuation on page 119
INPut:ATTenuation:AUTO on page 120

Using Electronic Attenuation

If the (optional) Electronic Attenuation hardware is installed on the R&S FPS, 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: Electronic attenuation is not available for stop frequencies (or center frequencies in zero span) above 7 GHz.
In "Auto" mode, RF attenuation is provided by the electronic attenuator as much as possible to reduce the amount of mechanical switching required. Mechanical attenuation may provide a better signal-to-noise ratio, however.

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

The electronic attenuation can be varied in 1 dB steps. If the electronic attenuation is on, the mechanical attenuation can be varied in 5 dB steps. Other entries are rounded to the next lower integer value.

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 121
INPut:EATT:AUTO on page 120
INPut:EATT on page 120

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.

Preamplifier (option B22/B24) ← Input Settings

Switches the preamplifier on and off. If activated, the input signal is amplified by 20 dB.

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

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

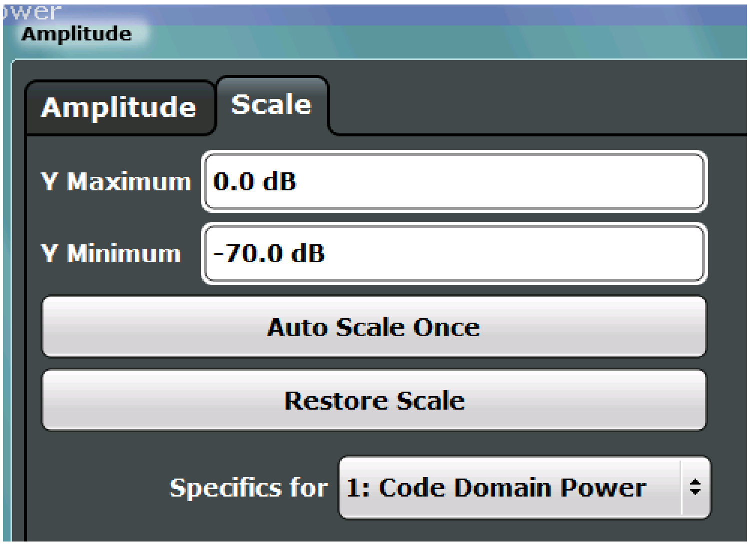
Remote command:
INPut:GAIN:STATe on page 119

6.2.3.2 Y-Axis Scaling

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

Or: AMPT > "Scale Config"

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



Y-Maximum, Y-Minimum
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 116
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum` on page 117

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

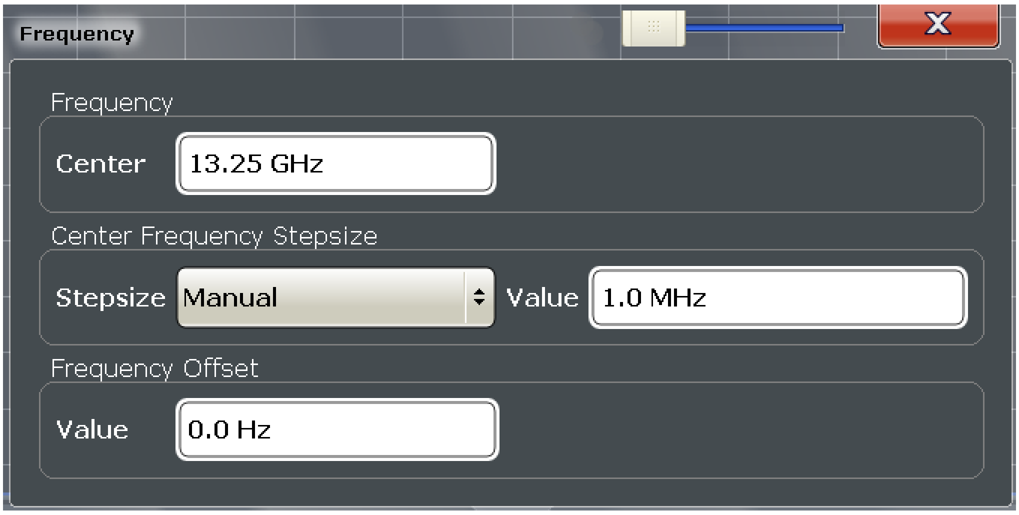
The display is only set once; it is not adapted further if the measurement settings are changed again.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE` on page 116

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

6.2.3.3 Frequency Settings

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



Center Frequency

Defines the center frequency of the signal in Hertz.

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

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

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

Remote command:
`[SENSe:]FREQuency:CENTer` on page 114

Center Frequency Stepsize

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

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

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

This setting is available for frequency and time domain measurements.

"= 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 115

Frequency Offset

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

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

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

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

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

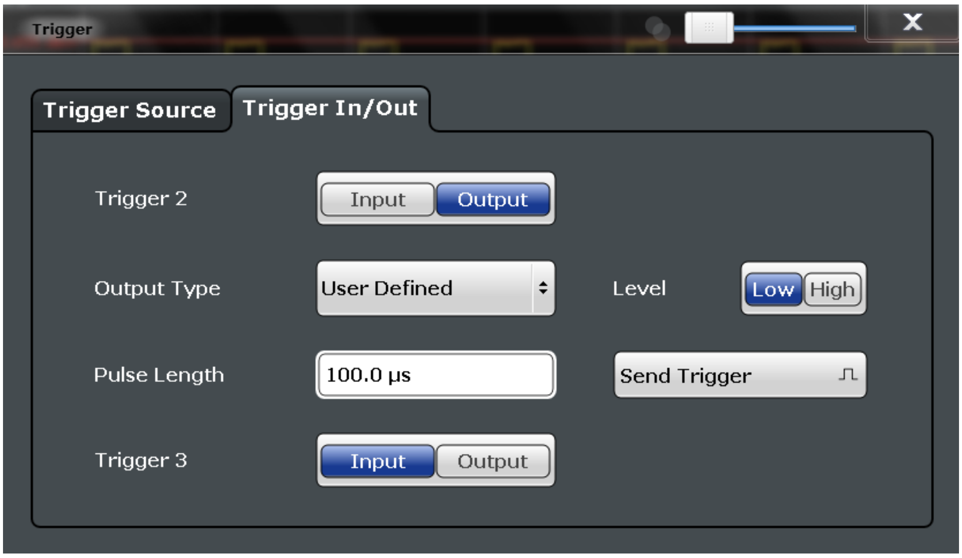
Remote command:
`[SENSe:]FREQuency:OFFSet` on page 115

6.2.4 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 FPS are configured in a separate tab of the dialog box.



For step-by-step instructions on configuring triggered measurements, see the main R&S FPS 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 123

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 123

External Trigger 1/2 ← Trigger Source ← Trigger Source
Data acquisition starts when the TTL signal fed into the specified input connector meets or exceeds the specified trigger level.

(See " Trigger Level " on page 59).

Note: The "External Trigger 1" softkey automatically selects the trigger signal from the TRG IN connector.

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

"External Trigger 1"
Trigger signal from the TRG IN connector.

"External Trigger 2"
Trigger signal from the TRG AUX connector.
Note: Connector must be configured for "Input" in the "Output" configuration
(See the R&S FPS User Manual).

Remote command:
`TRIG:SOUR EXT`, `TRIG:SOUR EXT2`
See `TRIGger[:SEQuence]:SOURce` on page 123

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

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

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

This trigger source is only available for RF input.

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

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 123

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

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

Remote command:
`TRIGger[:SEQuence]:LEVel[:EXTernal<port>]` on page 122

Trigger Offset ← Trigger Source
Defines the time offset between the trigger event and the start of the measurement.

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

Remote command:
`TRIGger[:SEQuence]:HOLDoff[:TIME]` on page 121

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 123

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

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

This setting is available for frequency and time domain measurements only.

Remote command:
`TRIGger[:SEQuence]:IFPower:HYSTeresis` on page 122

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

This softkey is available for frequency and time domain measurements only.

Remote command:
`TRIGger[:SEQuence]:IFPower:HOLDoff` on page 122

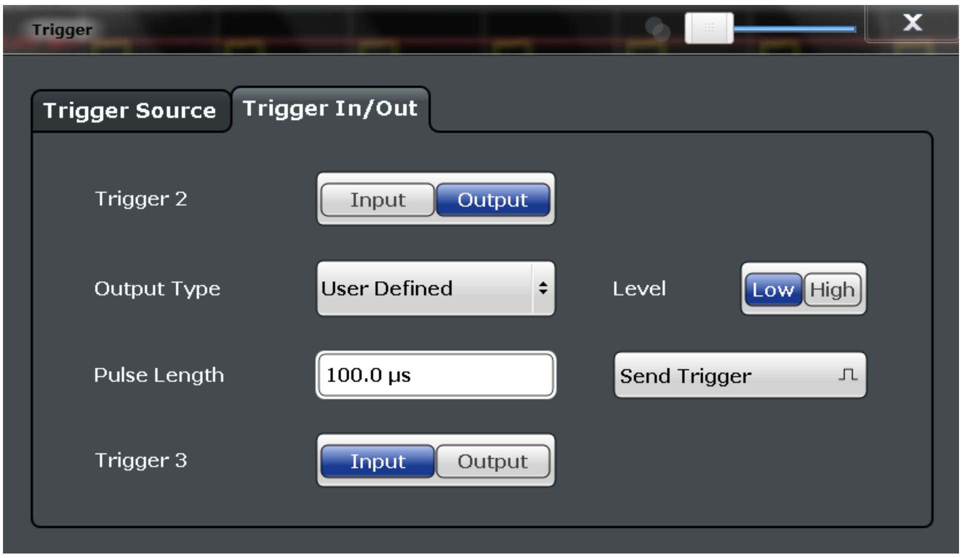
Capture Offset ← Trigger Source
This setting is only available for slave applications in **MSRA operating mode**. It has a similar effect as the trigger offset in other measurements: it defines the time offset between the capture buffer start and the start of the extracted slave application data.

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

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

Remote command:
`[SENSe:]MSRA:CAPTure:OFFSet` on page 187

Trigger 2



Defines the usage of the variable TRIGGER AUX connector on the rear panel.

(Trigger 1 is INPUT only.)

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

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

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

Remote command:
`OUTPut:TRIGger<port>:DIRection` on page 124

Output Type ← Trigger 2
Type of signal to be sent to the output

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

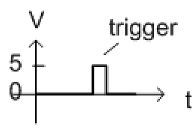
"Trigger Armed" Sends a (high level) trigger when the R&S FPS is in "Ready for trigger" state.
This state is indicated by a status bit in the `STATus:OPERation` register (bit 5).

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

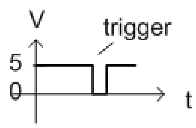
Remote command:
`OUTPut:TRIGger<port>:OTYPe` on page 125

Level ← Output Type ← Trigger 2
Defines whether a high (1) or low (0) constant signal is sent to the trigger output connector.

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



low-level constant, high-level trigger



high-level constant, low-level trigger

Remote command:
`OUTPut:TRIGger<port>:LEVel` on page 124

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

Remote command:
`OUTPut:TRIGger<port>:PULSe:LENGth` on page 125

Send Trigger ← Output Type ← Trigger 2
Sends a user-defined trigger to the output connector immediately.

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

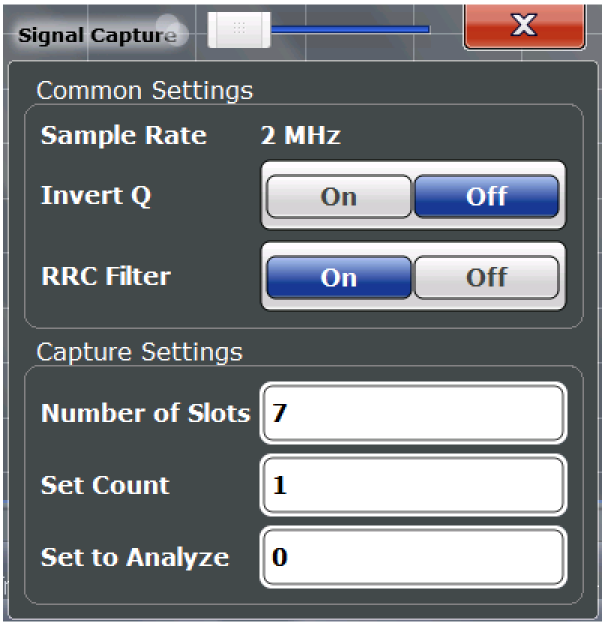
Which pulse level will be sent is indicated by a graphic on the button.

Remote command:
`OUTPut:TRIGger<port>:PULSe:IMMediate` on page 125

6.2.5 Signal Capture (Data Acquisition)

Access: "Overview" > "Signal Capture"

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



MSRA operating mode

In MSRA operating mode, only the MSRA Master channel actually captures data from the input signal. The data acquisition settings for the TD-SCDMA BTS application in MSRA mode define the **application data extract**. See Chapter 6.2.6, "Application Data (MSRA) ", on page 64.

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

Sample Rate

The sample rate is always 2 MHz (indicated for reference only).

Swap I/Q

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

Remote command:
`[SENSe:]CDPower:QINVert` on page 191

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 126

Set Count

Defines the number of consecutive sets to be captured and stored in the instrument's I/Q memory. One set consists of 63 slots. The R&S FPS can capture from 1 to 4500 sets.

Remote command:
`[SENSe:]CDPower:SET:COUNt` on page 127

Set to Analyze

Selects a specific set for further analysis. The value range depends on the Set Count and is between 0 and [Set Count-1].

Remote command:
`[SENSe:]CDPower:SET` on page 139

Number of Slots to Capture

Defines the number of slots to capture.

Note: if the Set Count is larger than 1, the number of slots to capture is automatically set to the maximum of 64.

Remote command:
`[SENSe:]CDPower:IQLength` on page 126

6.2.6 Application Data (MSRA)

For the TD-SCDMA BTS application in MSRA operating mode, the application data range is defined by the same settings used to define the signal capturing in Signal and Spectrum Analyzer mode (see Chapter 6.2.5, "Signal Capture (Data Acquisition)", on page 62.

In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the analysis interval for the TD-SCDMA BTS measurement (see " Capture Offset " on page 60).

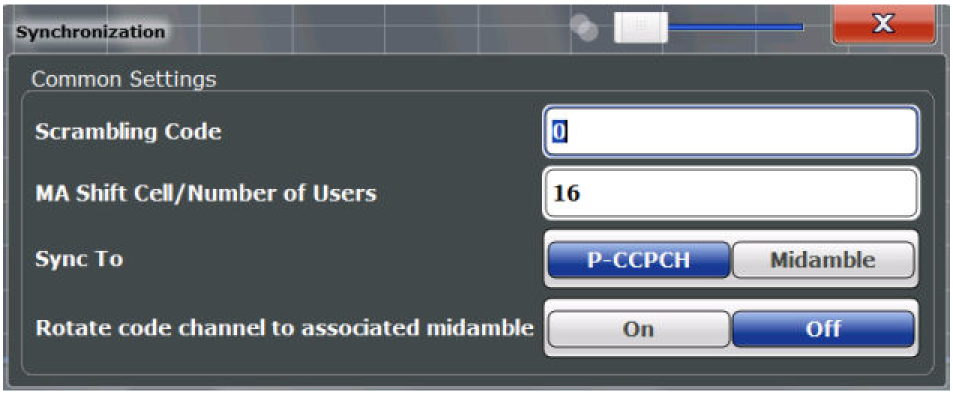
The **analysis interval** cannot be edited manually. It is determined automatically according to the selected channel, slot or set to analyze which is defined for the evaluation range, depending on the result display. Note that the set/slot/channel is analyzed *within the application data*.

For details, see Chapter 4.5, "CDA Measurements in MSRA Operating Mode", on page 40.

6.2.7 Synchronization

Access: "Overview" > "Synchronization"

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



Scrambling Code
Sets the Scrambling Code of the base station. Possible values are between 0 and 127 and have to be entered as decimals.

Remote command:
`[SENSe:]CDPower:SCODe` on page 128

SYNC-UL Code (UE only)
Defines the code used for synchronization on the UpPTS (see "Time Reference (UE mode)" on page 65).

Remote command:
`[SENSe:]CDPower:SULC` on page 129

MA Shift Cell / Number of Users
Sets the maximum number of usable midamble shifts (= number of users) on the base station. Possible values are in the range from 2 to 16 in steps of 2 midamble shifts.

If you use a predefined channel table, this value is replaced by that of the channel table.

For details see Chapter 4.4, "Data Fields and Midambles", on page 39.

Remote command:
`[SENSe:]CDPower:MSHift` on page 128

Time Reference (BTS mode)
Defines which slot is used as a time reference for synchronization.

"DwPTS"	Uses the Downlink Pilot Time Slot (DwPTS) as a time reference (see also Chapter 4.2, "Frames, Subframes and Slots", on page 34)
"Slot 0"	Uses slot 0 as a time reference.

Remote command:
`[SENSe:]CDPower:TREF` on page 130

Time Reference (UE mode)
Defines which slot is used as a time reference for synchronization.

"UpPTS"	Uses the Uplink Pilot Time Slot (UpPTS) as a time reference (see also Chapter 4.2, "Frames, Subframes and Slots", on page 34)
"Slot 1"	Uses slot 1 as a time reference.

Remote command:
`[SENSe:]CDPower:TREF` on page 130

Sync To
Defines the phase reference. For a successful synchronization, the selected slot must contain at least one data channel with sufficient power.

(Not available for Power vs Time measurements.)

"P-CCPCH" **(BTS application only)**
By default, the R&S FPS TD-SCDMA BTS application determines the phase reference for all downlink data slots from the downlink pilot channel (P-CCPCH) in slot 0. For some measurements like beam-forming or repeater measurements, it might be necessary to apply different phase offsets to each time slot. In these timeslots, using the P-CCPCH as phase reference leads to rotated constellation diagrams and poor EVM results.

"Code Channel"	**(UE application only)** The R&S FPS TD-SCDMA UE determines the phase reference from the channel of the selected slot. This is useful when synchronization fails in poor SNR environments. For channel synchronization, at least one of the channels must be QPSK or 8PSK modulated.
"Midamble"	The R&S FPS TD-SCDMA application determines the phase reference from the midamble of the selected slot. With this method, the data slots can be phase rotated to each other and a degradation of the EVM results can be avoided.

Remote command:
`[SENSe:]CDPower:STSLot` on page 128
UE application: `[SENSe:]CDPower:STSLot:MODE` on page 129

Rotate code channel to associated midamble
(Not available for Power vs Time measurements.)

By default, the R&S FPSTD-SCDMA application determines one phase reference for all midambles and channels of a data slot. If this option is enabled, phase rotations between the channels are allowed. Each channel gets its own phase reference from the associated midamble according to section AA.2 of the standard document 3GPP TS 25.221. If the associated midamble is missing, the common phase reference is used for this channel.

Remote command:
`[SENSe:]CDPower:STSLot:ROTate` on page 129

6.2.8 Channel Detection

Access: "Overview" > "Channel Detection"

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

6.2.8.1 General Channel Detection Settings

Access: "Overview" > "Channel Detection"

Figure 6-1: Channel detection configuration for TD-SCDMA BTS application

Inactive Channel Threshold

Defines the minimum power that a single channel must have compared to the total signal to be recognized as an active channel.

Remote command:

`[SENSe:]CDPower:ICTReshold` on page 131

Max Modulation

Defines the highest modulation to be considered in the automatic channel search. In low SNR environments, it may be necessary to limit the channel search to lower modulations than 64QAM. The following types are available:

- QPSK
- 8PSK
- 16QAM
- 64QAM

Remote command:
`[SENSe:]CDPower:MMAX` on page 131

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 based on the active predefined channel table.

Remote command:
`CONFigure:CDPower:CTABle[:STATe]` on page 133

6.2.8.2 Channel Table Management

Access: "Overview" > "Channel Detection" > "Predefined Channel Tables"

Predefined Tables
The list shows all available channel tables and marks the currently used table with a checkmark. The currently *focused* table is highlighted blue.

Remote command:
BTS measurements:
`CONFigure:CDPower:CTABle:CATalog?` on page 131

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:
`CONFigure:CDPower:CTABle:SELect` on page 133

Creating a New Table
Creates a new channel table. See Chapter 6.2.8.4, "Channel Details", on page 71.

For step-by-step instructions on creating a new channel table, see "To define or edit a channel table" on page 97.

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 6.2.8.4, "Channel Details", on page 71.

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 6.2.8.4, "Channel Details", on page 71.

Remote command:
`CONFigure:CDPower:CTABle:COPY` on page 132

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

Remote command:
`CONFigure:CDPower:CTABle:DELete` on page 132

6.2.8.3 Channel Table Settings and Functions

Access: "Overview" > "Channel Detection" > "Predefined Channel Tables" > "New"/ "Copy"/ "Edit"

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

Name
Name of the channel table that is displayed in the "Predefined Channel Tables" list.

Remote command:
`CONFigure:CDPower:CTABle:NAME` on page 134

Comment
Optional description of the channel table.

Remote command:
`CONFigure:CDPower:CTABle:COMMent` on page 133

MA Shifts Cell
Defines the maximum number of midamble shifts (i.e. the maximum number of users) in a single cell for channel detection using the predefined table.

This value replaces the global value defined by "MA Shift Cell / Number of Users" on page 65.

For details, see Chapter 4.4, "Data Fields and Midambles", on page 39.

Remote command:
`CONFigure:CDPower:CTABle:MSHift` on page 135

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:
`CONFigure:CDPower:MEASurement` on page 110

Sorting the Table by Midamble (BTS application only):

Sorting by midamble means that after each midamble, the corresponding code is listed. The R&S FPS automatically distinguishes between common and default midamble assignment. The assignment of code to midamble is specified in the TD-SCDMA standard.

If neither a common, nor a default midamble assignment is found, sorting is in code order.

For details, see Chapter 4.4, "Data Fields and Midambles", on page 39.

Sorting the Table by Code
The midambles are sorted according to their midamble shifts. Active and inactive channels are projected to a spreading factor of 16 and sorted according to their code numbers.

Selecting the Slot to Evaluate
The application analyzes a single slot over the total signal to detect channels. Which slot to analyze is defined here.

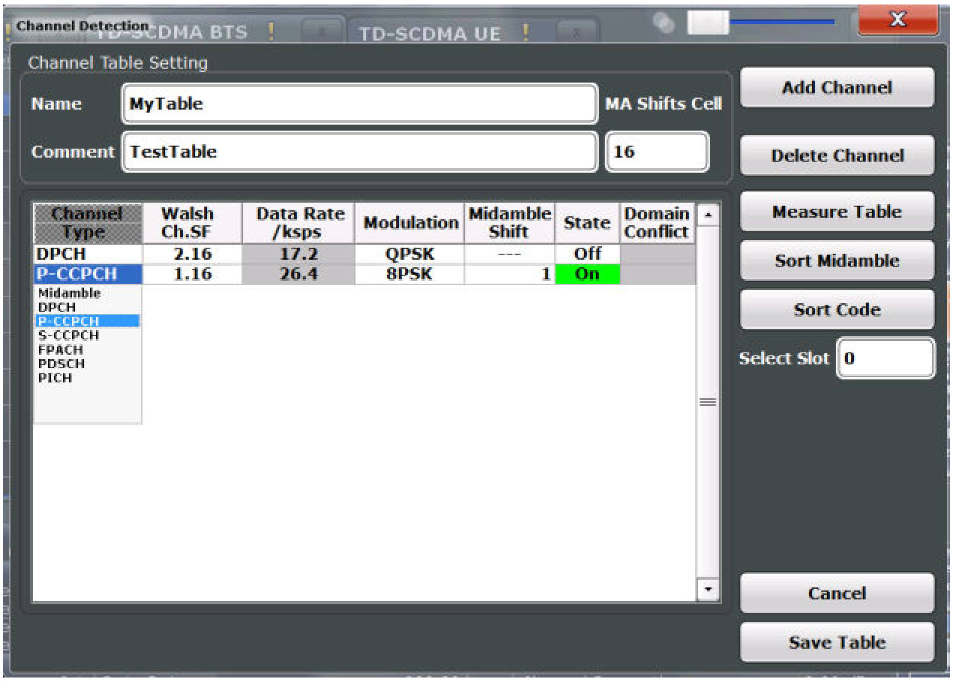
The values in the "Channel Detection" settings and in the "Evaluation Range" settings are identical.

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.

6.2.8.4 Channel Details

Access: "Overview" > "Channel Detection" > "Predefined Channel Tables" > "New"/ "Copy"/ "Edit" > "Add Channel"



To edit channel settings, select the corresponding cell in the table and enter the new value. Gray cells are read-only and cannot be edited.

Channel Type

Type of channel. For a list of possible channel types, see Chapter 4.3.1, "Special Channels", on page 36.

Remote command:
`CONFigure:CDPower:CTABle:DATA` on page 134

Channel Number (Ch. SF)

Channel number, defined by code and spreading factor

Remote command:
`CONFigure:CDPower:CTABle:DATA` on page 134

Symbol Rate

Symbol rate at which the channel is transmitted.

(Read-only; for reference purposes)

For an overview of possible symbol rates depending on the modulation type and other parameters, see Table 4-8.

Modulation
The modulation type.

For an overview of possible modulation types and other parameters, see Table 4-8.

Midamble Shift
For channels, this is the shift of the associated midamble if a common or default midamble assignment is detected.

For details, see Chapter 4.4, "Data Fields and Midambles", on page 39.

Remote command:
`CONFigure:CDPower:CTABle:MSHift` on page 135

State
Indicates the channel state. Codes that are not assigned are marked as inactive channels (OFF).

Remote command:
`CONFigure:CDPower:CTABle:DATA` on page 134

Domain Conflict
Indicates a code domain conflict between channel definitions (e.g. overlapping channels or conflicting channel codes).

6.2.9 Sweep Settings

Access: SWEEP

The sweep settings define how the data is measured.

Continuous Sweep / Run Cont
After triggering, starts the measurement and repeats it continuously until stopped.

While the measurement is running, the "Continuous Sweep" softkey and the RUN CONT key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again. The results are not deleted until a new measurement is started.

Note: Sequencer. If the Sequencer is active, the "Continuous Sweep" softkey only controls the sweep mode for the currently selected channel. However, the sweep mode only takes effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in continuous sweep mode is swept repeatedly.

Furthermore, the RUN CONT key controls the Sequencer, not individual sweeps. RUN CONT starts the Sequencer in continuous mode.

Remote command:
INITiate<n>:CONTinuous on page 153

Single Sweep / Run Single
While the measurement is running, the "Single Sweep" softkey and the RUN SINGLE key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

Remote command:
INITiate<n>[:IMMediate] on page 154

Continue Single Sweep
While the measurement is running, the "Continue Single Sweep" softkey and the RUN SINGLE key are highlighted. The running measurement can be aborted by selecting the highlighted softkey or key again.

Remote command:
INITiate<n>:CONMeas on page 153

Refresh (MSRA only)
This function is only available if the Sequencer is deactivated and only for **MSRA slave applications**.

The data in the capture buffer is re-evaluated by the currently active slave application only. The results for any other slave applications remain unchanged.

This is useful, for example, after evaluation changes have been made or if a new sweep was performed from another slave application; in this case, only that slave application is updated automatically after data acquisition.

Note: To update all active slave applications at once, use the "Refresh All" function in the "Sequencer" menu.

Remote command:
INITiate<n>:REFResh on page 186

Sweep/Average Count
Defines the number of measurements to be performed in the single sweep mode. Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one measurement is performed.

The sweep count is applied to all the traces in all diagrams.

Remote command:
[SENSe:]SWEep:COUNt on page 136

6.2.10 Automatic Settings

Access: AUTO SET

The R&S FPS TD-SCDMA Measurements application can adjust some settings automatically according to the current measurement settings. To do so, a measurement is performed. The duration of this measurement can be defined automatically or manually.

MSRA operating mode

In MSRA operating mode, the following automatic settings are not available, as they require a new data acquisition. However, TD-SCDMA applications cannot acquire data in MSRA operating mode.

Adjusting all Determinable Settings Automatically (Auto All)

Activates all automatic adjustment functions for the current measurement settings.

This includes:

- Auto Level
- "Auto Scale All" on page 75

Note: MSRA operating modes. In MSRA operating mode, this function is only available for the MSRA Master, not the applications.

Remote command:
`[SENSe:]ADJust:ALL` on page 137

Setting the Reference Level Automatically (Auto Level)

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

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

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

You can change the measurement time for the level measurement if necessary (see " Changing the Automatic Measurement Time (Meastime Manual)" on page 75).

Remote command:
`[SENSe:]ADJust:LEVel` on page 138

Auto Scale Window
Automatically determines the optimal range and reference level position to be displayed for the *current* measurement settings in the currently selected window. No new measurement is performed.

Auto Scale All
Automatically determines the optimal range and reference level position to be displayed for the *current* measurement settings in all displayed diagrams. No new measurement is performed.

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

Resetting the Automatic Measurement Time (Meastime Auto)
Resets the measurement duration for automatic settings to the default value.

Remote command:
`[SENSe:]ADJust:CONFigure[:LEVel]:DURation:MODE` on page 137

Changing the Automatic Measurement Time (Meastime Manual)
This function allows you to change the measurement duration for automatic setting adjustments. Enter the value in seconds.

Remote command:
`[SENSe:]ADJust:CONFigure[:LEVel]:DURation:MODE` on page 137
`[SENSe:]ADJust:CONFigure[:LEVel]:DURation` on page 137

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

Remote command:
`[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer` on page 138

Lower Level Hysteresis
When the reference level is adjusted automatically using the Auto Level function, the internal attenuators and the preamplifier are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Remote command:
`[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer` on page 138

6.3 Frequency and Time Domain Measurements

Access: "Overview" > "Select Measurement"

When you activate a TD-SCDMA application, Code Domain Analysis of the input signal is started automatically. However, the TD-SCDMA applications also provide various frequency and time domain measurement types.

The main measurement configuration menus for the RF measurements are identical to the Spectrum application.

For details refer to "General Measurement Configuration" in the R&S FPS User Manual.

The measurement-specific settings for the following measurements are available in the "Analysis" dialog box (via the "Overview").

6.3.1 Power vs Time

Access: "Overview" > "Select Measurement" > "Power vs Time"

The Power vs Time measurement checks the signal power against a transmission power mask defined by the TD-SCDMA specification.

6.3.1.1 Default Settings for PvT Measurements

By default, the following settings are used for a Power vs Time measurement in the TD-SCDMA BTS application:

Parameter	Default Value
Span	Zero Span
Sweep Time	2.4 ms
RBW	1.28 MHz
VBW	10 MHz
Trace Mode	Average
Switching point **(BTS application only):**	3
Number of subframes	100

6.3.1.2 PvT Configuration Overview

For Power vs Time measurements, the "Overview" provides quick access to the following configuration dialog boxes (listed in the recommended order of processing):

The "Signal Description", "Signal Capture" and "Channel Detection" buttons indicated in the "Overview" are not available for TD-SCDMA Power vs Time measurements.

1. "Select Measurement"
   See Chapter 3, "Measurements and Result Display", on page 9
2. "Input/ Frontend"
   See Chapter 6.2.2, "Data Input and Output Settings", on page 49
3. (Optionally:) "Trigger"
   See Chapter 6.2.4, "Trigger Settings", on page 57
4. "Synchronization"
   See Chapter 6.2.7, "Synchronization", on page 64
5. "Analysis"
   See Chapter 7, "Analysis", on page 85
6. "Display Configuration"
   See Chapter 6.1, "Result Display Configuration", on page 45

The "Span", "Lines", and "Marker Functions" menus are not available for Power vs Time measurements in TD-SCDMA applications.

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

Do not confuse the "Preset Channel" button with the PRESET *key*, which restores the entire instrument to its default values and thus closes **all channels** on the R&S FPS (except for the default channel)!

Remote command:
`SYSTem:PRESet:CHANnel[:EXEC]` on page 110

Select Measurement
Selects a different measurement to be performed.

See Chapter 3, "Measurements and Result Display", on page 9.

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

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

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

6.3.1.3 PvT Measurement Settings

The following settings and functions are specific to the Power vs Time measurement in the TD-SCDMA applications. They are available from the "Power vs Time" menu, which is displayed when you press the MEAS CONFIG key.

Switching Point
(BTS application only):

The switching point defines the border between uplink slots and downlink slots and is between 1 and 6.

In downlink Power vs Time measurements, the slots of interest are defined as the range from **slot 1** to the slot indicated by the "Switching Point".

In the TD-SCDMA **UE application**, the slot of interest is **slot 1**, which cannot be changed. Thus, the switching point is irrelevant.

Remote command:
`CONFigure:CDPower[:BTS]:PVTime:SPOint` on page 142

Start Meas
Starts measuring the power for the defined number of subframes (same effect as pressing the RUN SINGLE key).

Remote command:
`INIT:CONT OFF`, see `INITiate<n>:CONTinuous` on page 153
`INITiate<n>[:IMMediate]` on page 154

No of Subframes
Defines the number of subframes that the R&S FPS includes in the measurement. The results of the Power vs Time measurement are based on the average of the number of the subframes. This setting is identical to the " Sweep/Average Count " on page 73.

Remote command:
`CONFigure:CDPower[:BTS]:PVTime:SFRames` on page 142

Adapting the Measurement to the Current Signal
You can adapt the measurement range to the current TD-SCDMA signal.

Start Slot / Stop Slot ← Adapting the Measurement to the Current Signal (BTS application only):

Defines the measurement range for **Channel Power** measurements as a range of slots in the current TD-SCDMA signal, e.g. the downlink slots 4 to 6, for a "Switching Point" = 3.

Remote command:
`[SENSe:]POWer:ACHannel:SLOT:STARt` on page 143
`[SENSe:]POWer:ACHannel:SLOT:STOP` on page 143

Auto Level & Time ← Adapting the Measurement to the Current Signal
Automatically adjusts the reference level and the trigger offset to subframe start to their optimum levels for the current signal. This prevents overloading the R&S FPS.

When this function is activated, current measurements are aborted and resumed after the automatic level detection is finished.

Remote command:
`[SENSe:]POWer:ACHannel:AUTO:LTIMe` on page 142

6.3.2 Signal Channel Power Measurements

Access: "Overview" > "Select Measurement" > "Power"

The Power measurement determines the TD-SCDMA signal channel power in a single channel with a bandwidth of 1.2288 MHz.

In order to determine the signal power, the TD-SCDMA application performs a Channel Power measurement as in the Spectrum application with the following settings:

Table 6-1: Predefined settings for TD-SCDMA Signal Channel Power measurements

Standard	TD SCDMA FWD (**UE**: TD SCDMA REV)
Number of adjacent channels	0
Frequency span	3 MHz
Measurement bandwidth	1.6 MHz

The main measurement menus and the configuration "Overview" for the RF measurements are identical to the Spectrum application. However, an additional function is provided to adapt the Power measurement to the current TD-SCDMA signal.

Adapting the Measurement to the Current Signal
You can adapt the measurement range to the current TD-SCDMA signal.

Start Slot / Stop Slot ← Adapting the Measurement to the Current Signal (BTS application only):

Defines the measurement range for **Channel Power** measurements as a range of slots in the current TD-SCDMA signal, e.g. the downlink slots 4 to 6, for a "Switching Point" = 3.

Remote command:
[SENSe:]POWer:ACHannel:SLOT:STARt on page 143
[SENSe:]POWer:ACHannel:SLOT:STOP on page 143

Auto Level & Time ← Adapting the Measurement to the Current Signal
Automatically adjusts the reference level and the trigger offset to subframe start to their optimum levels for the current signal. This prevents overloading the R&S FPS.

When this function is activated, current measurements are aborted and resumed after the automatic level detection is finished.

Remote command:
[SENSe:]POWer:ACHannel:AUTO:LTIMe on page 142

6.3.3 Channel Power (ACLR) Measurements

Access: "Overview" > "Select Measurement" > "Channel Power ACLR"

Channel Power ACLR measurements are performed as in the Spectrum application with the following predefined settings according to TD-SCDMA specifications (adjacent channel leakage ratio).

Table 6-2: Predefined settings for TD-SCDMA ACLR Channel Power measurements

Standard	TD SCDMA FWD (**UE**: TD SCDMA REV)
Number of adjacent channels	2

For further details about the ACLR measurements refer to "Measuring Channel Power and Adjacent-Channel Power" in the R&S FPS User Manual.

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

- Reference level and reference level offset
- RBW, VBW
- Sweep time
- Span
- Number of adjacent channels
- Fast ACLR mode

The main measurement menus and the configuration "Overview" for the RF measurements are identical to the Spectrum application. However, an additional function is provided to adapt the ACLR measurement to the current TD-SCDMA signal.

Adapting the Measurement to the Current Signal
You can adapt the measurement range to the current TD-SCDMA signal.

Start Slot / Stop Slot ← Adapting the Measurement to the Current Signal (BTS application only):

Defines the measurement range for **Channel Power** measurements as a range of slots in the current TD-SCDMA signal, e.g. the downlink slots 4 to 6, for a "Switching Point" = 3.

Remote command:
`[SENSe:]POWer:ACHannel:SLOT:STARt` on page 143
`[SENSe:]POWer:ACHannel:SLOT:STOP` on page 143

Auto Level & Time ← Adapting the Measurement to the Current Signal
Automatically adjusts the reference level and the trigger offset to subframe start to their optimum levels for the current signal. This prevents overloading the R&S FPS.

When this function is activated, current measurements are aborted and resumed after the automatic level detection is finished.

Remote command:
`[SENSe:]POWer:ACHannel:AUTO:LTIMe` on page 142

6.3.4 Spectrum Emission Mask

Access: "Overview" > "Select Measurement" > "Spectrum Emission Mask"

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

For further details about the Spectrum Emission Mask measurements refer to "Spectrum Emission Mask Measurement" in the R&S FPS User Manual.

The TD-SCDMA applications perform the SEM measurement as in the Spectrum application with the following settings:

Table 6-3: Predefined settings for TD-SCDMA SEM measurements

Span	+/- 4 MHz
Number of ranges	9
Fast SEM	ON
Number of power classes	1
Channel bandwidth	1.28 MHz
Power reference type	Channel power
Detector	RMS

Changing the RBW and the VBW is restricted due to the definition of the limits by the standard.

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

- Reference level and reference level offset
- Sweep time
- Span

The main measurement menus and the configuration "Overview" for the RF measurements are identical to the Spectrum application. However, an additional function is provided to adapt the SEM measurement to the current TD-SCDMA signal.

Adapting the Measurement to the Current Signal
You can adapt the measurement range to the current TD-SCDMA signal.

Start Slot / Stop Slot ← Adapting the Measurement to the Current Signal (BTS application only):

Defines the measurement range for **Channel Power** measurements as a range of slots in the current TD-SCDMA signal, e.g. the downlink slots 4 to 6, for a "Switching Point" = 3.

Remote command:
`[SENSe:]POWer:ACHannel:SLOT:STARt` on page 143
`[SENSe:]POWer:ACHannel:SLOT:STOP` on page 143

Auto Level & Time ← Adapting the Measurement to the Current Signal
Automatically adjusts the reference level and the trigger offset to subframe start to their optimum levels for the current signal. This prevents overloading the R&S FPS.

When this function is activated, current measurements are aborted and resumed after the automatic level detection is finished.

Remote command:
`[SENSe:]POWer:ACHannel:AUTO:LTIMe` on page 142

6.3.5 Occupied Bandwidth

Access: "Overview" > "Select Measurement" > "OBW"

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

The Occupied Bandwidth measurement is performed as in the Spectrum application with the following predefined settings according to TD-SCDMA specifications:

Table 6-4: Predefined settings for TD-SCDMA OBW measurements

Setting	Default value
% Power Bandwidth	99 %
Channel bandwidth	1.28 MHz
Sweep Time	676 ms

Setting	Default value
RBW	30 kHz
VBW	300 kHz
Detector	RMS
Trigger	Gated, IF power

For further details about the Occupied Bandwidth measurements refer to "Measuring the Occupied Bandwidth" in the R&S FPS User Manual.

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

- Reference level and reference level offset
- RBW, VBW
- Sweep time
- Span

The main measurement menus and the configuration "Overview" for the RF measurements are identical to the Spectrum application. However, an additional function is provided to adapt the OBW measurement to the current TD-SCDMA signal.

Adapting the Measurement to the Current Signal
You can adapt the measurement range to the current TD-SCDMA signal.

Start Slot / Stop Slot ← Adapting the Measurement to the Current Signal (BTS application only):

Defines the measurement range for **Channel Power** measurements as a range of slots in the current TD-SCDMA signal, e.g. the downlink slots 4 to 6, for a "Switching Point" = 3.

Remote command:
`[SENSe:]POWer:ACHannel:SLOT:STARt` on page 143
`[SENSe:]POWer:ACHannel:SLOT:STOP` on page 143

Auto Level & Time ← Adapting the Measurement to the Current Signal
Automatically adjusts the reference level and the trigger offset to subframe start to their optimum levels for the current signal. This prevents overloading the R&S FPS.

When this function is activated, current measurements are aborted and resumed after the automatic level detection is finished.

Remote command:
`[SENSe:]POWer:ACHannel:AUTO:LTIMe` on page 142

6.3.6 CCDF

Access: "Overview" > "Select Measurement" > "CCDF"

The CCDF measurement determines the distribution of the signal amplitudes (complementary cumulative distribution function).

The CCDF measurement is performed as in the Spectrum application with the following settings:

Table 6-5: Predefined settings for TD-SCDMA CCDF measurements

CCDF	Active on trace 1
Analysis bandwidth	10 MHz
Number of samples	500000
Detector	Sample

For further details about the CCDF measurements refer to "Statistical Measurements" in the R&S FPS User Manual.

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

- Reference level and reference level offset
- Analysis bandwidth
- Number of samples

The main measurement menus and the configuration "Overview" for the RF measurements are identical to the Spectrum application. However, an additional function is provided to adapt the CCDF measurement to the current TD-SCDMA signal.

Adapting the Measurement to the Current Signal
You can adapt the measurement range to the current TD-SCDMA signal.

Start Slot / Stop Slot ← Adapting the Measurement to the Current Signal (BTS application only):

Defines the measurement range for **Channel Power** measurements as a range of slots in the current TD-SCDMA signal, e.g. the downlink slots 4 to 6, for a "Switching Point" = 3.

Remote command:
`[SENSe:]POWer:ACHannel:SLOT:STARt` on page 143
`[SENSe:]POWer:ACHannel:SLOT:STOP` on page 143

Auto Level & Time ← Adapting the Measurement to the Current Signal
Automatically adjusts the reference level and the trigger offset to subframe start to their optimum levels for the current signal. This prevents overloading the R&S FPS.

When this function is activated, current measurements are aborted and resumed after the automatic level detection is finished.

Remote command:
`[SENSe:]POWer:ACHannel:AUTO:LTIMe` on page 142

7 Analysis

Access: "Overview" > "Analysis"

Analysis of RF Measurements

General result analysis settings concerning the trace, markers, lines etc. for RF measurements are almost identical to the analysis functions in the Spectrum application. Only some special marker functions are not available in TD-SCDMA applications.

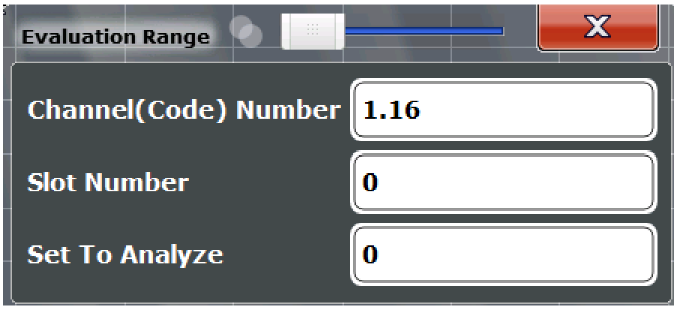
For details, see the "Common Analysis and Display Functions" chapter in the R&S FPS User Manual.

The remote commands required to perform these tasks are described in Chapter 10.10, "Analysis", on page 173.

7.1 Evaluation Range

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

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



Channel (Code) Number
Selects a channel for the following evaluations:

- Bitstream
- Power vs Slot
- Power vs Symbol
- Result Summary
- Symbol Constellation

- Symbol EVM

Enter a code number and spreading factor, separated by a decimal point.

The specified channel is selected and marked in red in the corresponding result displays, if active. If no spreading factor is specified, the code based on the spreading factor 16 is marked. For unused channels, the code resulting from the conversion is marked.

Example: Enter *4.8*

Channel 4 is marked at spreading factor 8 (35.2 ksps) if the channel is active, otherwise code 7 at spreading factor 16.

Remote command:
`[SENSe:]CDPower:CODE` on page 139

Slot Number
Selects the slot for evaluation. This affects channel detection as well as the following evaluations (see also Chapter 3.1.2, "Evaluation Methods for Code Domain Analysis", on page 11):

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

Remote command:
`[SENSe:]CDPower:SLOT` on page 139

Set to Analyze
Selects a specific set for further analysis. The value range depends on the Set Count and is between 0 and [Set Count-1].

Remote command:
`[SENSe:]CDPower:SET` on page 139

7.2 Code Domain Analysis Settings

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

Some evaluations provide further settings for the results.

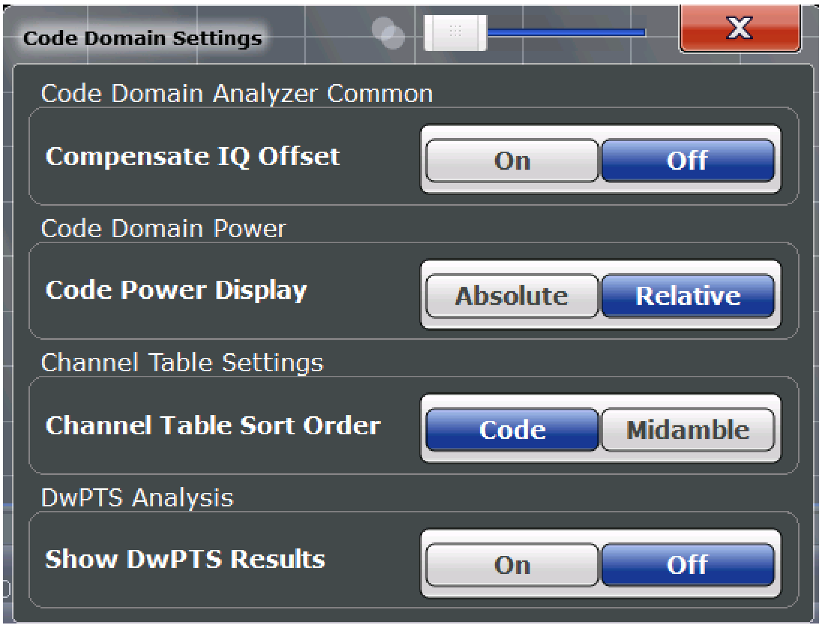


Figure 7-1: Code Domain Settings (BTS mode)

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 140

Code Power Display

For "Code Domain Power" evaluation:

Defines whether the absolute power or the power relative to the total power of the data parts of the signal is displayed.

Remote command:
`[SENSe:]CDPower:PDISplay` on page 140

Channel Table Sort Order

You can sort channels in the Channel Table result display in two ways:

"Code Order" First, all midambles are listed, then all control channels and last all data channels
The midambles are sorted according to their midamble shifts. Active and inactive channels are projected to a spreading factor of 16 and sorted according to their code numbers.

"Midamble Order" All control and data channels are assigned to the midambles they belong to; the midambles are in ascending order
The TD-SCDMA application automatically distinguishes between common and default midamble allocation. If neither a common nor a default midamble allocation is found, sorting is in code order.
The allocation of code to midamble is specified in the TD-SCDMA standard. (See also Chapter 4.4, "Data Fields and Midambles", on page 39).

Remote command:
`CONFigure:CDPower:CTABle:ORDer` on page 140

Show DwPTS Results (BTS mode)
Displays additional information on the "Downlink Pilot Time Slot" (DwPTS, see also Chapter 4.2, "Frames, Subframes and Slots", on page 34) in the Result Summary.

Remote command:
`[SENSe:]CDPower:PTS` on page 141

Show UpPTS Results (UE mode)
Displays additional information on the "Uplink Pilot Time Slot" (UpPTS, see also Chapter 4.2, "Frames, Subframes and Slots", on page 34) in the Result Summary.

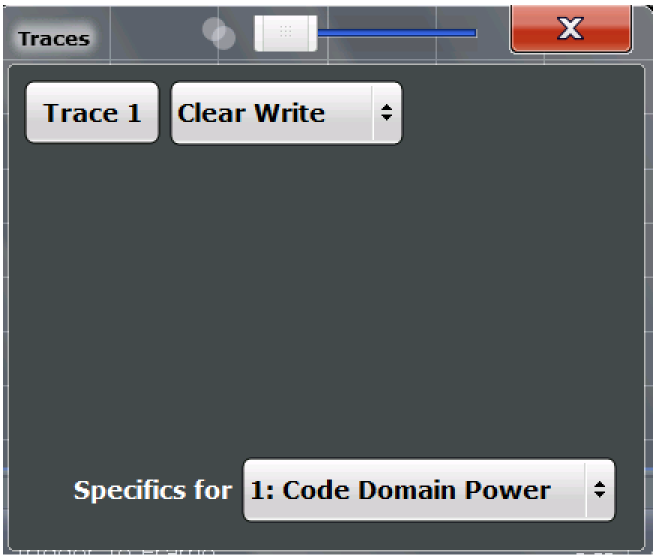
Remote command:
`[SENSe:]CDPower:PTS` on page 141

7.3 Traces

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

Or: TRACE > "Trace Config"

The trace settings determine how the measured data is analyzed and displayed on the screen.



In CDA evaluations, only one trace can be active in each diagram at any time.

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.
"Max Hold"	The maximum value is determined over several measurements and displayed. The R&S FPS saves each trace point in the trace memory only if the new value is greater than the previous one.
"Min Hold"	The minimum value is determined from several measurements and displayed. The R&S FPS saves each trace point in the trace memory only if the new value is lower than the previous one.
"Average"	The average is formed over several measurements.
"View"	The current contents of the trace memory are frozen and displayed.
"Blank"	Removes the selected trace from the display.

Remote command:
`DISPlay[:WINDow<n>]:TRACe<t>:MODE` on page 173

7.4 Markers

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

Or: MKR

Markers help you analyze your measurement results by determining particular values in the diagram. Thus you can extract numeric values from a graphical display.

Markers in Code Domain Analysis measurements

In Code Domain Analysis measurements, the markers are set to individual symbols, codes, slots or channels, depending on the result display. Thus you can use the markers to identify individual codes, for example.

7.4.1 Individual Marker Settings

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

Or: MKR > "Marker Config"

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

Selected Marker

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 175

`CALCulate<n>:DELTamarker<m>[:STATe]` on page 176

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 176
CALCulate<n>:MARKer<m>:X on page 175

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 175
CALCulate<n>:DELTamarker<m>[:STATe] on page 176

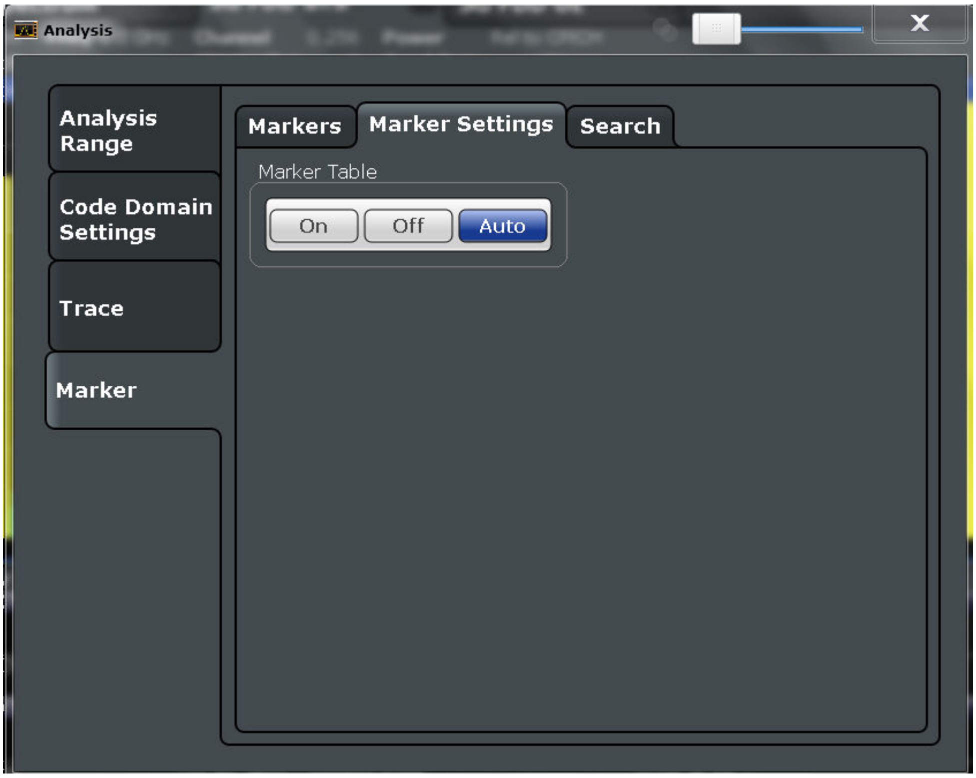
All Marker Off
Deactivates all markers in one step.

Remote command:
CALCulate<n>:MARKer<m>:AOFF on page 175

7.4.2 General Marker Settings

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

Or: MKR > "Marker Config" > "Marker Settings" tab



Marker Table Display

Defines how the marker information is displayed.

"On" Displays the marker information in a table in a separate area beneath the diagram.

"Off" 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.

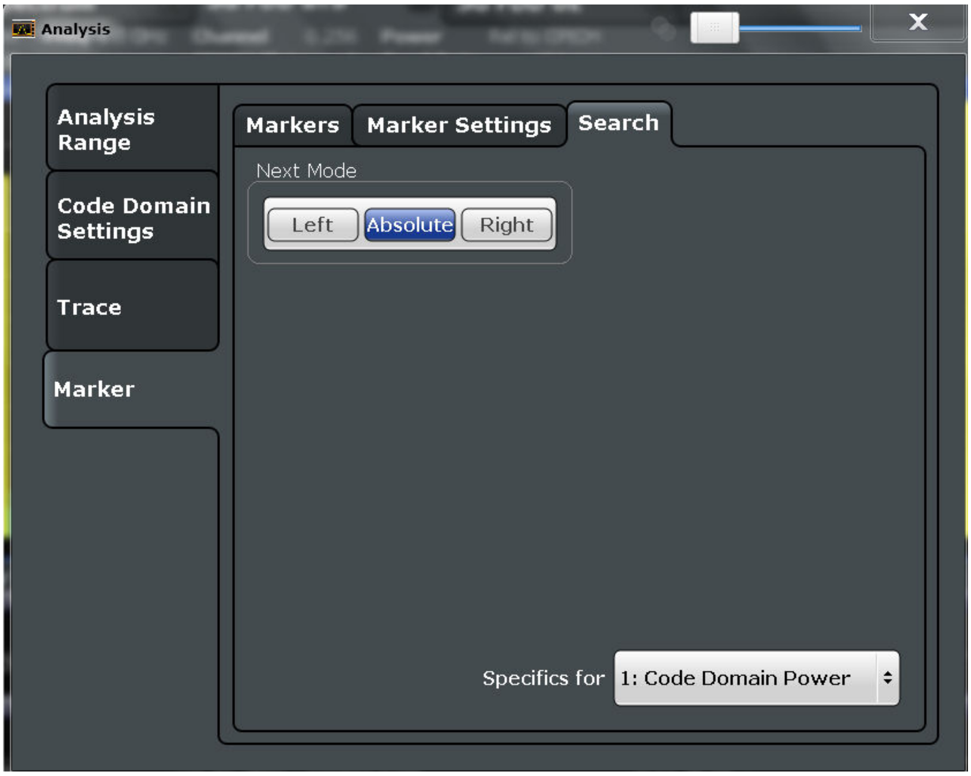
Remote command:
`DISPlay[:WINDow<n>]:MTABle` on page 178

7.4.3 Marker Search Settings

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

Access: MKR -> > "Search Config"

Several functions are available to set the marker to a specific position very quickly and easily. In order to determine the required marker position, searches can be performed. The search results are affected by special settings.



Search Mode for Next Peak
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 10.10.2.3, "Positioning the Marker", on page 178

7.4.4 Marker Positioning Functions

Access: MKR ->

The following functions set the currently selected marker to the result of a peak search.

Markers in Code Domain Analysis measurements

In Code Domain Analysis measurements, the markers are set to individual symbols, codes, slots or channels, depending on the result display. Thus you can use the markers to identify individual codes, for example.

Search Next Peak

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 179
`CALCulate<n>:MARKer<m>:MAXimum:RIGHt` on page 179
`CALCulate<n>:MARKer<m>:MAXimum:LEFT` on page 178
`CALCulate<n>:DELTamarker<m>:MAXimum:NEXT` on page 181
`CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt` on page 182
`CALCulate<n>:DELTamarker<m>:MAXimum:LEFT` on page 181

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 180
`CALCulate<n>:MARKer<m>:MINimum:LEFT` on page 179
`CALCulate<n>:MARKer<m>:MINimum:RIGHt` on page 180
`CALCulate<n>:DELTamarker<m>:MINimum:NEXT` on page 182
`CALCulate<n>:DELTamarker<m>:MINimum:LEFT` on page 182
`CALCulate<n>:DELTamarker<m>:MINimum:RIGHt` on page 183

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 179
`CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]` on page 181

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 180
`CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]` on page 182

8 Optimizing and Troubleshooting the Measurement

If the results do not meet your expectations, try the following methods to optimize the measurement:

Synchronization fails

- Check the frequency.
- Check the reference level.
- When using an **external trigger,** check whether an external trigger is being sent to the R&S FPS.
- Check the **carrier frequency error** (see Chapter 3.1.1, "Code Domain Parameters", on page 10)
  Frequency differences between the transmitter and receiver of more than 1.0 kHz impair synchronization of the Code Domain Power measurement. If at all possible, the transmitter and the receiver should be synchronized.
- Check the **chip rate error**. A large chip rate error results in symbol errors and, therefore, in possible synchronization errors for code domain measurements.

EVM and Error results are too high

Only the channels detected as being active are used to generate the ideal reference signal. If a channel is not detected as being active, e.g. on account of low power, the difference between the test signal and the reference signal and therefore the (composite) EVM and code domain errors are very large.

Distortions also occur if unassigned codes are wrongly given the status of "active channel". To obtain reliable measurement results, select an adequate **channel threshold**.

8.1 Error Messages

Error messages are entered in the error/event queue of the status reporting system in the remote control mode and can be queried with the command `SYSTem:ERRor?`.

A short explanation of the device-specific error messages for the TD-SCDMA applications is given below.

Status bar message	Description
Sync not found	This message is displayed if synchronization is not possible. Possible causes are that frequency, level, scrambling code, Invert Q values are set incorrectly, or the input signal is invalid.

9 How to Perform Measurements in TD-SCDMA Applications

The following step-by-step instructions demonstrate how to perform measurements with the TD-SCDMA applications.

The following tasks are described:

- To perform Code Domain Analysis
- To define or edit a channel table
- To perform a Power vs Time check
- To perform an RF measurement
- To select the application data for MSRA measurements

To perform Code Domain Analysis

1. Press the MODE key and select the "TD-SCDMA BTS" applications for base station tests, or "TD-SCDMA UE" for user equipment tests.

   Code Domain Analysis of the input signal is performed by default.
2. Select the "Overview" softkey to display the "Overview" for Code Domain Analysis.
3. Select the "Input/Frontend" button and then the "Frequency" tab to define the input signal's center frequency.
4. Select the "Amplitude" tab to define the reference level and other settings concerning the expected power levels.
5. Optionally, in the "Overview", select the "Trigger" button and define a trigger for data acquisition, for example an external trigger to start capturing data only when a useful signal is transmitted.
6. Select the "Signal Capture" button and define the acquisition parameters for the input signal, i.e. how many sets and slots are to be captured.
   In MSRA mode, define the application data instead, see "To select the application data for MSRA measurements" on page 99.
7. Select the "Synchronization" button and define the channel synchronization settings, i.e. the maximum number of users and the scrambling code to be expected in the input signal.
8. Select the "Channel Detection" button and define how the individual channels are to be detected within the input signal. If necessary, define a channel table as described in "To define or edit a channel table" on page 97.
9. Select the "Display Config" button and select the evaluation methods that are of interest to you.
   Arrange them on the display to suit your preferences.
10. Exit the SmartGrid mode and select the "Overview" softkey to display the "Overview" again.

11. Select the "Analysis" button in the "Overview" to configure how the data is evaluated in the individual result displays.
    - Select the channel, slot and set to be evaluated.
    - Configure specific settings for the selected evaluation method(s).
    - Optionally, configure the trace to display the average over a series of measurements. If necessary, increase the "Sweep/Average Count" in the "Sweep Config" dialog box.
    - Configure markers and delta markers to determine deviations and offsets within the results, e.g. when comparing errors or peaks.
12. Start a new measurement with the defined settings.
    In MSRA mode you may want to stop the continuous measurement mode by the Sequencer and perform a single data acquisition:
    a) Select the Sequencer icon () from the toolbar.
    b) Set the Sequencer state to "OFF".
    c) Press the RUN SINGLE key.

To define or edit a channel table

Channel tables contain a list of channels to be detected and their specific parameters. You can create user-defined and edit pre-defined channel tables.

1. Select the "Channel Detection" softkey from the main "Code Domain Analyzer" menu to open the "Channel Detection" dialog box.
2. To define a new channel table, select the "New" button next to the "Predefined Tables" list.
   To edit an existing channel table:
   a) Select the existing channel table in the "Predefined Tables" list.
   b) Select the "Edit" button next to the "Predefined Tables" list.
3. In the "Channel Table" dialog box, define a name and, optionally, a comment that describes the channel table. The comment is displayed when you set the focus on the table in the "Predefined Tables" list.
4. Define the maximum number of users ("MA Shifts Cell") to be used for the channel table.
5. 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.
6. 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.

7. 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) Close the dialog box.
   e) Start a new measurement.

To perform a Power vs Time check

The Power vs Time measurement checks the signal power in the time domain against a transmission power mask defined by the TD-SCDMA specification (for details see "Power vs Time" on page 25).

1. Press the MODE key and select the "TD-SCDMA BTS" applications for base station tests, or "TD-SCDMA UE" for user equipment tests.

   Code Domain Analysis of the input signal is performed by default.

2. Switch to the Power vs Time measurement:
   a) Press the MEAS key.
   b) In the "Select Measurement" dialog box, select the "Power vs Time" button.

3. For downlink measurements (BTS application) only:
   Select the "Switching Point" softkey to define the slot which separates the uplink from the downlink data. Only the slots for downlink data are measured and checked against the transmission power mask.
   (For uplink measurements, the application always measures slot 1, thus the switching point is irrelevant.)

4. For downlink measurements (BTS application):
   Select the "Auto Level & Time" softkey to adjust the reference level and the trigger offset to subframe start to their optimum levels for the current signal.
   For uplink measurements, select the "Adapt to Signal" softkey and then the "Auto Level & Time" button to adjust the reference level and the trigger offset to subframe start automatically.

5. Select the "No. of Subframes" softkey to define how many slots are taken into consideration for the Power vs Time results.

6. Optionally, press the TRIGGER key and define a trigger for the measurement, for example an external trigger to start measuring only when a useful signal is transmitted.

7. Select the "Start Meas" softkey or press the RUN SINGLE key to start a new measurement.

   The Power vs Time diagram is displayed, averaged over the defined number of subframes. The result of the limit check against the transmission power mask is also indicated.

8. To display the numerical results, select the "Display Config" softkey and drag the "Evaluation List" result to the display.

To perform an RF measurement

1. Press the MODE key and select the "TD-SCDMA BTS" applications for base station tests, or "TD-SCDMA UE" for user equipment tests.

   Code Domain Analysis of the input signal is performed by default.

2. Select the RF measurement:

   a) Press the MEAS key.
   b) In the "Select Measurement" dialog box, select the required measurement.

   The selected measurement is activated with the default settings for TD-SCDMA mode immediately.

3. If necessary, adapt the settings as described for the individual measurements in the R&S FPS User Manual.

4. Select the "Display Config" button and select the evaluation methods that are of interest to you.
   Arrange them on the display to suit your preferences.

5. Exit the SmartGrid mode and select the "Overview" softkey to display the "Overview" again.

6. Select the "Analysis" button in the "Overview" to make use of the advanced analysis functions in the result displays.

   - Configure a trace to display the average over a series of sweeps; if necessary, increase the "Sweep Count" in the "Sweep" settings.
   - Configure markers and delta markers to determine deviations and offsets within the evaluated signal.
   - Use special marker functions to calculate noise or a peak list.
   - Configure a limit check to detect excessive deviations.

7. Optionally, export the trace data of the graphical evaluation results to a file.

   a) In the "Traces" tab of the "Analysis" dialog box, switch to the "Trace Export" tab.
   b) Select "Export Trace to ASCII File".
   c) Define a file name and storage location and select "OK".

To select the application data for MSRA measurements

In multi-standard radio analysis you can analyze the data captured by the MSRA Master in the TD-SCDMA BTS application. Assuming you have detected a suspect area of the captured data in another application, you would now like to analyze the same data in the TD-SCDMA BTS application.

1. Select the "Overview" softkey to display the "Overview" for Code Domain Analysis.

2. Select the "Signal Capture" button.

3. Define the application data range as the "Capture Length (Slots)".
4. Define the starting point of the application data as the "Capture offset". The offset is calculated according to the following formula:
   <capture offset> = *<starting point for application>* - *<starting point in capture buffer>*
5. The analysis interval is automatically determined according to the selected channel, slot or set to analyze (defined for the evaluation range), depending on the result display. Note that the set/slot/channel is analyzed *within the application data*. If the analysis interval does not yet show the required area of the capture buffer, move through the sets/slots/channels in the evaluation range or correct the application data range.
6. If the Sequencer is off, select the "Refresh" softkey in the "Sweep" menu to update the result displays for the changed application data.

10 Remote Commands for TD-SCDMA Measurements

The following commands are required to perform measurements in TD-SCDMA applications in a remote environment. It assumes that the R&S FPS has already been set up for remote operation in a network as described in the base unit manual.

Note that basic tasks that are also performed in the base unit in the same way are not described here. For a description of such tasks, see the R&S FPS User Manual.

In particular, this includes:

- Managing Settings and Results, i.e. storing and loading settings and result data
- Basic instrument configuration, e.g. checking the system configuration, customizing the screen layout, or configuring networks and remote operation
- Using the common status registers

The following topics specific to TD-SCDMA applications 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, in most cases, one or more parameters. To use a command as a query, you have to append a question mark after the last header element, even if the command contains a parameter.

A header contains one or more keywords, separated by a colon. Header and parameters are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). If there is more than one parameter for a command, these are separated by a comma from one another.

Only the most important characteristics that you need to know when working with SCPI commands are described here. For a more complete description, refer to the User Manual of the R&S FPS.

Remote command examples

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

10.1.1 Conventions used in Descriptions

Note the following conventions used in the remote command descriptions:

- **Command usage**
  If not specified otherwise, commands can be used both for setting and for querying parameters.
  If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.
- **Parameter usage**
  If not specified otherwise, a parameter can be used to set a value and it is the result of a query.
  Parameters required only for setting are indicated as **Setting parameters**.
  Parameters required only to refine a query are indicated as **Query parameters**.
  Parameters that are only returned as the result of a query are indicated as **Return values**.
- **Conformity**
  Commands that are taken from the SCPI standard are indicated as **SCPI confirmed**. All commands used by the R&S FPS follow the SCPI syntax rules.
- **Asynchronous commands**
  A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an **Asynchronous command**.
- **Reset values (*RST)**
  Default parameter values that are used directly after resetting the instrument (`*RST` command) are indicated as ***RST** values, if available.
- **Default unit**
  This is the unit used for numeric values if no other unit is provided with the parameter.
- **Manual operation**
  If the result of a remote command can also be achieved in manual operation, a link to the description is inserted.

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 upper case letters. Note however, that this emphasis only serves the purpose to distinguish the short from the long form in the manual. For the instrument, the case does not matter.

Example:

`SENSe:FREQuency:CENTer` is the same as `SENS:FREQ:CENT`.

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 don't quote a suffix for keywords that support one, a 1 is assumed.

Example:

`DISPlay[:WINDow<1...4>]:ZOOM:STATe` enables the zoom in a particular measurement window, selected by the suffix at `WINDow`.

`DISPlay:WINDow4:ZOOM:STATe ON` refers to window 4.

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.

Note that if an optional keyword has a numeric suffix and you need to use the suffix, you have to include the optional keyword. Otherwise, the suffix of the missing keyword is assumed to be the value 1.

Optional keywords are emphasized with square brackets.

Example:

Without a numeric suffix in the optional keyword:

`[SENSe:]FREQuency:CENTer` is the same as `FREQuency:CENTer`

With a numeric suffix in the optional keyword:

`DISPlay[:WINDow<1...4>]:ZOOM:STATe`

`DISPlay:ZOOM:STATe ON` enables the zoom in window 1 (no suffix).

`DISPlay:WINDow4:ZOOM:STATe ON` enables the zoom in window 4.

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, these are separated by a comma.

Example:

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

Parameters may 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. In case of physical quantities, you can also add the unit. If the unit is missing, the command uses the basic unit.

Example:

With unit: `SENSe:FREQuency:CENTer 1GHZ`

Without unit: `SENSe:FREQuency:CENTer 1E9` would also set a frequency of 1 GHz.

Values exceeding the resolution of the instrument are rounded up or down.

If the number you have entered is not supported (e.g. in case of discrete steps), the command returns an error.

Instead of a number, you can also set numeric values with a text parameter in special cases.

- MIN/MAX
  Defines the minimum or maximum numeric value that is supported.
- DEF
  Defines the default value.

- UP/DOWN
  Increases or decreases the numeric value by one step. The step size depends on the setting. In some cases you can customize the step size with a corresponding command.

Querying numeric values

When you query numeric values, the system returns a number. In case of physical quantities, it applies the basic unit (e.g. Hz in case of frequencies). The number of digits after the decimal point depends on the type of numeric value.

Example:

Setting: `SENSe:FREQuency:CENTer 1GHZ`

Query: `SENSe:FREQuency:CENTer?` would return `1E9`

In some cases, numeric values may be returned as text.

- INF/NINF
  Infinity or negative infinity. Represents the numeric values 9.9E37 or -9.9E37.
- NAN
  Not a number. Represents the numeric value 9.91E37. NAN is returned in case of errors.

10.1.6.2 Boolean

Boolean parameters represent two states. The "ON" state (logically true) is represented by "ON" or a numeric value 1. The "OFF" state (logically untrue) is represented by "OFF" or the numeric value 0.

Querying Boolean parameters

When you query Boolean parameters, the system returns either the value 1 ("ON") or the value 0 ("OFF").

Example:

Setting: `DISPlay:WINDow:ZOOM:STATe ON`

Query: `DISPlay:WINDow:ZOOM:STATe?` would return `1`

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 103.

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. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all end or other control signs are ignored until all bytes are transmitted. #0 specifies a data block of indefinite length. The use of the indefinite format requires an `NL^END` message to terminate the data block. This format is useful when the length of the transmission is not known or if speed or other considerations prevent segmentation of the data into blocks of definite length.

10.2 Common Suffixes

In the R&S FPS TD-SCDMA Measurements application, the following common suffixes are used in remote commands:

Table 10-1: Common suffixes used in remote commands in the R&S FPS TD-SCDMA Measurements application

Suffix	Value range	Description
<m>	1 to 4 (RF: 1 to 16)	Marker
<n>	1 to 16	Window (**in the currently selected channel**)
<t>	1 (RF: 1 to 6)	Trace

10.3 Activating the TD-SCDMA Applications

TD-SCDMA measurements require a special application on the R&S FPS. The measurement is started immediately with the default settings.

INSTrument:CREate:DUPLicate

This command duplicates the currently selected channel, i.e creates a new channel of the same type and with the identical measurement settings. The name of the new channel is the same as the copied channel, extended by a consecutive number (e.g. "IQAnalyzer" -> "IQAnalyzer 2").

The channel to be duplicated must be selected first using the `INST:SEL` command.

This command is not available if the MSRA Master channel is selected.

Example: `INST:SEL 'IQAnalyzer'`
`INST:CRE:DUPL`
Duplicates the channel named 'IQAnalyzer' and creates a new channel named 'IQAnalyzer2'.

Usage: Event

INSTrument:CREate[:NEW] <ChannelType>, <ChannelName>

This command adds an additional channel.

The number of channels you can configure at the same time depends on available memory.

Parameters:

<ChannelType> Channel type of the new channel.
For a list of available channel types see `INSTrument:LIST?` on page 108.

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the channel.
Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see `INSTrument:LIST?` on page 108).

Example: `INST:CRE IQ, 'IQAnalyzer2'`
Adds an additional I/Q Analyzer channel named "IQAnalyzer2".

INSTrument:CREate:REPLace <ChannelName1>,<ChannelType>,<ChannelName2>

This command replaces a channel with another one.

Setting parameters:

<ChannelName1> String containing the name of the channel you want to replace.

<ChannelType> Channel type of the new channel.
For a list of available channel types see `INSTrument:LIST?` on page 108.

<ChannelName2> String containing the name of the new channel.
Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see `INSTrument:LIST?` on page 108).

Example: `INST:CRE:REPL 'IQAnalyzer2',IQ,'IQAnalyzer'`
Replaces the channel named "IQAnalyzer2" by a new channel of type "IQ Analyzer" named "IQAnalyzer".

Usage: Setting only

INSTrument:DELete <ChannelName>

This command deletes a channel.

If you delete the last channel, the default "Spectrum" channel is activated.

Parameters:

<ChannelName> String containing the name of the channel you want to delete.
A channel must exist in order to be able delete it.

Example: `INST:DEL 'IQAnalyzer4'`
Deletes the channel with the name 'IQAnalyzer4'.

Usage: Event

INSTrument:LIST?

This command queries all active channels. This is useful in order to obtain the names of the existing channels, which are required in order to replace or delete the channels.

Return values:

<ChannelType>, <ChannelName> For each channel, the command returns the channel type and channel name (see tables below).
Tip: to change the channel name, use the `INSTrument:REName` command.

Example: `INST:LIST?`
Result for 3 channels:
`'ADEM','Analog Demod','IQ','IQ Analyzer','IQ','IQ Analyzer2'`

Usage: Query only

Table 10-2: Available channel types and default channel names in Signal and Spectrum Analyzer mode

Application	<ChannelType> Parameter	Default Channel Name*)
Spectrum	SANALYZER	Spectrum
1xEV-DO BTS (R&S FPS-K84)	BDO	1xEV-DO BTS
1xEV-DO MS (R&S FPS-K85)	MDO	1xEV-DO MS
3GPP FDD BTS (R&S FPS-K72)	BWCD	3G FDD BTS
3GPP FDD UE (R&S FPS-K73)	MWCD	3G FDD UE
Analog Demodulation (R&S FPS-K7)	ADEM	Analog Demod
cdma2000 BTS (R&S FPS-K82)	BC2K	CDMA2000 BTS
cdma2000 MS (R&S FPS-K83)	MC2K	CDMA2000 MS
GSM (R&S FPS-K10)	GSM	GSM
I/Q Analyzer	IQ	IQ Analyzer
LTE (R&S FPS-K10x)	LTE	LTE
NB-IoT (R&S FPS-K106)	NIOT	NB-IoT
Noise (R&S FPS-K30)	NOISE	Noise
Phase Noise (R&S FPS-K40)	PNOISE	Phase Noise
TD-SCDMA BTS (R&S FPS-K76)	BTDS	TD-SCDMA BTS
TD-SCDMA UE (R&S FPS-K77)	MTDS	TD-SCDMA UE
Verizon 5GTF Measurement Application (V5GTF, R&S FPS-K118)	V5GT	V5GT
VSA (R&S FPS-K70)	DDEM	VSA
WLAN (R&S FPS-K91)	WLAN	WLAN
*) the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.		

INSTrument:REName <ChannelName1>, <ChannelName2>

This command renames a channel.

Parameters:

<ChannelName1> String containing the name of the channel you want to rename.

<ChannelName2> String containing the new channel name.
Note that you cannot assign an existing channel name to a new channel; this will cause an error.

Example: `INST:REN 'IQAnalyzer2','IQAnalyzer3'`
Renames the channel with the name 'IQAnalyzer2' to 'IQAnalyzer3'.

Usage: Setting only

INSTrument[:SELect] <Mode>

This command activates a new measurement channel with the defined channel type, or selects an existing measurement channel with the specified name.

Also see

- `INSTrument:CREate[:NEW]` on page 107

Parameters:

<Mode> **BTDS**
TD-SCDMA BTS mode (R&S FPS-K76 option)

MTDS
TD-SCDMA UE mode (R&S FPS-K77 option)

SYSTem:PRESet:CHANnel[:EXEC]

This command restores the default instrument 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 48

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 9.

CONFigure:CDPower:MEASurement <Measurement>

This command selects the measurement type for the TD-SCDMA BTS application.

For details on these measurements see Chapter 3.2, "Frequency and Time Domain Measurements", on page 24.

Parameters:

<Measurement>

ACLR
Adjacent Channel Power

CCDF
Complementary Cumulative Distribution Function

CDPower
Code Domain Power

ESPectrum
Spectrum Emission Mask

OBWidth
Occupied Bandwidth

POWer
Channel Power

PVTime
Power vs Time

*RST: CDPower

Example:

`CONF:CDP:MEAS POW`
Selects Signal Channel Power measurement.

Manual operation:

See "Power vs Time" on page 25
See "Power" on page 27
See "Channel Power ACLR" on page 27
See "Spectrum Emission Mask" on page 28
See "Occupied Bandwidth" on page 29
See "CCDF" on page 30
See "Creating a New Channel Table from the Measured Signal (Measure Table)" on page 70

10.5 Configuring Code Domain Analysis

The following commands are required to configure Code Domain Analysis.

10.5.1 Configuring the Data Input and Output

10.5.1.1 RF Input

INPut:COUPling <CouplingType>

This command selects the coupling type of the RF input.

Parameters:

<CouplingType>

AC
AC coupling

DC
DC coupling

*RST: AC

Example: `INP:COUP DC`

Manual operation: See " Input Coupling " on page 50

INPut:DPATh <State>

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

Parameters:

<State>

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

OFF | 0
The analog mixer path is always used.

*RST: 1

Example: `INP:DPAT OFF`

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

This command turns the YIG-preselector on and off.

Note the special conditions and restrictions for the YIG-preselector described in " YIG-Preselector " on page 50.

Parameters:
<State> ON | OFF | 0 | 1
*RST: 1 (0 for I/Q Analyzer, GSM, VSA, Pulse, Amplifier measurements)

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

Manual operation: See " YIG-Preselector " on page 50

INPut:IMPedance <Impedance>

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

Parameters:
<Impedance> 50 | 75
*RST: 50 Ω

Example: `INP:IMP 75`

Manual operation: See " Impedance " on page 50

INPut:SELect <Source>

This command selects the signal source for measurements, i.e. it defines which connector is used to input data to the R&S FPS.

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

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

Manual operation: See " Radio Frequency State " on page 50

10.5.1.2 Configuring the Outputs

The following commands are required to provide output from the R&S FPS.

Configuring trigger input/output is described in Chapter 10.5.3.2, "Configuring the Trigger Output", on page 124.

DIAGnostic:SERVice:NSOurce <State>

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

Suffix:
<n> Window

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

*RST: 0

Example: `DIAG:SERV:NSO ON`

Manual operation: See "Noise Source Control" on page 51

10.5.2 Frontend Configuration

The following commands configure frequency, amplitude and y-axis scaling settings, which represent the "frontend" of the measurement setup.

10.5.2.1 Frequency

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency.

Parameters:
<Frequency> The allowed range and f_{max} is specified in the data sheet.

UP
Increases the center frequency by the step defined using the `[SENSe:]FREQuency:CENTer:STEP` command.

DOWN
Decreases the center frequency by the step defined using the `[SENSe:]FREQuency:CENTer:STEP` command.

*RST: 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 56

[SENSe:]FREQuency:CENTer:STEP <StepSize>

This command defines the center frequency step size.

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 56

[SENSe:]FREQuency:CENTer:STEP:AUTO <State>

This command couples or decouples the center frequency step size to the span.

In time domain (zero span) measurements, the center frequency is coupled to the RBW.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example:

```
FREQ:CENT:STEP:AUTO ON
```

Activates the coupling of the step size to the span.

[SENSe:]FREQuency:OFFSet <Offset>

This command defines a frequency offset.

If this value is not 0 Hz, the application assumes that the input signal was frequency shifted outside the application. All results of type "frequency" will be corrected for this shift numerically by the application.

Note: In MSRA mode, the setting command is only available for the MSRA Master. For MSRA slave applications, only the query command is available.

Parameters:

<Offset> Range: -100 GHz to 100 GHz
*RST: 0 Hz

Example:

```
FREQ:OFFS 1GHZ
```

Manual operation: See " Frequency Offset " on page 56

10.5.2.2 Amplitude and Scaling Settings

The following commands are required to configure the amplitude and scaling settings in a remote environment.

Useful commands for amplitude settings described elsewhere:

- `INPut:COUPling` on page 112
- `INPut:IMPedance` on page 113
- `[SENSe:]ADJust:LEVel` on page 138

Remote commands exclusive to amplitude settings:

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

Automatic scaling of the y-axis is performed once, then switched off again (for all traces).

Suffix:

<n>	Window
<t>	irrelevant

Manual operation: See " Auto Scale Once " on page 55

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum <Value>

This command defines the maximum value of the y-axis for all traces in the selected result display.

Suffix:

<n>	Window
<t>	irrelevant

Parameters:

<Value> <numeric value>

*RST: depends on the result display
The unit and range depend on the result display.

Example:

```
DISP:TRAC:Y:MIN -60
DISP:TRAC:Y:MAX 0
```

Defines the y-axis with a minimum value of -60 and maximum value of 0.

Manual operation: See "Y-Maximum, Y-Minimum" on page 55

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum <Value>

This command defines the minimum value of the y-axis for all traces in the selected result display.

Suffix:

<n> Window

<t> irrelevant

Parameters:

<Value> <numeric value>

*RST: depends on the result display

The unit and range depend on the result display.

Example:
```
DISP:TRAC:Y:MIN -60
DISP:TRAC:Y:MAX 0
```
Defines the y-axis with a minimum value of -60 and maximum value of 0.

Manual operation: See "Y-Maximum, Y-Minimum" on page 55

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:PDIVision <Value>

This remote command determines the grid spacing on the Y-axis for all diagrams, where possible.

Suffix:

<n> Window

<t> irrelevant

Parameters:

<Value> numeric value WITHOUT UNIT (unit according to the result display)

Defines the range per division (total range = 10*<Value>)

*RST: depends on the result display

Example:
```
DISP:TRAC:Y:PDIV 10
```
Sets the grid spacing to 10 units (e.g. dB) per division

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel <ReferenceLevel>

This command defines the reference level (for all traces in all windows).

Suffix:

<n>, <t> irrelevant

Example:
```
DISP:TRAC:Y:RLEV -60dBm
```

Manual operation: See " Reference Level " on page 52

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Offset>

This command defines a reference level offset (for all traces in all windows).

Suffix:
<n>, <t> irrelevant

Parameters:
<Offset> Range: -200 dB to 200 dB
*RST: 0dB

Example: `DISP:TRAC:Y:RLEV:OFFS -10dB`

Manual operation: See " Shifting the Display (Offset)" on page 53

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RPOSition <Position>

This command defines the vertical position of the reference level on the display grid (for all traces).

The R&S FPS adjusts the scaling of the y-axis accordingly.

Suffix:
<n> Window

<t> irrelevant

Parameters:
<Position> 0 PCT corresponds to the lower display border, 100% corresponds to the upper display border.
*RST: 100 PCT = frequency display; 50 PCT = time display

Example: `DISP:TRAC:Y:RPOS 50PCT`

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RVALue <Value>

The command defines the power value assigned to the reference position in the grid (for all traces).

For external generator calibration measurements (requires the optional External Generator Control), this command defines the power offset value assigned to the reference position.

Suffix:
<n> Window

<t> irrelevant

Parameters:
<Value> *RST: 0 dBm, coupled to reference level

Example: `DISP:TRAC:Y:RVAL -20dBm`
Sets the power value assigned to the reference position to -20 dBm

INPut:GAIN:STATe <State>

This command turns the preamplifier on and off.

If activated, the input signal is amplified by 20 dB.

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

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

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

Example: `INP:GAIN:STAT ON`
Switches on 20 dB preamplification.

Manual operation: See " Preamplifier (option B22/B24)" on page 54

10.5.2.3 Configuring the Attenuation

INPut:ATTenuation <Attenuation>

This command defines the total attenuation for RF input.

If an electronic attenuator is available and active, the command defines a mechanical attenuation (see `INPut:EATT:STATe` on page 121).

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.

Parameters:

<Attenuation> Range: see data sheet
Increment: 5 dB (with optional electr. attenuator: 1 dB)
*RST: 10 dB (AUTO is set to ON)

Example: `INP:ATT 30dB`
Defines a 30 dB attenuation and decouples the attenuation from the reference level.

Manual operation: See " Attenuation Mode / Value " on page 53

INPut:ATTenuation:AUTO <State>

This command couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S FPS determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

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 53

INPut:EATT <Attenuation>

This command defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see `INPut:EATT:AUTO` on page 120).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

This command requires the electronic attenuation hardware option.

Parameters:

<Attenuation> attenuation in dB

Range: see data sheet
Increment: 1 dB
*RST: 0 dB (OFF)

Example:
```
INP:EATT:AUTO OFF
INP:EATT 10 dB
```

Manual operation: See " Using Electronic Attenuation " on page 54

INPut:EATT:AUTO <State>

This command turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

This command requires the electronic attenuation hardware option.

Parameters:

<State> 1 | 0 | ON | OFF

1 | ON

0 | OFF

*RST: 1

Example: `INP:EATT:AUTO OFF`

Manual operation: See " Using Electronic Attenuation " on page 54

INPut:EATT:STATe <State>

This command turns the electronic attenuator on and off.

This command requires the electronic attenuation hardware option.

Parameters:

<State> 1 | 0 | ON | OFF

1 | ON

0 | OFF

*RST: 0

Example: `INP:EATT:STAT ON`
Switches the electronic attenuator into the signal path.

Manual operation: See " Using Electronic Attenuation " on page 54

10.5.3 Configuring Triggered Measurements

The following commands are required to configure a triggered measurement in a remote environment. The tasks for manual operation are described in Chapter 6.2.4, "Trigger Settings", on page 57.

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.

10.5.3.1 Configuring the Triggering Conditions

TRIGger[:SEQuence]:HOLDoff[:TIME] <Offset>

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

Parameters:

<Offset> *RST: 0 s

Example: `TRIG:HOLD 500us`

Manual operation: See " Trigger Offset " on page 59

TRIGger[:SEQuence]:IFPower:HOLDoff <Period>

This command defines the holding time before the next trigger event.

Note that this command can be used for **any trigger source**, not just IF Power (despite the legacy keyword).

Note: If you perform gated measurements in combination with the IF Power trigger, the R&S FPS ignores the holding time for frequency sweep, FFT sweep, zero span and I/Q data measurements.

Parameters:

<Period>	Range:	0 s to 10 s
	*RST:	0 s

Example:
`TRIG:SOUR EXT`
Sets an external trigger source.
`TRIG:IFP:HOLD 200 ns`
Sets the holding time to 200 ns.

Manual operation: See " Trigger Holdoff " on page 60

TRIGger[:SEQuence]:IFPower:HYSTeresis <Hysteresis>

This command defines the trigger hysteresis, which is only available for "IF Power" trigger sources.

Parameters:

<Hysteresis>	Range:	3 dB to 50 dB
	*RST:	3 dB

Example:
`TRIG:SOUR IFP`
Sets the IF power trigger source.
`TRIG:IFP:HYST 10DB`
Sets the hysteresis limit value.

Manual operation: See " Hysteresis " on page 60

TRIGger[:SEQuence]:LEVel[:EXTernal<port>] <TriggerLevel>

This command defines the level the external signal must exceed to cause a trigger event.

Suffix:
<port>
Selects the trigger port.
1 = trigger port 1 (TRIG IN connector on rear panel)
2 = trigger port 2 (TRIG AUX connector on rear panel)

Parameters:

<TriggerLevel>	Range:	0.5 V to 3.5 V
	*RST:	1.4 V

Example: `TRIG:LEV 2V`

Manual operation: See " Trigger Level " on page 59

TRIGger[:SEQuence]:SLOPe <Type>

For external and time domain trigger sources you can define whether triggering occurs when the signal rises to the trigger level or falls down to it.

Parameters:

<Type> POSitive | NEGative

POSitive
Triggers when the signal rises to the trigger level (rising edge).

NEGative
Triggers when the signal drops to the trigger level (falling edge).

*RST: POSitive

Example: `TRIG:SLOP NEG`

Manual operation: See " Slope " on page 59

TRIGger[:SEQuence]:SOURce <Source>

This command selects the trigger source.

Note on external triggers:

If a measurement is configured to wait for an external trigger signal in a remote control program, remote control is blocked until the trigger is received and the program can continue. Make sure this situation is avoided in your remote control programs.

Parameters:

<Source>

IMMediate
Free Run

EXTernal
Trigger signal from the TRIGGER IN connector.

EXT2
Trigger signal from the TRIGGER AUX connector.

RFPower
First intermediate frequency
(Frequency and time domain measurements only.)

IFPower
Second intermediate frequency
(For frequency and time domain measurements only.)

*RST: IMMediate

Example: `TRIG:SOUR EXT`
Selects the external trigger input as source of the trigger signal

Manual operation: See "Trigger Source" on page 58
See " Free Run " on page 58
See "External Trigger 1/2" on page 58
See " IF Power " on page 59

10.5.3.2 Configuring the Trigger Output

The following commands are required to send the trigger signal to one of the variable TRIGGER INPUT/OUTPUT connectors on the R&S FPS.

OUTPut:TRIGger<port>:DIRection <Direction>

This command selects the trigger direction for trigger ports that serve as an input as well as an output.

Suffix:

<port> Selects the used trigger port.
2 = TRG AUX

Parameters:

<Direction> **INPut**
Port works as an input.

OUTPut
Port works as an output.

*RST: INPut

Manual operation: See "Trigger 2" on page 60

OUTPut:TRIGger<port>:LEVel <Level>

This command defines the level of the (TTL compatible) signal generated at the trigger output.

This command works only if you have selected a user defined output with `OUTPut:TRIGger<port>:OTYPe`.

Suffix:

<port> Selects the trigger port to which the output is sent.
2 = TRG AUX

Parameters:

<Level> **HIGH**
5 V

LOW
0 V

*RST: LOW

Example: `OUTP:TRIG2:LEV HIGH`

Manual operation: See " Level " on page 61

OUTPut:TRIGger<port>:OTYPe <OutputType>

This command selects the type of signal generated at the trigger output.

Suffix:

<port> Selects the trigger port to which the output is sent.
2 = TRG AUX

Parameters:

<OutputType> **DEVice**
Sends a trigger signal when the R&S FPS has triggered internally.

TARMed
Sends a trigger signal when the trigger is armed and ready for an external trigger event.

UDEFined
Sends a user defined trigger signal. For more information see `OUTPut:TRIGger<port>:LEVel`.

*RST: DEVice

Manual operation: See " Output Type " on page 61

OUTPut:TRIGger<port>:PULSe:IMMediate

This command generates a pulse at the trigger output.

Suffix:

<port> Selects the trigger port to which the output is sent.
2 = TRG AUX

Usage: Event

Manual operation: See " Send Trigger " on page 62

OUTPut:TRIGger<port>:PULSe:LENGth <Length>

This command defines the length of the pulse generated at the trigger output.

Suffix:

<port> Selects the trigger port to which the output is sent.
2 = TRG AUX

Parameters:

<Length> Pulse length in seconds.

Example: `OUTP:TRIG2:PULS:LENG 0.02`

Manual operation: See " Pulse Length " on page 61

10.5.4 Signal Capturing

The following commands are required to configure how much and how data is captured from the input signal.

MSRA operating mode

In MSRA operating mode, only the MSRA Master channel actually captures data from the input signal. The data acquisition settings for the TD-SCDMA application in MSRA mode define the **application data** (see also Chapter 10.12, "Configuring the Slave Application Data Range (MSRA mode only)", on page 185).

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

Useful commands when defining signal capturing described elsewhere:

- `[SENSe:]CDPower:SET` on page 139

Remote commands exclusive to defining signal capturing:

[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 63

[SENSe:]CDPower:IQLength <CaptureLength>

This command specifies the number of slots that are captured by one measurement. If more than one set is to be captured (see `[SENSe:]CDPower:SET:COUNt` on page 127), the number of slots is automatically set to the maximum of 64.

Parameters:

<CaptureLength> Range: 2 to 64
*RST: 7

Example: `SENS:CDP:IQLength 3`

Manual operation: See "Number of Slots to Capture" on page 63

[SENSe:]SWAPiq <State>

This command 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 FPS 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

[SENSe:]CDPower:SET:COUNt <NoOfSets>

This command sets the number of sets to be captured and stored in the instrument's memory.

Refer to "Set Count" on page 63 for more information.

Parameters:

<NoOfSets>
Range: 1 to TDS: 99; CDMA: 490
Increment: 1
*RST: 1

Example: `CDP:SET:COUN 12`
Sets the number of sets to 12.

Mode: TDS

Manual operation: See "Set Count" on page 63

10.5.5 Synchronization

The individual channels in the input signal need to be synchronized to detect timing offsets in the slot spacings. These commands are described here.

Remote commands exclusive to synchronization:

[SENSe:]CDPower:MSHift <MaxMAShift>

This command sets the maximum number of usable midamble shifts (= number of users) on the base station.

If you use a predefined channel table, this value is replaced by that of the channel table (see `CONFigure:CDPower:CTABle:MSHift` on page 135).

Parameters:

<MaxMAShift> Range: 2 to 16
Increment: 2
*RST: 16

Example: `CDP:MSH 10`
Sets the maximum number of midamble shifts to 10.

Manual operation: See "MA Shift Cell / Number of Users" on page 65

[SENSe:]CDPower:SCODe <numeric value>

This command sets the scrambling code of the base station.

Parameters:

<numeric value> Range: 0 to 127
Increment: 1
*RST: 0

Example: `CDP:SCOD 28`
Sets scrambling code 28.

Manual operation: See "Scrambling Code" on page 64

[SENSe:]CDPower:STSLot <State>

This command selects the phase reference for synchronization (see "Sync To" on page 65).

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
The instrument synchronizes to the midamble of the selected slot.

OFF | 0
BTS application:
The instrument synchronizes to the P-CCPCH in slot 0.
UE application:
The instrument synchronizes to the channel of the selected slot.

*RST: 0

Example: `CDP:SLOT 7`
Selects slot number 7.
`CDP:STSL ON`
Activates synchronizing to the midamble of slot 7.

Manual operation: See "Sync To" on page 65

[SENSe:]CDPower:STSLot:MODE <Mode>

This command selects the phase reference for synchronization (see "Sync To" on page 65).

Parameters:
<Mode> CODE | MA

CODE
The instrument synchronizes to the P-CCPCH in slot 0.

MA
The instrument synchronizes to the midamble of the selected slot.

*RST: MA

Example: `CDP:STSL:MODE CODE`
Activates channel synchronizing

Mode: UE only

Manual operation: See "Sync To" on page 65

[SENSe:]CDPower:STSLot:ROTate <Mode>

By default, the TD-SCDMA application determines one phase reference for all midambles and channels of a data slot. If this function is enabled, phase rotations between the channels are allowed. Each channel gets its own phase reference from the associated midamble according to section AA.2 of the standard document 3GPP TS 25.221. If the associated midamble is missing, the common phase reference is used for this channel.

Parameters:
<Mode> ON | OFF | 1 | 0

*RST: 0

Example: `CDP:STSL:ROT ON`
Allows phase rotations between channels.

Manual operation: See "Rotate code channel to associated midamble" on page 66

[SENSe:]CDPower:SULC <SyncUL>

Defines the code used for synchronization on the UpPTS (see "Time Reference (UE mode)" on page 65).

This command is available for UE mode (K77) only.

Parameters:

<SyncUL> integer

For details on available values depending on the scrambling code see Table 4-1.

Range: 0 to 255
*RST: 0

Example: `CDP:SULC 28`
Sets the code 28.

Manual operation: See "SYNC-UL Code (UE only)" on page 65

[SENSe:]CDPower:TREF <numeric value>

Defines which slot is used as a time reference for synchronization.

Parameters:

<numeric value>

DPTS
Uses the Downlink Pilot Time Slot (DwPTS) as a time reference

UPTS
Uses the Uplink Pilot Time Slot (UpPTS) as a time reference

SLOT
Uses slot 0 (BTS mode) or slot 1 (UE mode) as a time reference

*RST: SLOT

Example: `CDP:TREF DPTS`

Manual operation: See "Time Reference (BTS mode)" on page 65
See "Time Reference (UE mode)" on page 65

10.5.6 Channel Detection

The channel detection settings determine which channels are found in the input signal. The commands required to work with channel tables are described here.

10.5.6.1 General Channel Detection

The following commands configure how channels are detected in general.

Useful commands for general channel detection described elsewhere:

- `CONFigure:CDPower:CTABle[:STATe]` on page 133

Remote commands exclusive to general channel detection:

[SENSe:]CDPower:ICTReshold <ThresholdLevel>

This command defines the minimum power that a single channel must have compared to the total signal in order to be regarded as an active channel. Channels below the specified threshold are regarded as "inactive".

Parameters:

<ThresholdLevel> Range: -100 dB to 0 dB
*RST: -40 dB

Example: `SENS:CDP:ICTR -100`

Manual operation: See "Inactive Channel Threshold " on page 67

[SENSe:]CDPower:MMAX <ModType>

This command defines the highest modulation to be considered in the automatic channel search. In low SNR environments it may be necessary to limit the channel search to lower modulations than 64QAM.

Parameters:

<ModType>

QPSK
Consider QPSK modulation only

PSK8
Consider QPSK and 8PSK modulation.

QAM16
Consider QPSK, 8PSK and 16QAM modulation

QAM64
Consider QPSK, 8PSK, 16QAM and 64QAM modulation

*RST: QAM64

Example: `SENS:CDP:MMAX PSK8`
Assume QPSK and 8PSK modulations only for the automatic channel search

Manual operation: See "Max Modulation" on page 67

10.5.6.2 Managing Channel Tables

CONFigure:CDPower:CTABle:CATalog?

This command queries the names of all the channel tables stored on the instrument for the current application.

The first two result values are global values for all channel tables, the subsequent values are listed for each individual table.

The syntax for the return values is: <TotalSize>, <FreeMem>, <FileName>, <FileSize>, <FileName>, <FileSize>,...,<FileName>, <FileSize>

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:CDP:CTAB:CAT?`
Returns all existing channel tables.

Usage: Query only

Manual operation: See "Predefined Tables" on page 68

CONFigure:CDPower:CTABle:COPY <TargetFileName>

This command copies one channel table to another. Select the channel table you want to copy using the `CONFigure:CDPower:CTABle:NAME` command. The name of the channel table may contain up to eight characters.

Parameters:

<TargetFileName> <string> = name of the new channel table

Example: `CONF:CDP:CTAB:NAME 'CTAB_1'`
Selects channel table 'CTAB_1'.
`CONF:CDP:CTAB:COPY 'CTAB_2'`
Makes a copy of 'CTAB_1' with the name 'CTAB_2'.

Manual operation: See "Copying a Table" on page 69

CONFigure:CDPower:CTABle:DELete

This command deletes the selected channel table. Select the channel table you want to delete using the `CONFigure:CDPower:CTABle:NAME` command.

Example: `CONF:CDP:CTAB:NAME 'CTAB_1'`
Selects channel table 'CTAB_1'
`CONF:CDP:CTAB:DEL`
Deletes channel table 'CTAB_1'.

Usage: Event

Manual operation: See "Deleting a Table" on page 69

CONFigure:CDPower:CTABle:SELect <FileName>

This command selects a predefined channel table file for comparison during channel detection. Before using this command, the "RECENT" channel table must be switched on first with the command `CONFigure:CDPower:CTABle[:STATe]` on page 133.

Parameters:

<FileName>	*RST:	RECENT

Example: `CONF:WCDP:CTAB ON`
Switches the channel table on.
`CONF:CDP:CTAB:SEL 'CTAB_1'`
Selects the predefined channel table 'CTAB_1'.

Manual operation: See "Selecting a Table" on page 68

CONFigure:CDPower:CTABle[:STATe] <State>

This command switches the use of a predefined 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:CDPower:CTABle:SELect` on page 133.

Parameters:

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

Example: `CONF:CDP:CTAB ON`

Manual operation: See "Using Predefined Channel Tables" on page 68

10.5.6.3 Configuring Channel Tables

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

Remote commands exclusive to configuring channel tables:

CONFigure:CDPower:CTABle:COMMent <Comment>

This command defines a comment for the channel table selected with `CONFigure:CDPower:CTABle:NAME`.

Parameters:

<Comment> comment for the channel table

Example: `CONF:CDP:CTAB:NAME 'CTAB_1'`
Selects channel table 'CTAB_1'.
`CONF:CDP:CTAB:COMM 'Comment for CTAB_1'`
Writes a comment for 'CTAB_1'.

Manual operation: See "Comment" on page 69

CONFigure:CDPower:CTABle:NAME <ChannelTable>

This command selects an existing channel table or creates a new one. Use this command to edit the channel table. To use a channel table for a measurement, use the `CONFigure:CDPower:CTABle:SELect` command.

Parameters:
<ChannelTable> <string> = name of the channel table
*RST: RECENT

Example: `CONF:CDP:CTAB:NAME 'NEW_TAB'`
Selects channel table for editing. If a channel table with this name does not exist, a new channel table by that name is created.

Manual operation: See "Name" on page 69

CONFigure:CDPower:CTABle:DATA <ChannelType>, <CodeClass>, <CodeNumber>, <ModType>, <MAShift>, <ActiveFlag>,<Reserved>, <Reserved>

This command defines or queries the parameters of the channel table selected or created with the `CONFigure:CDPower:CTABle:NAME` command.

To define a channel (one row in the channel table), you have to enter eight values in the following order:

<ChannelType>, <CodeClass>, <CodeNumber>, <ModType>, <MAShift>, <ActiveFlag>,<Reserved>, <Reserved>

Return values:
<ChannelType> 0 ... 7

Type of the channel
0 = inactive
1 = midamble
2 = DPCH
3 = P-CCPCH
4 = S-CCPCH
5 = FPACH
6 = PDSCH
7 = PICH
Note that **values 2 to 7** are not distinguished by the application; all these values are mapped to the value 2 (DPCH).

<CodeClass> **0 … 4**
Code class of the channel. The code class specifies the spreading factor of the channel.
0 = spreading factor 1
1 = spreading factor 2
2 = spreading factor 4
3 = spreading factor 8
4 = spreading factor 16

<CodeNo> **1 … 16**
Code number of the channel. The number of codes depends on the spreading factor (see Table 4-2).

<ModType> Modulation type of the channel
0 = invalid (for midamble)
1 = QPSK
2 = 8PSK
3 = 16QAM
4 = 64QAM

<MAShift> **0 … 38400**
Midamble shift of the channel

<ActiveFlag> 0 | 1
Flag to indicate whether a channel is active (1) or not (0)

<Reserved1>, <Reserved2> Placeholder values; Currently not used.

Example:
`CONF:CDP:CTAB:NAME 'CTAB_1'`
Selects or creates channel table 'CTAB_1'
`CONF:CDP:CTAB:DATA '2,4,1,1,1,1,0,0,2,4,2,1,1,1,0,0'`
Defines two data channels with QPSK modulation.

Manual operation: See "Channel Type" on page 71
See "Channel Number (Ch. SF)" on page 71
See "State" on page 72

CONFigure:CDPower:CTABle:MSHift <MAShift>

This command defines the number of midamble shifts in the channel table.

This value replaces the value defined by `[SENSe:]CDPower:MSHift` on page 128.

Parameters:
<numeric value> **2 | 4 | 6 | 8 | 10 | 12 | 14 | 16**
*RST: 16

Example:
`CONF:CDP:CTAB:MSH 4`
Sets the number of midamble shifts to 4.

Manual operation: See "MA Shifts Cell" on page 70
See "Midamble Shift" on page 72

10.5.7 Sweep Settings

[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

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 " Sweep/Average Count " on page 73

10.5.8 Automatic Settings

MSRA operating mode

In MSRA operating mode, the following commands are not available, as they require a new data acquisition. However, TD-SCDMA applications cannot perform data acquisition in MSRA operating mode.

Useful commands for adjusting settings automatically described elsewhere:

- `DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO ONCE` on page 116

Remote commands exclusive to adjusting settings automatically:

[SENSe:]ADJust:ALL

This command initiates a measurement to determine and set the ideal settings for the current task automatically (only once for the current measurement).

This includes:

- Reference level

Example: `ADJ:ALL`

Usage: Event

Manual operation: See " Adjusting all Determinable Settings Automatically (Auto All)" on page 74

[SENSe:]ADJust:CONFigure[:LEVel]:DURation <Duration>

In order to determine the ideal reference level, the R&S FPS performs a measurement on the current input data. This command defines the length of the measurement if `[SENSe:]ADJust:CONFigure[:LEVel]:DURation:MODE` is set to `MANual`.

Parameters:

<Duration> Numeric value in seconds

Range: 0.001 to 16000.0
*RST: 0.001
Default unit: s

Example: `ADJ:CONF:DUR:MODE MAN`
Selects manual definition of the measurement length.
`ADJ:CONF:LEV:DUR 5ms`
Length of the measurement is 5 ms.

Manual operation: See " Changing the Automatic Measurement Time (Meastime Manual)" on page 75

[SENSe:]ADJust:CONFigure[:LEVel]:DURation:MODE <Mode>

In order to determine the ideal reference level, the R&S FPS performs a measurement on the current input data. This command selects the way the R&S FPS determines the length of the measurement .

Parameters:

<Mode>

AUTO
The R&S FPS determines the measurement length automatically according to the current input data.

MANual
The R&S FPS uses the measurement length defined by `[SENSe:]ADJust:CONFigure[:LEVel]:DURation` on page 137.

*RST: AUTO

Manual operation: See " Resetting the Automatic Measurement Time (Meastime Auto)" on page 75
See " Changing the Automatic Measurement Time (Meastime Manual)" on page 75

[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer <Threshold>

When the reference level is adjusted automatically using the `[SENSe:]ADJust:LEVel` on page 138 command, the internal attenuators and the preamplifier are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Parameters:
<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 will only be adjusted when the signal level falls below 18 dBm.

Manual operation: See " Lower Level Hysteresis " on page 75

[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer <Threshold>

Parameters:
<Threshold> Range: 0 dB to 200 dB
*RST: +1 dB
Default unit: dB

Example: `SENS:ADJ:CONF:HYST:UPP 2`

Example: For an input signal level of currently 20 dBm, the reference level will only be adjusted when the signal level rises above 22 dBm.

Manual operation: See " Upper Level Hysteresis " on page 75

[SENSe:]ADJust:LEVel

This command initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S FPS or limiting the dynamic range by an S/N ratio that is too small.

Example: `ADJ:LEV`

Usage: Event

Manual operation: See " Setting the Reference Level Automatically (Auto Level)" on page 53

10.5.9 Evaluation Range

The evaluation range defines which data is evaluated in the result display.

[SENSe:]CDPower:CODE <CodeNumber>

This command sets the code number. The code number refers to spreading factor 16.

Parameters:

<CodeNumber> <numeric value>

*RST: 0

Example: `SENS:CDP:CODE 3`

Manual operation: See "Channel (Code) Number" on page 85

[SENSe:]CDPower:SET <SetNo>

This command selects a specific set for further analysis. The number of sets to capture has to be defined with the `[SENSe:]CDPower:SET` command before using this command.

Parameters:

<SetNo> Range: 0 to SET COUNT -1
Increment: 1
*RST: 0

Example: `CDP:SET:COUN 10`
Selects the 10th set for further analysis.

Manual operation: See "Set to Analyze" on page 63

[SENSe:]CDPower:SLOT <SlotNumber>

This command selects the slot number to be evaluated. The number of slots to capture has to be defined with the `[SENSe:]CDPower:IQLength` command before using this command.

Parameters:

<SlotNumber> <numeric value>

Range: 0 to <Number of slots to capture> -1
Increment: 1
*RST: 0

Example: `SENS:CDP:SLOT 3`

Manual operation: See "Slot Number" on page 86

10.5.10 Code Domain Analysis Settings

Some evaluations provide further settings for the results.

CONFigure:CDPower:CTABle:ORDer <CODE | MIDamble>

This command selects sorting of the channel table in code order or midamble order.

Parameters:

<CODE | MIDamble> **CODE**
Channels are sorted in code order.

MIDamble
Channels are sorted in midamble order.

*RST: CODE

Example: `CONF:CDP:CTAB:ORD`
Sorts the channels in code order.

Manual operation: See "Channel Table Sort Order" on page 87

[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 87

[SENSe:]CDPower:PDISplay <Mode>

This command switches between showing the absolute or relative power.

This parameter only affects the Code Domain Power evaluation.

Parameters:
<Mode> ABS | REL

ABSolute
Absolute power levels

RELative
Power levels relative to total power of the data parts of the signal

*RST: ABS

Example: `SENS:CDP:PDIS ABS`

Manual operation: See "Code Power Display" on page 87

[SENSe:]CDPower:PTS <State>

If activated, additional information on the DwPTS (BTS mode) or UpPTS (UE mode) is displayed in the Result Summary. (See also Chapter 4.2, "Frames, Subframes and Slots", on page 34.)

This parameter only affects the Code Domain Power evaluation.

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

ON | 1
PTS evaluation is activated.

OFF | 0
PTS evaluation is disabled.

*RST: 0

Example: `SENS:CDP:PTS ON`

Manual operation: See "Show DwPTS Results (BTS mode)" on page 88
See "Show UpPTS Results (UE mode)" on page 88

10.6 Configuring Frequency and Time Domain Measurements

Frequency and time domain measurements are performed in the Spectrum application, with some predefined settings as described in Chapter 6.3, "Frequency and Time Domain Measurements", on page 75.

For details on configuring these RF measurements in a remote environment, see the Remote Commands chapter of the R&S FPS User Manual.

The TD-SCDMA RF measurements must be activated for a TD-SCDMA application, see Chapter 10.3, "Activating the TD-SCDMA Applications", on page 106.

The individual measurements are activated using the `CONFigure:CDPower:MEASurement` on page 110 command.

Some frequency and time domain measurements require further configuration.

Analysis for Frequency and Time Domain Measurements

General result analysis settings concerning the trace, markers, lines etc. for RF measurements are identical to the analysis functions in the Spectrum application except for some special marker functions, which are not available in TD-SCDMA applications.

For details see the "General Measurement Analysis and Display" chapter in the R&S FPS User Manual.

10.6.1 Configuring Power vs Time Measurements

CONFigure:CDPower[:BTS]:PVTime:SFRames <numeric value>

This command defines the number of subframes to be used for averaging.

Parameters:

<numeric value> Subframe value.

*RST: 100

Example: `CONF:CDP:PVT:SFR 50`
Sets the number of subframes to 50.

Manual operation: See "No of Subframes" on page 78

CONFigure:CDPower[:BTS]:PVTime:SPOint <numeric value>

This command defines the switching point between uplink and downlink slots.

Parameters:

<numeric value> 1 to 7

*RST: 3

Example: `CONF:CDP:PVT:SPO 7`
Sets the switching point to 7.

Manual operation: See "Switching Point" on page 78

[SENSe:]POWer:ACHannel:AUTO:LTIMe

This command automatically adjusts the reference level and the trigger to frame time to their optimum levels. This prevents overloading of the R&S FPS.

Current measurements are aborted when this command is executed and resumed after the automatic level detection is finished.

Usage: Event

Manual operation: See "Auto Level & Time" on page 79

10.6.2 Configuring the Slot Range for Frequency Sweeps on Downlink Data

In the BTS application, you can define which slots to analyze, i.e. which slots contain downlink data (depending on the switching point).

[SENSe:]POWer:ACHannel:SLOT:STARt <StartSlot>

Sets the first slot of the measurement.

Parameters:

<StartSlot> The start slot may not be larger than the stop slot.
In the UE application, the default value is 1.

Range: 1 to 7
*RST: 4

Example: `POW:ACH:SLOT:STAR 2`

Manual operation: See "Start Slot / Stop Slot" on page 79

[SENSe:]POWer:ACHannel:SLOT:STOP <StopSlot>

Sets the last slot of the measurement.

Parameters:

<StopSlot> The stop slot may not be lower than the start slot.
In the UE application, stop slots other than 1 require an external trigger. The default value is 1.

Range: 1 to 7
*RST: 6

Example: `POW:ACH:SLOT:STOP 5`

Manual operation: See "Start Slot / Stop Slot" on page 79

10.7 Configuring the Result Display

The following commands are required to configure the screen display in a remote environment. The tasks for manual operation are described in Chapter 6.1, "Result Display Configuration", on page 45.

10.7.1 General Window Commands

The following commands are required to configure general window layout, independent of the application.

DISPlay:FORMat <Format>

This command 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>]:SIZE <Size>

This command maximizes the size of the selected result display window *temporarily*. To change the size of several windows on the screen permanently, use the `LAY:SPL` command (see `LAYout:SPLitter` on page 149).

Suffix:

<n> Window

Parameters:

<Size>

LARGe
Maximizes the selected window to full screen.
Other windows are still active in the background.

SMALl
Reduces the size of the selected window to its original size.
If more than one measurement window was displayed originally, these are visible again.

*RST: SMALl

Example: `DISP:WIND2:SIZE LARG`

10.7.2 Working with Windows in the Display

The following commands are required to change the evaluation type and rearrange the screen layout for a channel as you do using the SmartGrid in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected channel.

LAYout:ADD[:WINDow]? <WindowName>,<Direction>,<WindowType>

This command adds a window to the display in the active channel.

This command is always used as a query so that you immediately obtain the name of the new window as a result.

To replace an existing window, use the `LAYout:REPLace[:WINDow]` command.

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.

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',LEFT,MTAB`
Result:
`'2'`
Adds a new window named '2' with a marker table to the left of window 1.

Usage: Query only

Manual operation:
See "Bitstream" on page 12
See "Channel Table" on page 12
See "Code Domain Power" on page 14
See "Code Domain Error Power" on page 14
See "Composite Constellation" on page 15
See "Composite EVM" on page 16
See "Mag Error vs Chip" on page 17
See " Marker Table " on page 18
See "Peak Code Domain Error" on page 18
See "Phase Error vs Chip" on page 19
See "Power vs Slot" on page 20
See "Power vs Symbol" on page 21
See "Result Summary" on page 21
See "Symbol Constellation" on page 22
See "Symbol EVM" on page 22
See "Symbol Magnitude Error" on page 23
See "Symbol Phase Error" on page 23
See " Diagram " on page 31
See "List Evaluation" on page 32
See " Result Summary " on page 32
See " Marker Peak List " on page 33

Table 10-3: <WindowType> parameter values for TD-SCDMA 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
LEValuation	List evaluation (Power vs. Time)
MTABle	Marker table
PCDerror	Peak Code Domain Error
PSLot	Channel Power vs. Slot
PSYMbol	Power vs. Symbol
RSUMmary	Result Summary
SCONst	Symbol Constellation
SEVM	Symbol EVM

LAYout:CATalog[:WINDow]?

This command 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>

Return values:

<WindowName> string
Name of the window.
In the default state, the name of the window is its index.

<WindowIndex> **numeric value**
Index of the window.

Example: `LAY:CAT?`
Result:
`'2',2,'1',1`
Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).

Usage: Query only

LAYout:IDENtify[:WINDow]? <WindowName>

This command queries the **index** of a particular display window in the active channel.

Note: to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

Query parameters:

<WindowName> String containing the name of a window.

Return values:

<WindowIndex> Index number of the window.

Example: `LAY:WIND:IDEN? '2'`
Queries the index of the result display named '2'.
Response:
`2`

Usage: Query only

LAYout:MOVE[:WINDow] <arg0>, <arg1>, <arg2>

Setting parameters:

<arg0> 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.

<arg1> 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.

<arg2> 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>

This command 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: Event

LAYout:REPLace[:WINDow] <WindowName>,<WindowType>

This command replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window in the active 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 145 for a list of available window types.

Example: `LAY:REPL:WIND '1',MTAB`
Replaces the result display in window 1 with a marker table.

Usage: Setting only

LAYout:SPLitter <Index1>,<Index2>,<Position>

This command changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

Compared to the `DISPlay[:WINDow<n>]:SIZE` on page 144 command, the `LAYout:SPLitter` changes the size of all windows to either side of the splitter permanently, it does not just maximize a single window temporarily.

Note that windows must have a certain minimum size. If the position you define conflicts with the minimum size of any of the affected windows, the command will not work, but does not return an error.

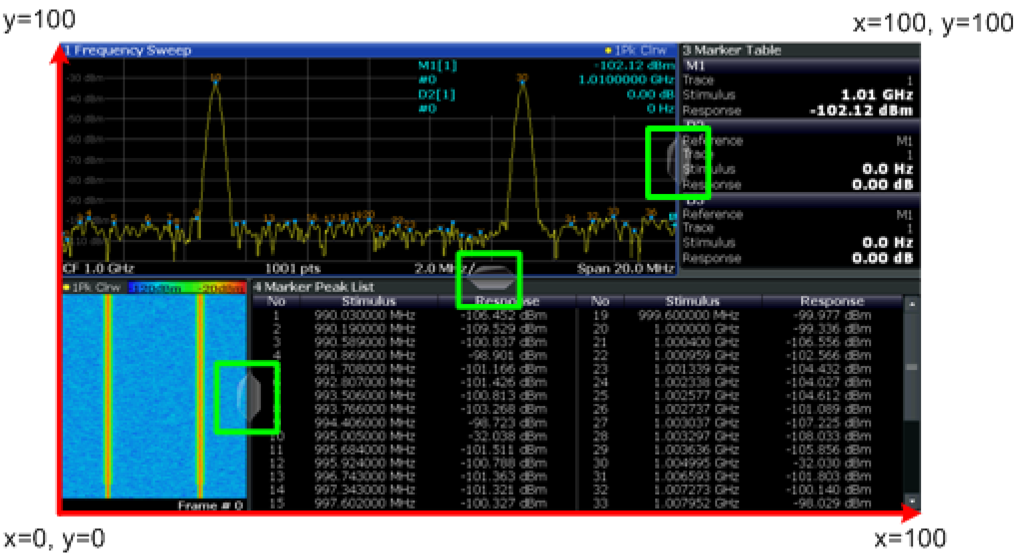


Figure 10-1: SmartGrid coordinates for remote control of the splitters

Parameters:

<Index1> The index of one window the splitter controls.

<Index2> The index of a window on the other side of the splitter.

<Position> New vertical or horizontal position of the splitter as a fraction of the screen area (without channel and status bar and softkey menu).
The point of origin (x = 0, y = 0) is in the lower left corner of the screen. The end point (x = 100, y = 100) is in the upper right corner of the screen. (See Figure 10-1.)
The direction in which the splitter is moved depends on the screen layout. If the windows are positioned horizontally, the splitter also moves horizontally. If the windows are positioned vertically, the splitter also moves vertically.

Range: 0 to 100

Example: `LAY:SPL 1,3,50`
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('Marker Table') to the center (50%) of the screen, i.e. in the figure above, to the left.

Example: `LAY:SPL 1,4,70`
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('Marker Peak List') towards the top (70%) of the screen.
The following commands have the exact same effect, as any combination of windows above and below the splitter moves the splitter vertically.
`LAY:SPL 3,2,70`
`LAY:SPL 4,1,70`
`LAY:SPL 2,1,70`

LAYout:WINDow<n>:ADD? <Direction>,<WindowType>

This command adds a measurement window to the display. Note that with this command, the suffix <n> determines the existing window next to which the new window is added, as opposed to `LAYout:ADD[:WINDow]?`, for which the existing window is defined by a parameter.

To replace an existing window, use the `LAYout:WINDow<n>:REPLace` command.

This command is always used as a query so that you immediately obtain the name of the new window as a result.

Suffix:
<n> Window

Parameters:
<Direction> LEFT | RIGHt | ABOVe | BELow

<WindowType> Type of measurement window you want to add.
See `LAYout:ADD[:WINDow]?` on page 145 for a list of available window types.

Return values:
<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

Example: `LAY:WIND1:ADD? LEFT,MTAB`
Result:
`'2'`
Adds a new window named '2' with a marker table to the left of window 1.

Usage: Query only

LAYout:WINDow<n>:IDENtify?

This command queries the **name** of a particular display window (indicated by the <n> suffix) in the active channel.

Note: to query the **index** of a particular window, use the `LAYout:IDENtify[:WINDow]?` command.

Suffix:
<n> Window

Return values:
<WindowName> String containing the name of a window.
In the default state, the name of the window is its index.

Example: `LAY:WIND2:IDEN?`
Queries the name of the result display in window 2.
Response:
`'2'`

Usage: Query only

LAYout:WINDow<n>:REMove

This command removes the window specified by the suffix <n> from the display in the active channel.

The result of this command is identical to the `LAYout:REMove[:WINDow]` command.

Suffix:
<n> Window

Example: `LAY:WIND2:REM`
Removes the result display in window 2.

Usage: Event

LAYout:WINDow<n>:REPLace <WindowType>

This command changes the window type of an existing window (specified by the suffix <n>) in the active 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 145 for a list of available window types.

Example: `LAY:WIND2:REPL MTAB`
Replaces the result display in window 2 with a marker table.

Usage: Setting only

10.8 Starting a Measurement

The measurement is started immediately when a TD-SCDMA application is activated, however, you can stop and start a new measurement any time.

ABORt

This command aborts the measurement in the current channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the `*OPC?` or `*WAI` command after `ABOR` and before the next command.

For details see the "Remote Basics" chapter in the R&S FPS User Manual.

To abort a sequence of measurements by the Sequencer, use the `INITiate<n>:SEQuencer:ABORt` command.

Note on blocked remote control programs:

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the R&S FPS is blocked for further commands. In this case, you must interrupt processing on the remote channel first in order to abort the measurement.

To do so, send a "Device Clear" command from the control instrument to the R&S FPS on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa**: `viClear()`

Now you can send the `ABORt` command on the remote channel performing the measurement.

Example: `ABOR;:INIT:IMM`
Aborts the current measurement and immediately starts a new one.

Example: `ABOR;*WAI`
`INIT:IMM`
Aborts the current measurement and starts a new one once abortion has been completed.

Usage: Event

INITiate<n>:CONMeas

This command restarts a (single) measurement that has been stopped (using `ABORt`) or finished in single measurement mode.

The measurement is restarted at the beginning, not where the previous measurement was stopped.

As opposed to `INITiate<n>[:IMMediate]`, this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using maxhold or averaging functions.

Suffix:
<n> irrelevant

Usage: Event

Manual operation: See " Continue Single Sweep " on page 73

INITiate<n>:CONTinuous <State>

This command controls the measurement mode for an individual channel.

Note that in single measurement mode, you can synchronize to the end of the measurement with *OPC, *OPC? or *WAI. In continuous measurement mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous measurement mode in remote control, as results like trace data or markers are only valid after a single measurement end synchronization.

For details on synchronization see the "Remote Basics" chapter in the R&S FPS User Manual.

If the measurement mode is changed for a channel while the Sequencer is active (see `INITiate<n>:SEQuencer:IMMediate` on page 154) the mode is only considered the next time the measurement in that channel is activated by the Sequencer.

Suffix:
<n> irrelevant

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

ON | 1
Continuous measurement

OFF | 0
Single measurement

*RST: 0

Example:
`INIT:CONT OFF`
Switches the measurement mode to single measurement.
`INIT:CONT ON`
Switches the measurement mode to continuous measurement.

Manual operation: See " Continuous Sweep / Run Cont " on page 72
See "Start Meas" on page 78

INITiate<n>[:IMMediate]

This command starts a (single) new measurement.

You can synchronize to the end of the measurement with *OPC, *OPC? or *WAI.

For details on synchronization see the "Remote Basics" chapter in the R&S FPS User Manual.

Suffix:
<n> irrelevant

Usage: Event

Manual operation: See " Single Sweep / Run Single " on page 73
See "Start Meas" on page 78

INITiate<n>:SEQuencer:ABORt

This command stops the currently active sequence of measurements. The Sequencer itself is not deactivated, so you can start a new sequence immediately using `INITiate<n>:SEQuencer:IMMediate` on page 154.

To deactivate the Sequencer use `SYSTem:SEQuencer` on page 156.

Suffix:
<n> irrelevant

Usage: Event

INITiate<n>:SEQuencer:IMMediate

This command starts a new sequence of measurements by the Sequencer.

Its effect is similar to the `INITiate<n>[:IMMediate]` command used for a single measurement.

Before this command can be executed, the Sequencer must be activated (see `SYSTem:SEQuencer` on page 156).

Suffix:
<n> irrelevant

Example:
`SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single sequence mode so each active measurement will be performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.

Usage: Event

INITiate<n>:SEQuencer:MODE <Mode>

This command selects the way the R&S FPS application performs measurements sequentially.

Before this command can be executed, the Sequencer must be activated (see `SYSTem:SEQuencer` on page 156).

A detailed programming example is provided in the "Operating Modes" chapter in the R&S FPS User Manual.

Note: In order to synchronize to the end of a sequential measurement using *OPC, *OPC? or *WAI you must use `SINGle` Sequence mode.

For details on synchronization see the "Remote Basics" chapter in the R&S FPS User Manual.

Suffix:

<n> irrelevant

Parameters:

<Mode>

SINGle
Each measurement is performed once (regardless of the channel's sweep mode), considering each channels' sweep count, until all measurements in all active channels have been performed.

CONTinuous
The measurements in each active channel are performed one after the other, repeatedly (regardless of the channel's sweep mode), in the same order, until the Sequencer is stopped.

CDEFined
First, a single sequence is performed. Then, only those channels in continuous sweep mode (`INIT:CONT ON`) are repeated.

*RST: CONTinuous

Example:

`SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single sequence mode so each active measurement will be performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.

INITiate<n>:SEQuencer:REFResh[:ALL]

This function is only available if the Sequencer is deactivated (`SYSTem:SEQuencer` SYST:SEQ:OFF) and only in MSRA mode.

The data in the capture buffer is re-evaluated by all active MSRA slave applications.

Suffix:

<n> irrelevant

Example: `SYST:SEQ:OFF`
Deactivates the scheduler
`INIT:CONT OFF`
Switches to single sweep mode.
`INIT;*WAI`
Starts a new data measurement and waits for the end of the sweep.
`INIT:SEQ:REFR`
Refreshes the display for all channels.

Usage: Event

SYSTem:SEQuencer <State>

This command turns the Sequencer on and off. The Sequencer must be active before any other Sequencer commands (`INIT:SEQ...`) are executed, otherwise an error will occur.

A detailed programming example is provided in the "Operating Modes" chapter in the R&S FPS User Manual.

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

ON | 1
The Sequencer is activated and a sequential measurement is started immediately.

OFF | 0
The Sequencer is deactivated. Any running sequential measurements are stopped. Further Sequencer commands (`INIT:SEQ...`) are not available.

*RST: 0

Example: `SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single Sequencer mode so each active measurement will be performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.
`SYST:SEQ OFF`

10.9 Retrieving Results

The following commands are required to retrieve the results from a TD-SCDMA 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 10.5.6, "Channel Detection", on page 130.

10.9.1 Retrieving Calculated Measurement Results

The following commands describe how to retrieve the calculated results from the CDA.

CALCulate<n>:MARKer:FUNCtion:CDPower:RESult? <ResultType>

This command queries the results of the code domain measurement. Refer to Chapter 3.1.1, "Code Domain Parameters", on page 10 for a detailed description of all results.

(The suffix <n> is irrelevant.)

Query parameters:

<ResultType>

ACTive
Returns the number of active channels.

ARCD
Returns the Average Relative Code Domain Error.

CDPabsolute
Returns the absolute channel power in dBm.

CDPRelative
Returns the relative channel power in dB.

CHANnel
Returns the current channel number.

CERror
Returns the Chip Rate Error in ppm.

DACTive
Indicates whether DwPTS slot is active (BTS mode only)

DPOWer
Power in the DwPTS slot (BTS mode only)

DRHO
RHO for the DwPTS slot (BTS mode only)

DERM
EVM (RMS) for the DwPTS slot (BTS mode only)

DEPK
EVM (Peak) for the DwPTS slot (BTS mode only)

EVMPeak
Returns the maximum Error Vector Magnitude of the selected channel.

EVMRMS
Returns the average Error Vector Magnitude of the selected channel.

IQIMbalance
Returns the IQ Imbalance in %.

IQOFfset
Returns the IQ Offset in %.

MACCuracy
Returns the Composite EVM in %.

PCDerror
Returns the Peak Code Domain Error dB.

PD1
Returns the power of the slot's data part 1 in dBm.

PD2
Returns the power of the slot's data part 2 in dBm.

PDATa
Returns the average power of the data parts in dBm.

PMIDamble

Returns the power of the midamble in dBm.

RHO
Returns the parameter Rho.

SFACtor
Returns the spreading factor of the channel.

SFRame
Subframe number

SLOT
Returns the currently analyzed slot number.

SRATe
Returns the symbol rate in ksps.
Note that TFRame returns a '9' if the trigger is at Free Run.

TFRame
Returns the Trigger to Frame time in seconds.

UACTive
Indicates whether UpPTS slot is active (UE mode only)

UPOWer
Power in the UpPTS slot (UE mode only)

URHO
RHO for the UpPTS slot (UE mode only)

UERM
EVM (RMS) for the UpPTS slot (UE mode only)

UEPK
EVM (Peak) for the UpPTS slot (UE mode only)

Example: `CALC:MARK:FUNC:CDP:RES? CERR`
Returns the Chip Rate Error

Usage: Query only

Manual operation: See "Code Domain Power" on page 14
See "Result Summary" on page 21

CONFigure:CDPower[:BTS]:PVTime:LIST:RESult?

Queries the list evaluation results for Power vs Time measurements. The results are a comma-separated list containing the following values for each list range:

Return values:

<RangeNo>	consecutive number of list range
<StartTime>	Start time of the individual list range
<StopTime>	Stop time of the individual list range
<AverageDBM>	Average power level in list range in dBm.
<AverageDB>	Average power level in list range in dB.
<MaxDBM>	Maximum power level in list range in dBm.
<MaxDB>	Maximum power level in list range in dB.

<MinDBM>	Minimum power level in list range in dBm.
<MinDB>	Minimum power level in list range in dB.
<LimitCheck>	Result of limit check for the list range. **0** Passed **1** Failed
<Reserved1>	0; currently not used
<Reserved2>	0; currently not used
Usage:	Query only
Manual operation:	See "Power vs Time" on page 25

10.9.2 Retrieving Trace Results

The following commands describe how to retrieve the trace data from the CDA. Note that for these measurements, only 1 trace per window can be configured.

FORMat[:DATA] <Format>

This command selects the data format that is used for transmission of trace data from the R&S FPS to the controlling computer.

Note that the command has no effect for data that you send to the R&S FPS. The R&S FPS automatically recognizes the data it receives, regardless of the format.

Parameters:

<Format> **ASCii**
ASCii format, separated by commas.
This format is almost always suitable, regardless of the actual data format. However, the data is not as compact as other formats may be.

REAL,16
16-bit floating-point numbers (according to IEEE 754) in the "definite length block format".
In the Spectrum application, the format setting `REAL` is used for the binary transmission of trace data.
Compared to `REAL,32` format, half as many numbers are returned.

REAL,32
32-bit floating-point numbers (according to IEEE 754) in the "definite length block format".
In the Spectrum application, the format setting `REAL` is used for the binary transmission of trace data.
For I/Q data, 8 bytes per sample are returned for this format setting.

REAL,64
64-bit floating-point numbers (according to IEEE 754) in the "definite length block format".
In the Spectrum application, the format setting `REAL` is used for the binary transmission of trace data.
Compared to `REAL,32` format, twice as many numbers are returned.

*RST: ASCII

Example: `FORM REAL,32`

TRACe<n>[:DATA]? <ResultType>

This command returns the trace data. Depending on the evaluation, the trace data format varies.

The data format depends on `FORMat[:DATA]`.

For details see Chapter 10.9.3, "Measurement Results for TRACe<n>[:DATA]? TRACE<n>", on page 165.

Query parameters:

<ResultType> Selects the type of result to be returned.

TRACE1 | ... | TRACE4
Returns the trace data for the corresponding trace as a comma-separated list of values. This data consists of some or all of the result parameters described below, depending on the result type.
For details see Chapter 10.9.3, "Measurement Results for TRACe<n>[:DATA]? TRACE<n>", on page 165.

LIST
For CDA measurements:
For RF measurements:
Returns the results of the peak list evaluation for Spurious Emission and Spectrum Emission Mask measurements.
For details see Table 10-4.

Return values:

<AbsLevel> | <RelLevel> **dBm or %**
Absolute level of the channel at the selected channel slot
or:
Relative level of the channel at the selected channel slot referenced to CPICH or total power
(Depending on `[SENSe:]CDPower:PDISplay` on page 140)

<ActiveFlag> 0 | 1
Flag to indicate whether a channel is active (1) or not (0)

<CError> Chip Rate Error in ppm.

<CDPAbsolute>, <CDPRelative> Code domain power absolute or relative to total signal power (data parts).

<ChannelType> 0 ... 2
Type of the channel
0 = inactive
1 = midamble
2 = DPCH

<CodeClass> **0 … 4**
Code class of the channel. The code class specifies the spreading factor of the channel.
0 = spreading factor 1
1 = spreading factor 2
2 = spreading factor 4
3 = spreading factor 8
4 = spreading factor 16

<CodeNo> **1 … 16**
Code number of the channel. The number of codes depends on the spreading factor (see Table 4-2).

<EVMPeak> Maximum value of the EVM.

<EVMRMS>	Average value of the EVM.
<FError>	Frequency Error in Hz.
<CIQImbal>	I/Q Imbalance in %.
<IQOffset>	I/Q Offset in %.
<MAccuracy>	Composite EVM in %.
<MAShift>	**0 … 38400** Midamble shift of the channel
<ΔMiD1>, <ΔMiD2>	dB Power offset between: sum power of channels belonging to midamble(k), only data field 1/2 and power of midamble(k)
<ModType>	Modulation type of the channel **0** = invalid (for midamble) **1** = QPSK **2** = 8PSK **3** = 16QAM **4** = 64QAM
<PCDError>	Peak Code Domain Error in dB.
<PD1>, <PD2>	Power of the data parts over all channels in dB.
<PData>	Mean power of both data parts (P1 and P2) over all channels in dBm.
<PMidamble>	Power of the midamble in dB.
<reserved1-4>	Placeholder value; Currently not used.
<RHO>	0 | 1 Rho.
<SF>	1 ... 16 Spreading Factor of the channel.
<Slot>	Slot number. The range depends on the capture length.
<SYMRate>	Symbol rate in kbps.
<TrigFrame>	Trigger to Frame in ms. This value is valid only after successful synchronization to the TD-SCDMA signal. When using the Free Run trigger mode, the command returns a '9'.
<Validity>	**0** = inactive channel **1** = active channel **2** = alias channel. In this case the channel consists of more than one code.

Example: `TRAC2:DATA? TRACE1`
Returns the trace data from trace 1 in window 2.

Usage: Query only

Manual operation:
See "Bitstream" on page 12
See "Channel Table" on page 12
See "Code Domain Power" on page 14
See "Code Domain Error Power" on page 14
See "Composite Constellation" on page 15
See "Composite EVM" on page 16
See "Mag Error vs Chip" on page 17
See "Peak Code Domain Error" on page 18
See "Phase Error vs Chip" on page 19
See "Power vs Slot" on page 20
See "Power vs Symbol" on page 21
See "Result Summary" on page 21
See "Symbol Constellation" on page 22
See "Symbol EVM" on page 22
See "Symbol Magnitude Error" on page 23
See "Symbol Phase Error" on page 23
See "Power vs Time" on page 25

Table 10-4: Return values for LIST parameter (Spurious / SEM measurements)

For every measurement range you have defined (range 1...n), the command returns eight values in the following order.

<No>,<StartFreq>,<StopFreq>,<RBW>,<PeakFreq>,<PowerAbs>,<PowerRel>,<PowerDelta>,<LimitCheck>,<Unused1>,<Unused2>

- <No>: range number
- <StartFreq>,<StopFreq>: start and stop frequency of the range
- <RBW>: resolution bandwidth
- <PeakFreq>: frequency of the peak in a range
- <PowerAbs>: absolute power of the peak in dBm
- <PowerRel>: power of the peak in relation to the channel power in dBc
- <PowerDelta>: distance from the peak to the limit line in dB, positive values indicate a failed limit check
- <LimitCheck>: state of the limit check (0 = PASS, 1 = FAIL)
- <Unused1>,<Unused2>: reserved (0.0)

TRACe<n>[:DATA]:X? <TraceNumber>

This command queries the horizontal trace data for each sweep point in the specified window, for example the frequency in frequency domain or the time in time domain measurements.

This is especially useful for traces with non-equidistant x-values, e.g. for SEM or Spurious Emissions measurements.

Suffix:
<n> Window

Query parameters:
<TraceNumber> Trace number.
TRACE1 | ... | TRACE6

Example: `TRAC3:X? TRACE1`
Returns the x-values for trace 1 in window 3.

Usage: Query only

10.9.3 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 (see `TRACe<n>[:DATA]?` on page 161).

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 3.1.2, "Evaluation Methods for Code Domain Analysis", on page 11.

10.9.3.1 Bitstream

When the trace data for this evaluation is queried, the bit stream of one slot is transferred. One value is transferred per bit (range 0, 1).

The number of bits depends on the modulation (see Table 4-8).

10.9.3.2 Channel Table

For the Channel Table result display, the command returns 11 values for each channel in the following order:

`<ChannelType>, <CodeClass>, <CodeNo>, <ModType>, <AbsLevel>, <RelLevel>, <MAShift>, <ΔMiD1>, <ΔMiD2>, <reserved1>, <reserved2>`

For details on these parameters see `TRACe<n>[:DATA]?` on page 161.

The output depends on the channel sorting order (see `CONFigure:CDPower:CTABle:ORDer` on page 140).

In **code sorting order**, all midambles are output first, then control channels and last the data channels.

In **midamble sorting order**, each midamble is output with its corresponding control and data channel.

Example:

The following example shows the results of a query for three active channels in common midamble allocation:

- Midamble m(3), -3.0 dBm
- DPCH, 1.16, QPSK, -7.78 dB
- DPCH, 2.8, QPSK, -7.78 dB
- DPCH, 3.4, 8PSK, -7.78 dB

In this example, the command would return the following string:

```
1, 0, 0, 0, -3.0, 0, 3, 0.005, 0.005, 0, 0 2 , 4, 1, 1, -7.78,
-4.78, 3, 0, 0, 0, 0 2 , 3, 2, 1, -7.78, -4.78, 3, 0, 0, 0,
0 2 , 2, 3, 2, -7.78, -4.78, 3, 0, 0, 0, 0 0 , 4, 2, 1, -46.9,
-43.9, 3, 0, 0, 0, 0 0 , 4, 5, 1, -46.9, -43.9, 3, 0, 0, 0,
0 0 , 4, 6, 1, -46.9, -43.9, 3, 0, 0, 0, 0 0 , 4, 7, 1, -46.9,
-43.9, 3, 0, 0, 0, 0 0 , 4, 8, 1, -46.9, -43.9, 3, 0, 0, 0,
0 0 , 4, 13, 1, -46.9, -43.9, 3, 0, 0, 0, 0 0 , 4, 14, 1, -46.9,
-43.9, 3, 0, 0, 0, 0 0 , 4, 15, 1, -46.9, -43.9, 3, 0, 0, 0,
0 0 , 4, 16, 1, -46.9, -43.9, 3, 0, 0, 0, 0
```

10.9.3.3 Code Domain Power / Code Domain Error Power

When the trace data for this evaluation is queried, 4 values are transmitted for each channel:

`<CodeClass>, <CodeNo>, <Level>, <ActiveFlag>`

- the code class (<CodeClass>)
- the channel number (<CodeNo>)
- the absolute or relative level (<Level>), depending on `[SENSe:]CDPower:PDISplay` on page 140
- the state of the channel (<ActiveFlag>)

For details on these parameters see `TRACe<n>[:DATA]?` on page 161.

The query returns a maximum of 16 channels. Channels that consist of more than one code are returned as one channel.

Example:

Consider the following configuration (three active channels out of a total of 12):

- DPCH, 1.16, (CC4), -7.0 dB
- DPCH, 2.8, (CC3), -7.3 dB
- DPCH, 3.4, (CC2), -8.0 dB

In this example, the command would return the following string (active channels in **bold**):

4, 1, -7.0, 1, 4, 2, -55.1, 0, **3, 2, -7.3, 1,** 4, 5, -56.3, 0, 4, 6, -55.8, 0, 4, 7, -57.0, 0, **2, 3, -8.0, 1,** 4, 13, -55.8, 0, 4, 14, -56.3, 0, 4, 15, -55.9, 0, 4, 16, -57.3, 0

10.9.3.4 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>, ..., <Re864>, <Im864>

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

10.9.3.5 Composite EVM (RMS)

For the Composite EVM result display, the command returns two values for each slot in the following order:

<Slot_0>, <MAccuracy_0>, ..., <Slot_n>, <MAccuracy_n>

The number of slots depends on the capture length.

10.9.3.6 Peak Code Domain Error

For the Peak Code Domain Error result display, the command returns two values for each slot in the following order:

<Slot_0>, <AbsLevel_0>, ..., <Slot_n>, <AbsLevel_n>

The number of slots depends on the capture length.

10.9.3.7 Power vs Slot

For the Power vs Slot result display, the command returns three values for each slot in the following order:

<Slot_0>, <Level_0>, <Validity_0>..., <Slot_n>, <Level_n>, <Validity_n>

In addition to the power level, the source of the power (active, inactive or alias channel) is provided.

Whether the level is provided as an absolute or relative value depends on `[SENSe:]CDPower:PDISplay` on page 140).

10.9.3.8 Power vs Symbol

When the trace data for this evaluation is queried, the absolute power of each symbol at the selected slot is transferred.

The number of symbols depends on the spreading factor (see Table 4-8).

10.9.3.9 Power vs Time

When the trace data for this evaluation is queried, the peak power in the defined slot range for each measured subframe is transferred.

The number of values depends on the number of subframes (see "No of Subframes" on page 78).

10.9.3.10 Result Summary

For the Result Summary, the command returns 25 values for the selected set, slot and channel in the following order:

<Slot>, <PData>, <PD1>, <PD2>, <PMidamble>, <RHO>, <MAccuracy>, <PCDError>, <FError>, <CError>, <TrigFrame>, <IQImbalance>, <IQOffset>, <ActiveFlag>, <SymRate>, <CodeNo>, <SF>, <CDPRelative>, <CDPAbsolute>, <EVMRMS>, <EVMPeak>, <reserved1>, <reserved2>, <reserved3>, <reserved4>

For details on these parameters see `TRACe<n>[:DATA]?` on page 161.

10.9.3.11 Symbol Constellation

For the Symbol Constellation result display, the command returns one value each for the real and imaginary parts of each symbol:

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

The number of symbols depends on the spreading factor (see Table 4-8).

10.9.3.12 Symbol EVM

For the Symbol EVM result display, the command returns one value for each symbol: <EVMRMS>

The number of symbols depends on the spreading factor (see Table 4-8).

10.9.4 Exporting Trace Results

RF measurement trace results can be exported to a file.

For more commands concerning data and results storage see the R&S FPS User Manual.

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

This command exports trace data from the specified window to an ASCII file.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the R&S FPS User Manual.

Suffix:

<n>	Window

Setting 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`.
Usage:	Setting only

FORMat:DEXPort:DSEParator <Separator>

This command selects the decimal separator for data exported in ASCII format.

Parameters:

<Separator>	**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.

10.9.5 Retrieving RF Results

The following commands are required to retrieve the results of the TD-SCDMA RF measurements.

See also Chapter 10.9.3, "Measurement Results for TRACe<n>[:DATA]? TRACE<n>", on page 165.

CALCulate<n>:LIMit<k>:FAIL?

This command queries the result of a limit check in the specified window.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also `INITiate<n>:CONTinuous` on page 153.

Suffix:

<n>	Window
<k>	Limit line

Return values:

<Result>
0
PASS
1
FAIL

Example: `INIT;*WAI`
Starts a new sweep and waits for its end.
`CALC2:LIM3:FAIL?`
Queries the result of the check for limit line 3 in window 2.

Usage: Query only

Manual operation: See "Power vs Time" on page 25
See "Spectrum Emission Mask" on page 28

CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult? <Measurement>

This command queries the results of power measurements.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also `INITiate<n>:CONTinuous` on page 153.

Suffix:

<n>, <m>	irrelevant
<sb>	1 | 2 | 3 (4 | 5) Multi-SEM: 1 to 3 for all other measurements: irrelevant

Query parameters:

<Measurement>

ACPower | MCACpower
ACLR measurements (also known as adjacent channel power or multicarrier adjacent channel measurements).
Returns the power for every active transmission and adjacent channel. The order is:
• power of the transmission channels
• power of adjacent channel (lower,upper)
• power of alternate channels (lower,upper)
MSR ACLR results:
For MSR ACLR measurements, the order of the returned results is slightly different:
• power of the transmission channels
• total power of the transmission channels for each sub block
• power of adjacent channels (lower, upper)
• power of alternate channels (lower, upper)
• power of gap channels (lower1, upper1, lower2, upper2)
The unit of the return values depends on the scaling of the y-axis:
• logarithmic scaling returns the power in the current unit
• linear scaling returns the power in W

CN
Carrier-to-noise measurements.
Returns the C/N ratio in dB.

CN0
Carrier-to-noise measurements.
Returns the C/N ratio referenced to a 1 Hz bandwidth in dBm/Hz.

CPOWer
Channel power measurements.
Returns the channel power. The unit of the return values depends on the scaling of the y-axis:
• logarithmic scaling returns the power in the current unit
• linear scaling returns the power in W
For SEM measurements, the return value is the channel power of the reference range (in the specified sub block).

PPOWer
Peak power measurements.
Returns the peak power. The unit of the return values depends on the scaling of the y-axis:
• logarithmic scaling returns the power in the current unit
• linear scaling returns the power in W
For SEM measurements, the return value is the peak power of the reference range (in the specified sub block).

OBANdwidth | OBWidth
Occupied bandwidth.
Returns the occupied bandwidth in Hz.

Usage: Query only

Manual operation: See "Power" on page 27
See "Channel Power ACLR" on page 27
See "Spectrum Emission Mask" on page 28
See "Occupied Bandwidth" on page 29

CALCulate<n>:MARKer<m>:Y?

This command queries the position of a marker on the y-axis.

If necessary, the command activates the marker first.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also `INITiate<n>:CONTinuous` on page 153.

Suffix:

<n>	Window
<m>	Marker

Return values:

<Result>	Result at the marker position.

Example:
`INIT:CONT OFF`
Switches to single measurement mode.
`CALC:MARK2 ON`
Switches marker 2.
`INIT;*WAI`
Starts a measurement and waits for the end.
`CALC:MARK2:Y?`
Outputs the measured value of marker 2.

Usage: Query only

Manual operation: See " Marker Table " on page 18
See " Marker Peak List " on page 33

CALCulate<n>:STATistics:RESult<t>? <ResultType>

This command queries the results of a CCDF or ADP measurement for a specific trace.

Suffix:

<n>	irrelevant
<t>	Trace

Query parameters:

<ResultType>

MEAN
Average (=RMS) power in dBm measured during the measurement time.

PEAK
Peak power in dBm measured during the measurement time.

CFACtor
Determined crest factor (= ratio of peak power to average power) in dB.

ALL
Results of all three measurements mentioned before, separated by commas: <mean power>,<peak power>,<crest factor>

Example: `CALC:STAT:RES2? ALL`
Reads out the three measurement results of trace 2. Example of answer string: 5.56,19.25,13.69 i.e. mean power: 5.56 dBm, peak power 19.25 dBm, crest factor 13.69 dB

Usage: Query only

Manual operation: See "CCDF" on page 30

10.10 Analysis

The following commands define general result analysis settings concerning the traces and markers.

10.10.1 Traces

The trace settings determine how the measured data is analyzed and displayed on the screen. In TD-SCDMA applications, only one trace per window can be configured for Code Domain Analysis.

DISPlay[:WINDow<n>]:TRACe<t>:MODE <Mode>

This command selects the trace mode.

In case of max hold, min hold or average trace mode, you can set the number of single measurements with `[SENSe:]SWEep:COUNt`. Note that synchronization to the end of the measurement is possible only in single sweep mode.

Suffix:

<n> Window

<t>	Trace

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 89

DISPlay[:WINDow<n>]:TRACe<t>[:STATe] <State>

This command turns a trace on and off.

The measurement continues in the background.

Suffix:

<n>	Window
<t>	Trace

Parameters:

<State>	ON | OFF | 1 | 0 *RST: 1 for TRACe1, 0 for TRACe 2 to 6
Example:	`DISP:TRAC3 ON`

10.10.2 Markers

Markers help you analyze your measurement results by determining particular values in the diagram. In TD-SCDMA applications, only 4 markers per window can be configured for Code Domain Analysis.

10.10.2.1 Individual Marker Settings

CALCulate<n>:MARKer<m>[:STATe] <State>

This command 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 | 1 | 0

*RST: 0

Example: `CALC:MARK3 ON`
Switches on marker 3.

Manual operation: See " Marker State " on page 90
See " Marker Type " on page 91

CALCulate<n>:MARKer<m>:X <Position>

This command moves a marker to a particular coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

Suffix:

<m> Marker (query: 1 to 16)

<n> Window

Parameters:

<Position> Numeric value that defines the marker position on the x-axis.

Range: The range depends on the current x-axis range.

Example: `CALC:MARK2:X 1.7MHz`
Positions marker 2 to frequency 1.7 MHz.

Manual operation: See " Marker Table " on page 18
See " Marker Peak List " on page 33
See "X-value" on page 91

CALCulate<n>:MARKer<m>:AOFF

This command turns off all markers.

Suffix:

<n> Window

<m> Marker

Example: `CALC:MARK:AOFF`
Switches off all markers.

Usage: Event

Manual operation: See " All Marker Off " on page 91

CALCulate<n>:DELTamarker<m>[:STATe] <State>

This command turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker turns on delta marker 1.

Suffix:
<n> Window

<m> Marker

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

Example: `CALC:DELT2 ON`
Turns on delta marker 2.

Manual operation: See " Marker State " on page 90
See " Marker Type " on page 91

CALCulate<n>:DELTamarker<m>:AOFF

This command turns off *all* delta markers.

Suffix:
<n> Window

<m> irrelevant

Example: `CALC:DELT:AOFF`
Turns off all delta markers.

Usage: Event

CALCulate<n>:DELTamarker<m>:X <Position>

This command moves a delta marker to a particular coordinate on the x-axis.

If necessary, the command activates the delta marker and positions a reference marker to the peak power.

Suffix:
<m> Marker

<n> Window

Example: `CALC:DELT:X?`
Outputs the absolute x-value of delta marker 1.

Manual operation: See "X-value" on page 91

CALCulate<n>:DELTamarker<m>:X:RELative?

This command queries the relative position of a delta marker on the x-axis.

If necessary, the command activates the delta marker first.

Suffix:

<n>	Window
<m>	Marker

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

CALCulate<n>:DELTamarker<m>:Y?

This command queries the relative position of a delta marker on the y-axis.

If necessary, the command activates the delta marker first.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also `INITiate<n>:CONTinuous` on page 153.

The unit depends on the application of the command.

Suffix:

<m>	Marker
<n>	Window

Return values:

<Result>	Result at the position of the delta marker. The unit is variable and depends on the one you have currently set.

Example:	`INIT:CONT OFF`
	Switches to single sweep mode.
	`INIT;*WAI`
	Starts a sweep and waits for its end.
	`CALC:DELT2 ON`
	Switches on delta marker 2.
	`CALC:DELT2:Y?`
	Outputs measurement value of delta marker 2.

Usage:	Query only

10.10.2.2 General Marker Settings

DISPlay[:WINDow<n>]:MTABle <DisplayMode>

This command 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 92

10.10.2.3 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>:MAXimum:LEFT

This command moves a marker to the next lower peak.

The search includes only measurement values to the left of the current marker position.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Search Next Peak " on page 94

CALCulate<n>:MARKer<m>:MAXimum:NEXT

This command moves a marker to the next lower peak.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Search Next Peak " on page 94

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

This command moves a marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Peak Search " on page 94

CALCulate<n>:MARKer<m>:MAXimum:RIGHt

This command moves a marker to the next lower peak.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Search Next Peak " on page 94

CALCulate<n>:MARKer<m>:MINimum:LEFT

This command moves a marker to the next minimum value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Search Next Minimum " on page 94

CALCulate<n>:MARKer<m>:MINimum:NEXT

This command moves a marker to the next minimum value.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Search Next Minimum " on page 94

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

This command moves a marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Search Minimum " on page 94

CALCulate<n>:MARKer<m>:MINimum:RIGHt

This command moves a marker to the next minimum value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Search Next Minimum " on page 94

Positioning Delta Markers

The following commands position delta markers on the trace.

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT

This command moves a delta marker to the next higher value.

The search includes only measurement values to the left of the current marker position.

Suffix:

<n>	Window
<m>	Marker
Usage:	Event
Manual operation:	See " Search Next Peak " on page 94

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT

This command moves a marker to the next higher value.

Suffix:

<n>	Window
<m>	Marker
Usage:	Event
Manual operation:	See " Search Next Peak " on page 94

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

This command moves a delta marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n>	Window
<m>	Marker
Usage:	Event
Manual operation:	See " Peak Search " on page 94

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt

This command moves a delta marker to the next higher value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n>	Window
<m>	Marker
Usage:	Event
Manual operation:	See " Search Next Peak " on page 94

CALCulate<n>:DELTamarker<m>:MINimum:LEFT

This command moves a delta marker to the next higher minimum value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n>	Window
<m>	Marker
Usage:	Event
Manual operation:	See " Search Next Minimum " on page 94

CALCulate<n>:DELTamarker<m>:MINimum:NEXT

This command moves a marker to the next higher minimum value.

Suffix:

<n>	Window
<m>	Marker
Usage:	Event
Manual operation:	See " Search Next Minimum " on page 94

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

This command moves a delta marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n>	Window
<m>	Marker
Usage:	Event

Manual operation: See " Search Minimum " on page 94

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt

This command moves a delta marker to the next higher minimum value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> Window

<m> Marker

Usage: Event

Manual operation: See " Search Next Minimum " on page 94

10.11 Importing and Exporting I/Q Data and Results

For details on importing and exporting I/Q data see Chapter 5, "I/Q Data Import and Export", on page 42.

MMEMory:LOAD:IQ:STATe 1,<FileName>

This command restores I/Q data from a file.

The file extension is *.iq.tar.

Parameters:

<FileName> String containing the path and name of the source file.

Example:

```
MMEM:LOAD:IQ:STAT 1, 'C:
\R_S\Instr\user\data.iq.tar'
```

Loads IQ data from the specified file.

Usage: Setting only

Manual operation: See " I/Q Import " on page 43

MMEMory:STORe<n>:IQ:COMMent <Comment>

This command adds a comment to a file that contains I/Q data.

Suffix:

<n> irrelevant

Parameters:

<Comment> String containing the comment.

Example: `MMEM:STOR:IQ:COMM 'Device test 1b'`
Creates a description for the export file.
`MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`
Stores I/Q data and the comment to the specified file.

Manual operation: See " I/Q Export " on page 43

MMEMory:STORe:IQ:FORMat? <Format>,<DataFormat>

This command queries the format of the I/Q data to be stored.

Parameters:

<Format> **FLOat32**
32-bit floating point format.
*RST: FLOat32

<DataFormat> **COMPlex**
Exports complex data.
*RST: COMPlex

Usage: Query only

MMEMory:STORe<n>:IQ:STATe 1, <FileName>

This command writes the captured I/Q data to a file.

The file extension is *.iq.tar. By default, the contents of the file are in 32-bit floating point format.

Secure User Mode

In secure user mode, settings that are stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "memory limit reached" error can occur although the hard disk indicates that storage space is still available.

To store data permanently, select an external storage location such as a USB memory device.

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the R&S FPS User Manual.

Suffix:

<n> irrelevant

Setting parameters:

1

<FileName> String containing the path and name of the target file.

Example: `MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`
Stores the captured I/Q data to the specified file.

Usage: Setting only

Manual operation: See " I/Q Export " on page 43

10.12 Configuring the Slave Application Data Range (MSRA mode only)

In MSRA operating mode, only the MSRA Master actually captures data; the MSRA slave applications define an extract of the captured data for analysis, referred to as the **slave application data**.

For the TD-SCDMA BTS slave application, the slave application data range is defined by the same commands used to define the signal capture in Signal and Spectrum Analyzer mode (see Chapter 10.5.4, "Signal Capturing", on page 126). Be sure to select the correct measurement channel before executing this command.

In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the slave application data for the TD-SCDMA BTS measurement.

The **analysis interval** used by the individual result displays cannot be edited, but is determined automatically. However, you can query the currently used analysis interval for a specific window.

The **analysis line** is displayed by default but can be hidden or re-positioned.

Remote commands exclusive to MSRA slave applications

The following commands are only available for MSRA slave application channels:

CALCulate<n>:MSRA:ALINe:SHOW

This command defines whether or not the analysis line is displayed in all time-based windows in all MSRA slave applications and the MSRA Master.

Note: even if the analysis line display is off, the indication whether or not the currently defined line position lies within the analysis interval of the active slave application remains in the window title bars.

Suffix:
<n> irrelevant

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

CALCulate<n>:MSRA:ALINe[:VALue] <Position>

This command defines the position of the analysis line for all time-based windows in all MSRA slave applications and the MSRA Master.

Suffix:

<n>	irrelevant

Parameters:

<Position>	Position of the analysis line in seconds. The position must lie within the measurement time of the MSRA measurement. Default unit: s

CALCulate<n>:MSRA:WINDow<n>:IVAL?

This command queries the analysis interval for the window specified by the WINDow suffix <n> (the CALC suffix is irrelevant). This command is only available in slave application measurement channels, not the MSRA View or MSRA Master.

Suffix:

<n>	Window

Return values:

<IntStart>	Start value of the analysis interval in seconds Default unit: s
<IntStop>	Stop value of the analysis interval in seconds
Usage:	Query only

INITiate<n>:REFResh

This function is only available if the Sequencer is deactivated (`SYSTem:SEQuencer` SYST:SEQ:OFF) and only for slave applications in MSRA mode, not the MSRA Master.

The data in the capture buffer is re-evaluated by the currently active slave application only. The results for any other slave applications remain unchanged.

Suffix:

<n>	irrelevant

Example:

`SYST:SEQ:OFF`
Deactivates the scheduler
`INIT:CONT OFF`
Switches to single sweep mode.
`INIT;*WAI`
Starts a new data measurement and waits for the end of the sweep.
`INST:SEL 'IQ ANALYZER'`
Selects the IQ Analyzer channel.
`INIT:REFR`
Refreshes the display for the I/Q Analyzer channel.

Usage: Event

Manual operation: See " Refresh (MSRA only)" on page 73

[SENSe:]MSRA:CAPTure:OFFSet <Offset>

This setting is only available for slave applications in MSRA mode, not for the MSRA Master. It has a similar effect as the trigger offset in other measurements.

Parameters:

<Offset> This parameter defines the time offset between the capture buffer start and the start of the extracted slave application data. The offset must be a positive value, as the slave application can only analyze data that is contained in the capture buffer.

Range: 0 to <Record length>
*RST: 0

Manual operation: See " Capture Offset " on page 60

10.13 Status Registers

The following commands are required for the status reporting system specific to the TD-SCDMA applications. In addition, the TD-SCDMA applications also use the standard status registers of the R&S FPS (depending on the measurement type).

For details on the common R&S FPS status registers refer to the description of remote control basics in the R&S FPS User Manual.

*RST does not influence the status registers.

10.13.1 STATus:QUEStionable:SYNC Register

The `STATus:QUEStionable:SYNC` register contains application-specific information about synchronization errors or errors during pilot symbol detection.

Table 10-5: Status error bits in STATus:QUEStionable:SYNC register for TD-SCDMA applications

Bit	Definition
0	Not used.
1	Frame Sync failed This bit is set when synchronization is not possible within the application. Possible reasons: ● Invalid frequency ● Invalid level ● Invalid scrambling code ● Invalid max. number of MA shift cell ● Invalid values for INVERT Q ● Invalid signal at input
2 to 14	Not used.
15	This bit is always 0.

STATus:QUEStionable:SYNC[:EVENt]? <ChannelName>

This command reads out the EVENt section of the status register.

The command also deletes the contents of the EVENt section.

Suffix:

<n> Window

<m> Marker

Query parameters:

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Usage: Query only

STATus:QUEStionable:SYNC:CONDition? <ChannelName>

This command reads out the CONDition section of the status register.

The command does not delete the contents of the EVENt section.

Suffix:

<n> Window

<m> Marker

Query parameters:

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Usage: Query only

STATus:QUEStionable:SYNC:ENABle <BitDefinition>, <ChannelName>

This command controls the ENABle part of a register.

The ENABle part allows true conditions in the EVENt part of the status register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit transitions to true, a positive transition will occur in the summary bit reported to the next higher level.

Suffix:

<n> Window

<m> Marker

Parameters:

<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>

This command controls the Negative TRansition part of a register.

Setting a bit causes a 1 to 0 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENt register.

Suffix:

<n> Window

<m> Marker

Parameters:

<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.

Suffix:

<n> Window

<m> Marker

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.

10.14 Deprecated Commands

The following commands are provided for compatibility to other signal analyzers only. For new remote control programs use the specified alternative commands.

CALCulate<n>:FEED <Evaluation>

This command selects the evaluation method of the measured data that is to be displayed in the specified window.

Note that this command is maintained for compatibility reasons only. Use the `LAYout` commands for new remote control programs (see Chapter 10.7.2, "Working with Windows in the Display", on page 144).

Parameters:

<Evaluation> Type of evaluation you want to display.
See the table below for available parameter values.

Example:

`INST:SEL BTDS`
Activates TD-SCDMA mode.
`CALC:FEED CDP`
Selects the display of the code domain power.

Table 10-6: <Evaluation> parameter values for TD-SCDMA applications

String Parameter	Enum Parameter	Evaluation
'XTIM:CDP:BSTRream'	BITStream	Bitstream
'XTIM:CDP:COMP:CONStellation'	CCONst	Composite Constellation
*) Use [SENS:]CDP:PDIS ABS | REL subsequently to change the scaling		

String Parameter	Enum Parameter	Evaluation
'XPOW:CDEPower'	CDEPower	Code Domain Error Power
'XPOW:CDP' 'XPOW:CDP:ABSolute'	CDPower	Code Domain Power (absolute scaling)
'XPOW:CDP:RATio'	CDPower	Code Domain Power (relative scaling) ***)**
'XTIM:CDP:MACCuracy'	CEVM	Composite EVM
'XTIM:CDP:ERR:CTABle'	CTABle	Channel Table
'XTIM:CDP:ERR:PCDomain'	PCDerror	Peak Code Domain Error
'XTIM:CDP:PVSLot' '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
***)** Use [SENS:]CDP:PDIS ABS | REL subsequently to change the scaling		

CONFigure:CDPower[:BTS]:PVTime:LIST[:STATe] <State>

This command hides or shows the list evaluation result display.

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 144).

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

[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 FPS 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 FPS programs use `[SENSe:]ADJust:LEVel` on page 138.

[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

Manual operation: See "Swap I/Q" on page 63

10.15 Programming Examples (TD-SCDMA BTS)

The following programming examples are meant to demonstrate the operation of the R&S FPSTD-SCDMA application in a remote environment. They are performed with an R&S FPS equipped with option R&S FPS-K76. Only the commands required to control the R&S FPS-K76 application are provided, not the signal generator.

The measurements are performed using the following devices and accessories:

- The R&S FPS with Application Firmware R&S FPS-K76: TD-SCDMA BTS
- The Vector Signal Generator R&S SMU with option R&S SMU-B45: digital standard 3GPP (options R&S SMU-B20 and R&S SMU-B11 required)
- 1 coaxial cable, 50Ω, approx. 1 m, N connector
- 1 coaxial cable, 50Ω, approx. 1 m, BNC connector

Test setup

1. Connect the RF output of the R&S SMU to the input of the R&S FPS.
2. Connect the reference input (REF INPUT) on the rear panel of the R&S FPS to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).
3. Connect the external trigger input of the R&S FPS (TRIGGER INPUT) to the external trigger output of the R&S SMU (TRIGOUT1 of PAR DATA).

Settings on the R&S SMU

Setting	Value
Preset	
Frequency	2.1175 GHz
Level	0 dBm
Digital standard	TDSCDMA/3GPP
Link direction	DOWN/FORWARD
Test model	DPCCH_DPDCH960ksps
User equipment	UE 1

Setting	Value
Digital standard - State	ON
Scrambling code	0000

The following measurements are described:

10.15.1 Measurement 1: Measuring the Signal Channel Power

```
//------- Preparing the instrument ------------
//Reset the instrument
*RST
//Activate a TD-SCDMA BTS measurement channel named "BTSMeasurement"
INST:CRE:NEW BTDS,'BTSMeasurement'
//Set the reference level to 0 dBm
DISP:TRAC:Y:SCAL:RLEV 0
//Set the center frequency to 2.1175 GHz
FREQ:CENT 2.1175 GHz
//Select the power measurement
CONF:CDP:MEAS POW

//--------Configuring the measurement ----------------
//Set the slot range to analyze downlink data from slots 3 to 7 (switching point = 2)
SENS:POW:ACH:SLOT:STAR 3
SENS:POW:ACH:SLOT:STOP 7
//Automatically set the reference level and trigger to frame values according
//to measured levels and time.
SENS:POW:ACH:AUTO:LTIM

//----------Performing the measurement -----------------
//Stops continuous sweep
INIT:CONT OFF
//Sets the number of sweeps to be performed to 10
SWE:COUN 10
//Start a new measurement with 10 sweeps and wait for the end
INIT;*WAI

//-------------Retrieving results --------------------------
//Retrieves the calculated total power value of the signal channel
CALC:MARK:FUNC:POW:RES? CPOW
//Result: -1.02 [dB]
```

```
//Retrieve the trace data of the power measurement
TRAC:DATA? TRACE1
//Result: -1.482287750E+002,-6.440737915E+001,-1.482287750E+002,-1.482287750E+002,
-1.482287750E+002,-6.440737915E+001,-1.482287750E+002,-1.482287750E+002, [...]
```

Table 10-7: Trace results for power measurement

Frequency	Power level
-1.482287750E+002	-6.440737915E+001
-1.482287750E+002	-1.482287750E+002
-1.482287750E+002	-6.440737915E+001
...	...

10.15.2 Measurement 2: Determining the Spectrum Emission Mask

```
//------- Preparing the instrument ------------
//Reset the instrument
*RST
//Activate a TD-SCDMA BTS measurement channel named "BTSMeasurement"
INST:CRE:NEW BTDS,'BTSMeasurement'
//Set the reference level to 0 dBm
DISP:TRAC:Y:SCAL:RLEV 0
//Set the center frequency to 2.1175 GHz
FREQ:CENT 2.1175 GHz
//Select the spectrum emission mask measurement
CONF:CDP:MEAS ESP

//--------Configuring the measurement ----------------
//Set the slot range to analyze downlink data from slots 3 to 7 (switching point = 2)
SENS:POW:ACH:SLOT:STAR 3
SENS:POW:ACH:SLOT:STOP 7
//Automatically set the reference level and trigger to frame values according
//to measured levels and time.
SENS:POW:ACH:AUTO:LTIM

//----------Performing the measurement -----------------
//Stops continuous sweep
INIT:CONT OFF
//Sets the number of sweeps to be performed to 10
SWE:COUN 10
//Start a new measurement with 10 sweeps and wait for the end
INIT;*WAI

//-------------Retrieving results --------------------------
//Retrieves the calculated channel power value of the reference channel
CALC:MARK:FUNC:POW:RES? CPOW
//Result: -36.013 [dBm]
//Queries the result of the limit check
```

```
CALC:LIM:FAIL?
//Result: 0 [passed]
//Retrieves the peak list of the spectrum emission mask measurement
TRAC:DATA? LIST
//Result:
//+1.000000000,-1.275000000E+007,-8.500000000E+006,+1.000000000E+006,+2.108782336E+009,
//-8.057177734E+001,-7.882799530E+001,-2.982799530E+001,+0.000000000,+0.000000000,+0.00000000

//+2.000000000,-8.500000000E+006,-7.500000000E+006,+1.000000000E+006,+2.109000064E+009,
//-8.158547211E+001,-7.984169006E+001,-3.084169006E+001,+0.000000000,+0.000000000,+0.00000000

//+3.000000000,-7.500000000E+006,-3.500000000E+006,+1.000000000E+006,+2.113987200E+009,
//-4.202708435E+001,-4.028330231E+001,-5.270565033,+0.000000000,+0.000000000,+0.000000000,

 [...]
```

Table 10-8: Trace results for Relative Code Domain Power measurement

Range No.	Start freq. [Hz]	Stop freq. [Hz]	RBW [Hz]	Freq. peak power [Hz]	Abs. peak power [dBm]	Rel. peak power [%]	Delta to margin [dB]	Limit check result	-	-	-
1	+1.000000000	-1.275000000E+007	-8.500000000E+006	+1.000000000E+006	+2.108782336E+009	-8.057177734E+001	-7.882799530E+001	-2.982799530E+001	+0.000000000	+0.000000000	+0.000000000
2	+2.000000000	-8.500000000E+006	-7.500000000E+006	+1.000000000E+006	+2.109000064E+009	-8.158547211E+001	-7.984169006E+001	-3.084169006E+001	+0.000000000	+0.000000000	+0.000000000
3	+3.000000000	-7.500000000E+006	-3.500000000E+006	+1.000000000E+006	+2.113987200E+009	-4.202708435E+001	-4.028330231E+001	-5.270565033	+0.000000000	+0.000000000	+0.000000000
...	...										

10.15.3 Measurement 3: Measuring the Relative Code Domain Power

```
//------- Preparing the instrument ------------
//Reset the instrument
*RST
//Activate a TD-SCDMA BTS measurement channel named "BTSMeasurement"
INST:CRE:NEW BTDS,'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 measurementDISP:TRAC:Y:SCAL:AUTO ONCE


//-------Configuring CDA -----------------

//Capture 32 slots in 1 set
SENS:CDP:SET:COUN 1
SENS:CDP:IQL 32
//Invert Q-branch of signal
SENS:CDP:QINV ON
//Base station uses scrambling code 16
SENS:CDP:SCOD 16
//Maximum number of users on base station is 8
SENS:CDP:MSH 8
//Synchronize to phase reference of midamble in slot
SENS:CDP:STSL ON
//Allow for phase rotations between channels.
SENS:CDP:STSL:ROT ON
//Power threshold for active channel is -10 dB compared to total signal
SENS:CDP:ICTR -10
//Automatic channel search for modulation up to 8PSK.
SENS:CDP:MMAX PSK8
CONF:CDP:CTAB OFF


//--------Defining the evaluation range and result displays ----------
//Analyze slot 3 in set 0.SENS:CDP:SET 0
SENS:CDP:SLOT 3
//Set code 3 (for SF 16) as current code.
SENS:CDP:CODE 3
//Define relative power values
SENS:CDP:PDIS REL


//----------Performing the measurement -----------------
//Stops continuous sweep
INIT:CONT OFF
//Sets the number of sweeps to be performed to 10
SWE:COUN 10
//Start a new measurement with 10 sweeps and wait for the end
INIT;*WAI

//-------- Retrieving results----------
//Retrieve the relative code domain power
CALC:MARK:FUNC:CDP: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,
// [...]


//----------Synchronizing the Reference Frequencies-------------------------
//Select the external frequency from the REF INPUT 1..20 MHZ connector as a reference
//ROSC:SOUR EXT10

//Query the carrier frequency error
CALC:MARK:FUNC:CDP:BTS:RES? FERR
//Result: 0.1 [Hz]
```

Table 10-9: Trace results for Relative Code Domain Power measurement

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
...	...			

10.15.4 Measurement 4: Triggered Measurement of Relative Code Domain Power

```
//------- Preparing the instrument ------------
//Reset the instrument
*RST
//Activate a TD-SCDMA BTS measurement channel named "BTSMeasurement"
INST:CRE:NEW BTDS,'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

//--------Configuring the measurement ----------------
//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 -----------------
//Stops continuous sweep
```

```
INIT:CONT OFF
//Sets the number of sweeps to be performed to 10
SWE:COUN 10
//Start a new measurement with 10 sweeps and wait for the end
INIT;*WAI

//-------------Retrieving results --------------------------
//Retrieve the trigger to frame (the offset between trigger event and
// start of first captured frame)
CALC:MARK:FUNC:CDP: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:CDP:BTS:RES? TFR
//Result: 0.00599987013 [ms]
```

10.15.5 Measurement 5: Measuring the Composite EVM

```
//------- Preparing the instrument ------------
//Reset the instrument
*RST
//Activate a TD-SCDMA BTS measurement channel named "BTSMeasurement"
INST:CRE:NEW BTDS,'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

//--------Configuring the measurement ----------------
//Set the trigger source to the external trigger
//(TRIGGER INPUT connector)
TRIG:SOUR EXT
//Replace the second measurement window (Result Summary) by Composite EVM evaluation
LAY:REPL '2',CEVM
//Optimize the scaling of the y-axis for the Composite EVM measurement
DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE

//----------Performing the measurement -----------------
//Stops continuous sweep
INIT:CONT OFF
//Sets the number of sweeps to be performed to 10
SWE:COUN 10
//Start a new measurement with 10 sweeps and wait for the end
INIT;*WAI
```

```
//-------------Retrieving results --------------------------
//Retrieve the trace data of the composite EVM measurementTRAC2:DATA? TRACE1

//Result: +0.000000000,+5.876136422E-001,
//+1.000000000,+5.916179419E-001,
//+2.000000000,+5.949081182E-001,
//[...]
```

Table 10-10: Trace results for Composite EVM measurement

(CPICH) Slot number	EVM
0	+5.876136422E-001
1	+5.916179419E-001
2	+5.949081182E-001
...	...

10.15.6 Measurement 6: Determining the Peak Code Domain Error

```
//------- Preparing the instrument ------------
//Reset the instrument
*RST
//Activate a TD-SCDMA BTS measurement channel named "BTSMeasurement"
INST:CRE:NEW BTDS,'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

//--------Configuring the measurement ----------------
//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',PCD
//Optimize the scaling of the y-axis for the Composite EVM measurement
DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE

//----------Performing the measurement -----------------
//Stops continuous sweep
INIT:CONT OFF
//Sets the number of sweeps to be performed to 10
SWE:COUN 10
//Start a new measurement with 10 sweeps and wait for the end
INIT;*WAI

//-------------Retrieving results --------------------------
//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 10-11: Trace results for Peak Code Domain Error measurement

Slot number	Peak Error
0	-6.730751038E+001
1	-6.687619019E+001
2	-6.728615570E+001
...	...

10.15.7 Measurement 7: Checking the Power vs Time

This example demonstrates how to check the signal power in the time domain against a transmission power mask defined by the TD-SCDMA specification in a remote environment (for details see "Power vs Time" on page 25).

```
//------- Preparing the instrument ------------
//Reset the instrument
*RST
//Activate a TD-SCDMA BTS measurement channel named "BTSMeasurement"
INST:CRE:NEW BTDS,'BTSMeasurement'
//Set the center frequency to 2.1175 GHz
FREQ:CENT 2.1175 GHz
//Select the power vs time measurement
CONF:CDP:MEAS PVT

//--------Configuring the measurement ----------------
//Set the switching point to 2 to analyze downlink data in slots 3 to 7
CONF:CDP:PVT:SPO 2
//Set the number of subframes to average to 50.
CONF:CDP:PVT:SFR 50
//Automatically set the reference level and trigger to frame values according
//to measured levels and time.
SENS:POW:ACH:AUTO:LTIM
//Add a second measurement window for the list evaluation
LAY:ADD '1',BEL,LEV

//----------Performing the measurement -----------------
//Stops continuous sweep
INIT:CONT OFF
//Start a new measurement with 10 sweeps and wait for the end
INIT;*WAI

//-------------Retrieving results -------------------------
//Query the result of the limit check for the 50 subframes against the
```

```
//transmission power mask
CALC:LIM:FAIL?
//Retrieve the calculated peak power value of the 50 subframes
//CALC:MARK:FUNC:POW:RES? PPOW
//Result: -1.02 [dB]
//Retrieve the trace data of the power vs time measurement
TRAC:DATA? TRACE1
//Result: -1.201362252,-1.173495054,-1.187217355,-1.186594367,-1.171583891,
//-1.188250422,-1.204138160,-1.181404829,-1.186317205,-1.197872400, [...]
```

Table 10-12: Trace results for power vs time measurement

Subframe	Power level
-1.201362252	-1.173495054
-1.187217355	-1.186594367
-1.171583891	-1.188250422
...	...

11 I/Q Data File Format (iq-tar)

I/Q data is packed in a file with the extension `.iq.tar`. An iq-tar file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. the sample rate. The objective of the iq-tar file format is to separate I/Q data from the meta information while still having both inside one file. In addition, the file format allows you to preview the I/Q data in a web browser, and allows you to include user-specific data.

The iq-tar container packs several files into a single `.tar` archive file. Files in `.tar` format can be unpacked using standard archive tools (see http://en.wikipedia.org/wiki/Comparison_of_file_archivers) available for most operating systems. The advantage of `.tar` files is that the archived files inside the `.tar` file are not changed (not compressed) and thus it is possible to read the I/Q data directly within the archive without the need to unpack (untar) the `.tar` file first.

An application note on converting Rohde & Schwarz I/Q data files is available from the Rohde & Schwarz website:
1EF85: Converting R&S I/Q data files

Contained files

An iq-tar file must contain the following files:

- **I/Q parameter XML file**, e.g. `xyz.xml`
  Contains meta information about the I/Q data (e.g. sample rate). The filename can be defined freely, but there must be only one single I/Q parameter XML file inside an iq-tar file.
- **I/Q data binary file**, e.g. `xyz.complex.float32`
  Contains the binary I/Q data of all channels. There must be only one single I/Q data binary file inside an iq-tar file.

Optionally, an iq-tar file can contain the following file:

- **I/Q preview XSLT file**, e.g. `open_IqTar_xml_file_in_web_browser.xslt`
  Contains a stylesheet to display the I/Q parameter XML file and a preview of the I/Q data in a web browser.
  A sample stylesheet is available at http://www.rohde-schwarz.com/file/open_IqTar_xml_file_in_web_browser.xslt.

11.1 I/Q Parameter XML File Specification

The content of the I/Q parameter XML file must comply with the XML schema `RsIqTar.xsd` available at: http://www.rohde-schwarz.com/file/RsIqTar.xsd.

In particular, the order of the XML elements must be respected, i.e. iq-tar uses an "ordered XML schema". For your own implementation of the iq-tar file format make sure to validate your XML file against the given schema.

The following example shows an I/Q parameter XML file. The XML elements and attributes are explained in the following sections.

Sample I/Q parameter XML file: xyz.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl"
href="open_IqTar_xml_file_in_web_browser.xslt"?>
<RS_IQ_TAR_FileFormat fileFormatVersion="1"
xsi:noNamespaceSchemaLocation="RsIqTar.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <Name>R&S FPS</Name>
  <Comment>Here is a comment</Comment>
  <DateTime>2011-01-24T14:02:49</DateTime>
  <Samples>68751</Samples>
  <Clock unit="Hz">6.5e+006</Clock>
  <Format>complex</Format>
  <DataType>float32</DataType>
  <ScalingFactor unit="V">1</ScalingFactor>
  <NumberOfChannels>1</NumberOfChannels>
<DataFilename>xyz.complex.float32</DataFilename>
<UserData>
  <UserDefinedElement>Example</UserDefinedElement>
</UserData>
  <PreviewData>...</PreviewData>
</RS_IQ_TAR_FileFormat>
```

Element	Description
RS_IQ_TAR_File-Format	The root element of the XML file. It must contain the attribute `fileFormatVersion` that contains the number of the file format definition. Currently, `fileFormatVersion` "2" is used.
Name	Optional: describes the device or application that created the file.
Comment	Optional: contains text that further describes the contents of the file.
DateTime	Contains the date and time of the creation of the file. Its type is `xs:dateTime` (see `RsIqTar.xsd`).

Element	Description
Samples	Contains the number of samples of the I/Q data. For multi-channel signals all channels have the same number of samples. One sample can be: ● A complex number represented as a pair of I and Q values ● A complex number represented as a pair of magnitude and phase values ● A real number represented as a single real value See also `Format` element.
Clock	Contains the clock frequency in Hz, i.e. the sample rate of the I/Q data. A signal generator typically outputs the I/Q data at a rate that equals the clock frequency. If the I/Q data was captured with a signal analyzer, the signal analyzer used the clock frequency as the sample rate. The attribute `unit` must be set to "Hz".
Format	Specifies how the binary data is saved in the I/Q data binary file (see `DataFilename` element). Every sample must be in the same format. The format can be one of the following: ● `complex`: Complex number in cartesian format, i.e. I and Q values interleaved. I and Q are unitless ● `real`: Real number (unitless) ● `polar`: Complex number in polar format, i.e. magnitude (unitless) and phase (rad) values interleaved. Requires `DataType` = `float32` or `float64`
DataType	Specifies the binary format used for samples in the I/Q data binary file (see `DataFilename` element and Chapter 11.2, "I/Q Data Binary File", on page 206). The following data types are allowed: ● `int8`: 8 bit signed integer data ● `int16`: 16 bit signed integer data ● `int32`: 32 bit signed integer data ● `float32`: 32 bit floating point data (IEEE 754) ● `float64`: 64 bit floating point data (IEEE 754)
ScalingFactor	Optional: describes how the binary data can be transformed into values in the unit Volt. The binary I/Q data itself has no unit. To get an I/Q sample in the unit Volt the saved samples have to be multiplied by the value of the `ScalingFactor`. For polar data only the magnitude value has to be multiplied. For multi-channel signals the `ScalingFactor` must be applied to all channels. The attribute `unit` must be set to "`V`". The `ScalingFactor` must be > 0. If the `ScalingFactor` element is not defined, a value of 1 V is assumed.
NumberOfChannels	Optional: specifies the number of channels, e.g. of a MIMO signal, contained in the I/Q data binary file. For multi-channels, the I/Q samples of the channels are expected to be interleaved within the I/Q data file (see Chapter 11.2, "I/Q Data Binary File", on page 206). If the `NumberOfChannels` element is not defined, one channel is assumed.
DataFilename	Contains the filename of the I/Q data binary file that is part of the iq-tar file. It is recommended that the filename uses the following convention: <xyz>.<Format>.<Channels>ch.<Type> ● <xyz> = a valid Windows file name ● <Format> = complex, polar or real (see `Format` element) ● <Channels> = Number of channels (see `NumberOfChannels` element) ● <Type> = float32, float64, int8, int16, int32 or int64 (see `DataType` element) Examples: ● xyz.complex.1ch.float32 ● xyz.polar.1ch.float64 ● xyz.real.1ch.int16 ● xyz.complex.16ch.int8

Element	Description
UserData	Optional: contains user, application or device-specific XML data which is not part of the iq-tar specification. This element can be used to store additional information, e.g. the hardware configuration. User data must be valid XML content.
PreviewData	Optional: contains further XML elements that provide a preview of the I/Q data. The preview data is determined by the routine that saves an iq-tar file (e.g. R&S FPS). For the definition of this element refer to the `RsIqTar.xsd` schema. Note that the preview can be only displayed by current web browsers that have JavaScript enabled and if the XSLT stylesheet `open_IqTar_xml_file_in_web_browser.xslt` is available.

Example: ScalingFactor

Data stored as `int16` and a desired full scale voltage of 1 V

`ScalingFactor` = 1 V / maximum int16 value = 1 V / 2^{15} = 3.0517578125e-5 V

Scaling Factor	Numerical value	Numerical value x ScalingFactor
Minimum (negative) int16 value	$- 2^{15} = - 32768$	-1 V
Maximum (positive) int16 value	$2^{15}-1= 32767$	0.999969482421875 V

Example: PreviewData in XML

```
<PreviewData>
    <ArrayOfChannel length="1">
      <Channel>
        <PowerVsTime>
          <Min>
            <ArrayOfFloat length="256">
              <float>-134</float>
              <float>-142</float>
              ...
              <float>-140</float>
            </ArrayOfFloat>
          </Min>
          <Max>
            <ArrayOfFloat length="256">
              <float>-70</float>
              <float>-71</float>
              ...
              <float>-69</float>
            </ArrayOfFloat>
          </Max>
        </PowerVsTime>
        <Spectrum>
          <Min>
            <ArrayOfFloat length="256">
              <float>-133</float>
              <float>-111</float>
              ...
```

```
          <float>-111</float>
        </ArrayOfFloat>
      </Min>
      <Max>
        <ArrayOfFloat length="256">
          <float>-67</float>
          <float>-69</float>
          ...
          <float>-70</float>
          <float>-69</float>
        </ArrayOfFloat>
      </Max>
    </Spectrum>
    <IQ>
      <Histogram width="64" height="64">0123456789...0</Histogram>
    </IQ>
  </Channel>
</ArrayOfChannel>
</PreviewData>
```

11.2 I/Q Data Binary File

The I/Q data is saved in binary format according to the format and data type specified in the XML file (see `Format` element and `DataType` element). To allow reading and writing of streamed I/Q data, all data is interleaved, i.e. complex values are interleaved pairs of I and Q values and multi-channel signals contain interleaved (complex) samples for channel 0, channel 1, channel 2 etc. If the `NumberOfChannels` element is not defined, one channel is presumed.

Example: Element order for real data (1 channel)

```
I[0],                  // Real sample 0
I[1],                  // Real sample 1
I[2],                  // Real sample 2
...
```

Example: Element order for complex cartesian data (1 channel)

```
I[0], Q[0],            // Real and imaginary part of complex sample 0
I[1], Q[1],            // Real and imaginary part of complex sample 1
I[2], Q[2],            // Real and imaginary part of complex sample 2
...
```

Example: Element order for complex polar data (1 channel)

```
Mag[0], Phi[0],        // Magnitude and phase part of complex sample 0
Mag[1], Phi[1],        // Magnitude and phase part of complex sample 1
Mag[2], Phi[2],        // Magnitude and phase part of complex sample 2
...
```

Example: Element order for complex cartesian data (3 channels)

Complex data: I[channel no][time index], Q[channel no][time index]

```
I[0][0], Q[0][0],            // Channel 0, Complex sample 0
I[1][0], Q[1][0],            // Channel 1, Complex sample 0
I[2][0], Q[2][0],            // Channel 2, Complex sample 0

I[0][1], Q[0][1],            // Channel 0, Complex sample 1
I[1][1], Q[1][1],            // Channel 1, Complex sample 1
I[2][1], Q[2][1],            // Channel 2, Complex sample 1

I[0][2], Q[0][2],            // Channel 0, Complex sample 2
I[1][2], Q[1][2],            // Channel 1, Complex sample 2
I[2][2], Q[2][2],            // Channel 2, Complex sample 2
...
```

Example: Element order for complex cartesian data (1 channel)

This example demonstrates how to store complex cartesian data in float32 format using MATLAB®.

```
% Save vector of complex cartesian I/Q data, i.e. iqiqiq...
N = 100
iq = randn(1,N)+1j*randn(1,N)
fid = fopen('xyz.complex.float32','w');
for k=1:length(iq)
  fwrite(fid,single(real(iq(k))),'float32');
  fwrite(fid,single(imag(iq(k))),'float32');
end
fclose(fid)
```

List of Remote Commands (TD-SCDMA)

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