

# R&S®FPS-K76/K77

## TD-SCDMA Measurements Options

### User Manual



1176.9029.02 – 03

This manual applies to the following R&S®FPS models with firmware version 1.30 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 firmware of the instrument makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgement" on the user documentation CD-ROM (included in delivery).

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

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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".

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# 1 Preface

## 1.1 Documentation Overview

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

- Printed Getting Started manual
- Online Help system on the instrument
- Documentation CD-ROM with:
  - Getting Started
  - User Manuals for base unit and firmware applications
  - Service Manual
  - Release Notes
  - Data sheet and product brochures

### Online Help

The Online Help is embedded in the instrument's firmware. It offers quick, context-sensitive access to the complete information needed for operation and programming. Online help is available using the  icon on the toolbar of the R&S FPS.

### Getting Started

This manual is delivered with the instrument in printed form and in PDF format on the CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and handling are described. Safety information is also included.

The Getting Started manual in various languages is also available for download from the Rohde & Schwarz website, on the R&S FPS product page at <http://www.rohde-schwarz.com/product/FPS.html>.

### User Manuals

User manuals are provided for the base unit and each additional (firmware) application.

The user manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In the user manuals, all instrument functions are described in detail. Furthermore, they provide a complete description of the remote control commands with programming examples.

The user manual for the base unit provides basic information on operating the R&S FPS in general, and the Spectrum application in particular. Furthermore, the software functions that enhance the basic functionality for various applications are described here. An introduction to remote control is provided, as well as information on maintenance, instrument interfaces and troubleshooting.

In the individual application manuals, the specific instrument functions of the application are described in detail. For additional information on default settings and parame-

ters, refer to the data sheets. Basic information on operating the R&S FPS is not included in the application manuals.

All user manuals are also available for download from the Rohde & Schwarz website, on the R&S FPS product page at <http://www2.rohde-schwarz.com/product/FPS.html>.

### Service Manual

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

### Release Notes

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

The most recent release notes are also available for download from the Rohde & Schwarz website, on the R&S FPS product page at <http://www2.rohde-schwarz.com/product/FPS.html> > Downloads > Firmware.

## 1.2 Typographical Conventions

The following text markers are used throughout this documentation:

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

## 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 **Base Transceiver Station (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 6.2.2, "Configuration Overview"](#), on page 48).

### 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**

<b>Ref Level</b>	Reference level
<b>Att</b>	Mechanical and electronic RF attenuation
<b>Freq</b>	Center frequency for the RF signal
<b>Channel</b>	Channel number (code number and spreading factor)
<b>Slot</b>	Slot of the (CPICH) channel
<b>Code Power</b>	Power result mode: <ul style="list-style-type: none"> <li>• Absolute</li> <li>• Relative to total power of the data parts of the signal</li> </ul>
<b>Symbol Rate</b>	Symbol rate of the current channel

### Window title bar information

For each diagram, the header provides the following information:



**Fig. 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 mode. 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.

### 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 88.

- [Code Domain Analysis](#)..... 10
- [Frequency and Time Domain Measurements](#)..... 25

### 3.1 Code Domain Analysis

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 in order 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 113

- [Code Domain Parameters](#).....11
- [Evaluation Methods for Code Domain Analysis](#)..... 12
- [CDA Measurements in MSRA Operating Mode](#).....25

### 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 " <a href="#">Synchronization fails</a> " on page 98)
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 17
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 19). 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 <a href="#">table 4-4</a> )
Ch.SF	Channel number including the spreading factor (in the form <Channel>.<SF>).
SymRate[ksp/s]	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 24)
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 <a href="#">chapter 4.4, "Data Fields and Midambles"</a> , on page 40)
$\Delta$ Mid1/2	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 <a href="#">chapter 4.4, "Data Fields and Midambles"</a> , on page 40).

### 3.1.2 Evaluation Methods for Code Domain Analysis

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 169).

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Symbol Phase Error.....	25

### 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													

Fig. 3-1: Bitstream display for TD-SCDMA BTS measurements

Depending on the spreading factor (symbol rate) of the channel, a slot may 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 148  
[TRACe<n>\[:DATA\]?](#) on page 166

### 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 90), either by code number (starting with midambles, then control channels, then data channels), or by midamble, where all channels are listed below the midamble they belong to.

Channel Type	Ch.SF	SymRate [kps]	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	-23.53	-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	---	---	---

Fig. 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 14. Inactive channels are marked with dashes in the "Channel Type", "SymRate" and "Modulation" columns.

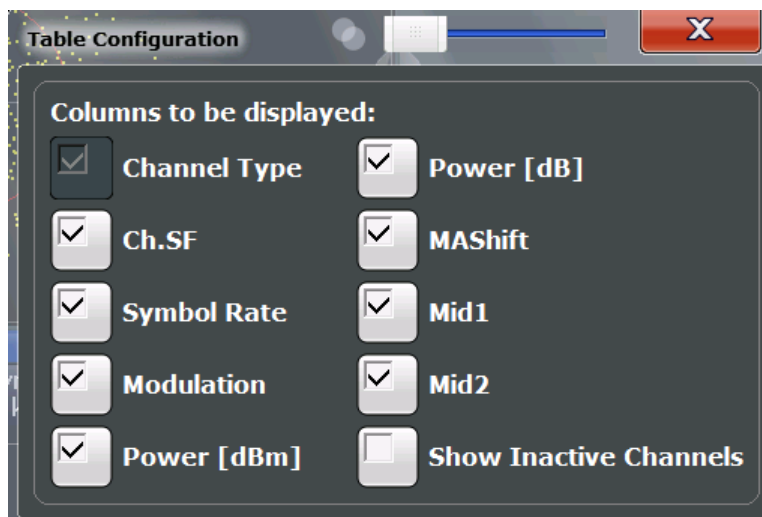
For details on the displayed results see [table 3-2](#).

Remote command:

LAY:ADD? '1',RIGH, CTABLE, see [LAYout:ADD\[:WINDOW\]?](#) on page 148  
[TRACe<n>\[:DATA\]?](#) on page 166

### 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.

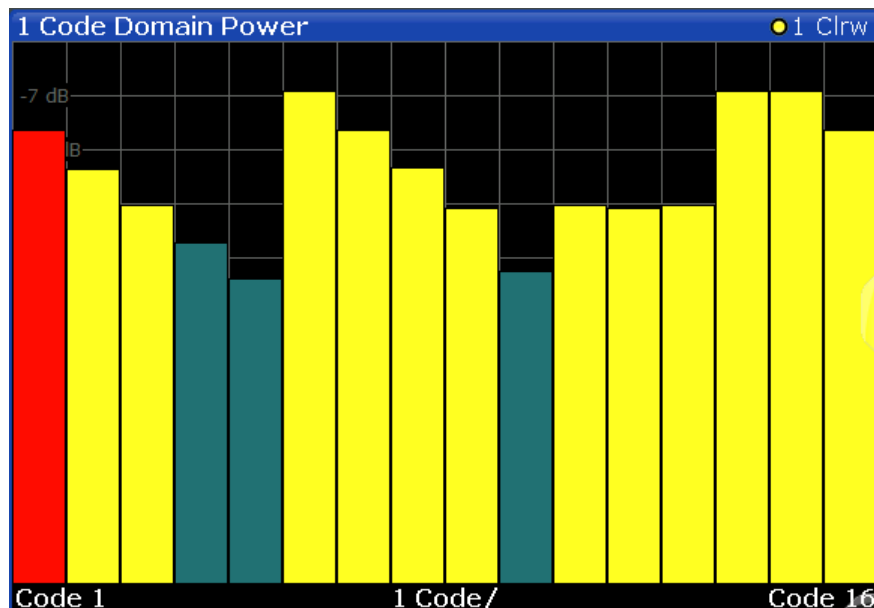


By default, only active channels are displayed. In order to display all channels, including the inactive ones, enable the "Show Inactive Channels" option.

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. Since channel detection is based on a power threshold (see [chapter 4.3, "Channels and Codes"](#), on page 37), 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 may 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 148

CALC:MARK:FUNC:CDP:RES? CDP, see [CALCulate<n>:MARKer:FUNCTION:CDPower:RESult?](#) on page 162

TRACe<n>[:DATA]? on page 166

### 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.

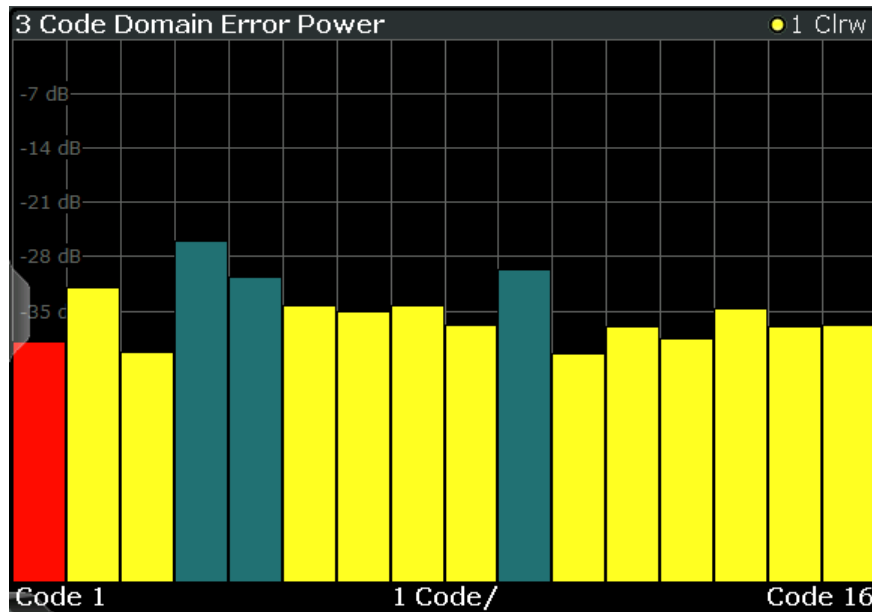


Fig. 3-3: Code Domain Error Power Display for TD-SCDMA BTS measurements

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 148  
 TRACe<n>[:DATA]? on page 166

### 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"



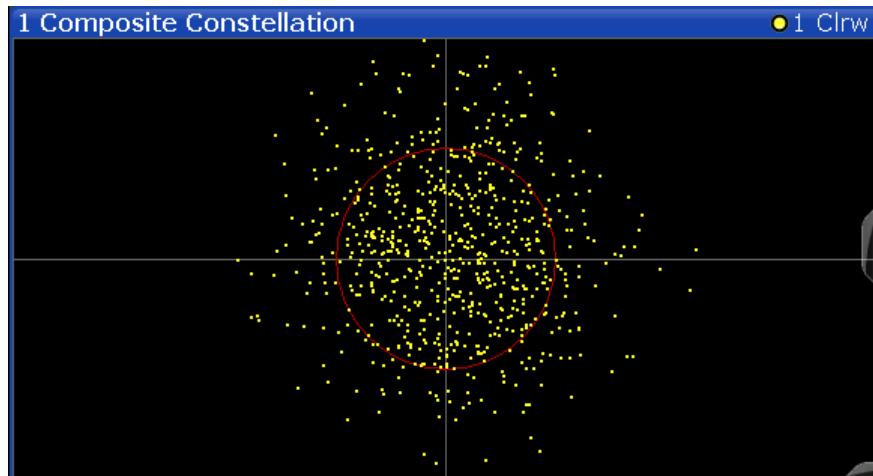


Fig. 3-4: Composite Constellation display for TD-SCDMA BTS measurements

Remote command:

LAY:ADD? '1',RIGH, CCONst, see LAYout:ADD[:WINDow]? on page 148  
 TRACe<n>[:DATA]? on page 166

### 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.



Fig. 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. 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 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 148  
TRACe<n>[:DATA]? on page 166

### Mag Error vs Chip

Mag Error vs Chip activates the Magnitude Error versus chip display. The magnitude error is displayed for all chips of the 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.

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

where:

MAG <sub>k</sub>	magnitude error of chip number k
s <sub>k</sub>	complex chip value of received signal
x <sub>k</sub>	complex chip value of reference signal
k	index number of the evaluated chip
N	number of chips at each CPICH slot
n	index number for mean power calculation of reference signal

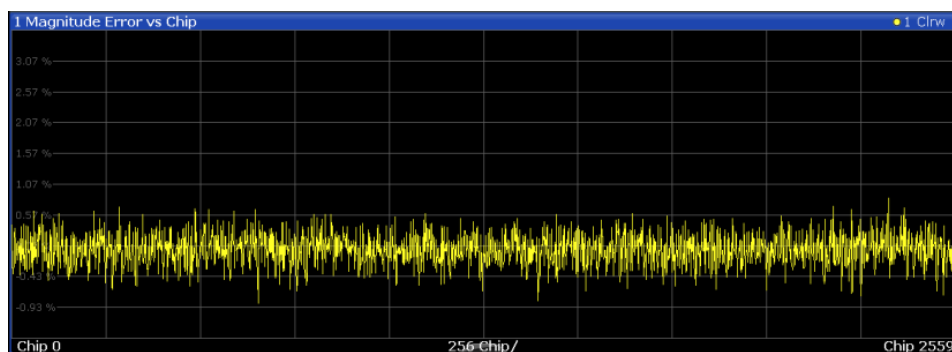


Fig. 3-6: Magnitude Error vs Chip display for TD-SCDMA BTS measurements

Remote command:

LAY:ADD? '1',RIGH, MEChip, see LAYout:ADD[:WINDow]? on page 148  
 TRACe<n>[:DATA]? TRACE<1...4>

### Marker Table

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

This table may be displayed automatically if configured accordingly (see "Marker Table Display" on page 95).

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

Remote command:

LAY:ADD? '1',RIGH, MTAB, see LAYout:ADD[:WINDow]? on page 148

Results:

CALCulate<n>:MARKer<m>:X on page 178

CALCulate<n>:MARKer<m>:Y? on page 176

### 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 and 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.

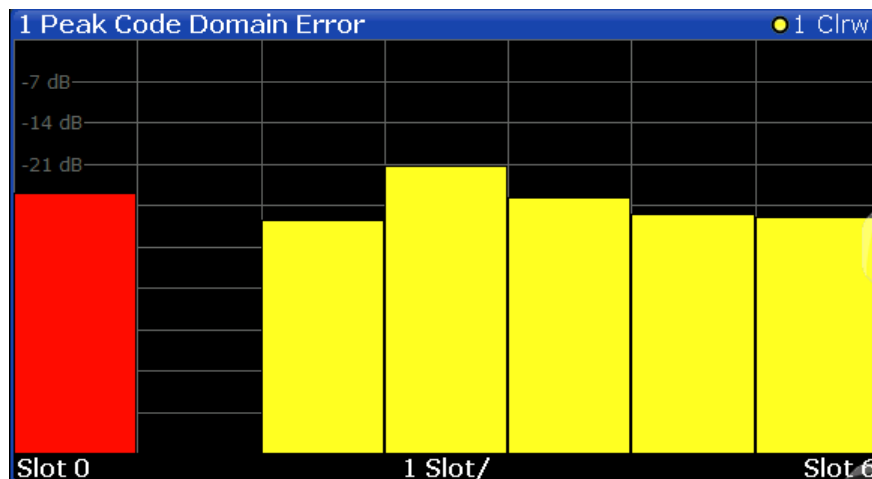


Fig. 3-7: Peak Code Domain Error display for TD-SCDMA BTS measurements

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. on account of 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 148  
[TRACe<n>\[:DATA\]?](#) on page 166

### 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  $+180^\circ$  to  $-180^\circ$ .

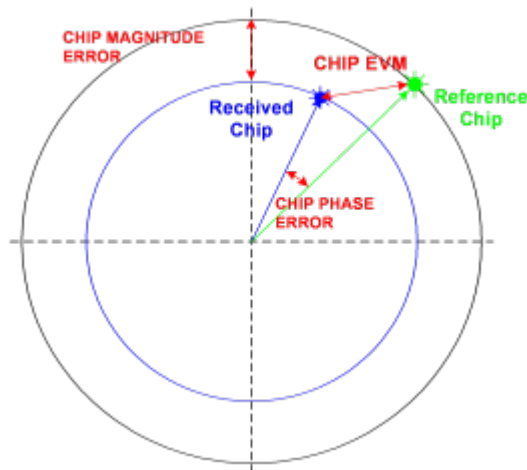
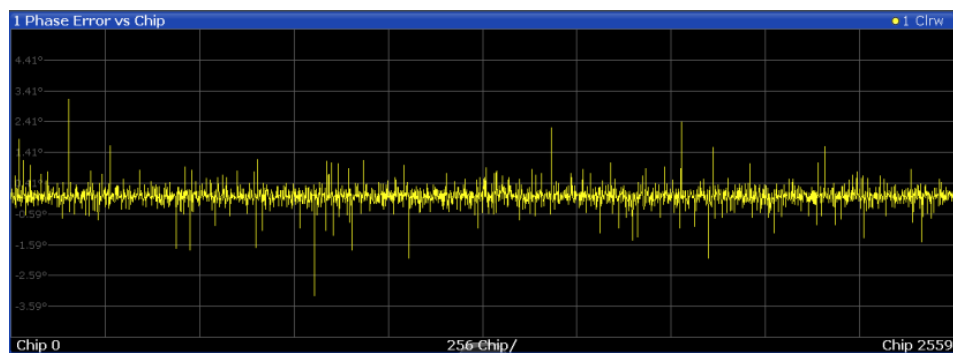


Fig. 3-8: Calculating the magnitude, phase and vector error per chip

$$\text{PHI}_k = \varphi(s_k) - \varphi(x_k) \quad | \quad N = 2560 \quad | \quad k \in [0 \dots (N-1)]$$

where:

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



Remote command:

LAY:ADD? '1',RIGH, PEChip, see LAYout:ADD[:WINDow]? on page 148  
[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.

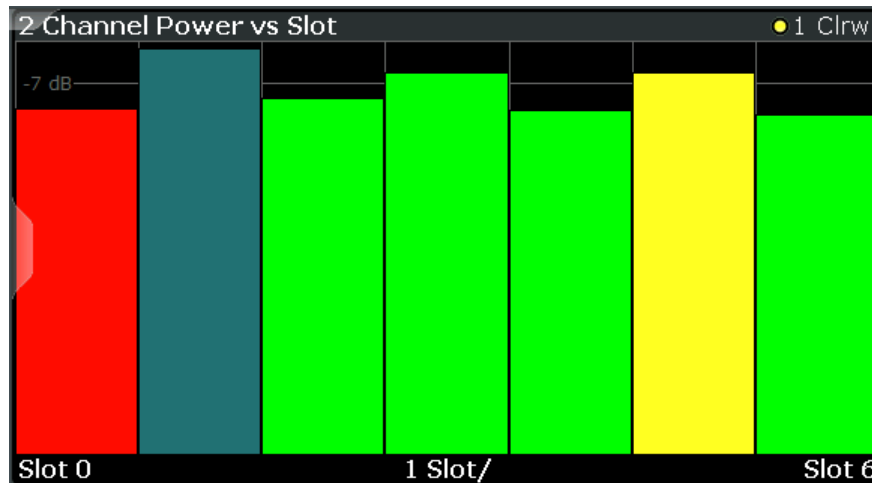


Fig. 3-9: Power vs Slot Display for TD-SCDMA BTS measurements

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 148

TRACe<n>[:DATA] ? on page 166

### 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.

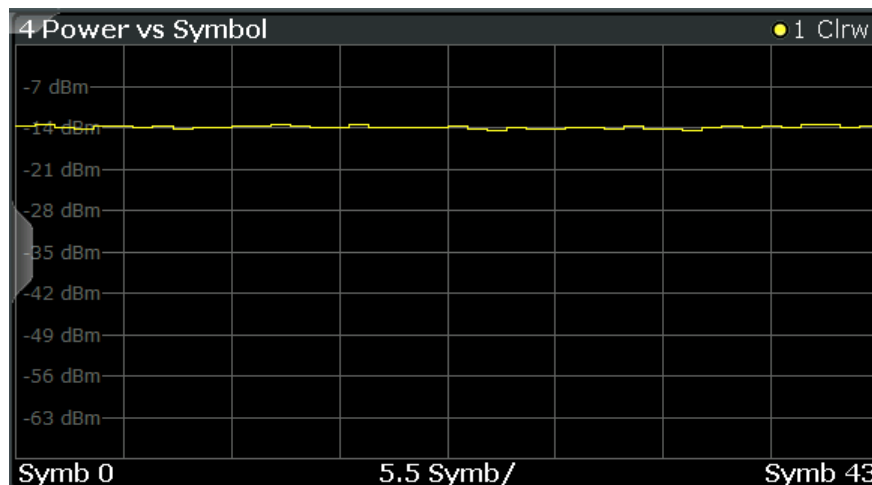


Fig. 3-10: Power vs Symbol display for TD-SCDMA BTS measurements

Depending on the spreading factor (symbol rate) of the channel, a slot may 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 148

TRACe<n>[:DATA]? on page 166

### 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 11.

2 Result Summary					
General Results (Set: 0)					
Chip Rate Error	-0.13 ppm	Trigger To Frame	---		
Slot Results (Slot: 0)					
P Data	-2.43 dBm	Carrier Frequency Error	3.63 Hz	Rho	0.987152
P D1	-2.43 dBm	IQ Imbalance	0.48 %	Average RCDE	-19.26 dB
P D2	-2.43 dBm	IQ Offset	1.63 %	Composite EVM	11.41 %
P Midamble	-3.69 dBm	Active Channels	13	Pk CDE (SF 16)	-25.98 dB
Channel Results (1.16)					
Channel SF	1.16	Symbol Rate	17.60 kbps	Channel Power Abs	-13.92 dBm
Symbol EVM	4.21 % rms	Symbol EVM	7.71 % Pk	Channel Power Rel	11.41 dB
Modulation Type	QPSK				

**Fig. 3-11: Result Summary display for TD-SCDMA BTS measurements**

Remote command:

LAY:ADD? '1',RIGH, RSUMmary, see [LAYout:ADD\[:WINDOW\]?](#) on page 148

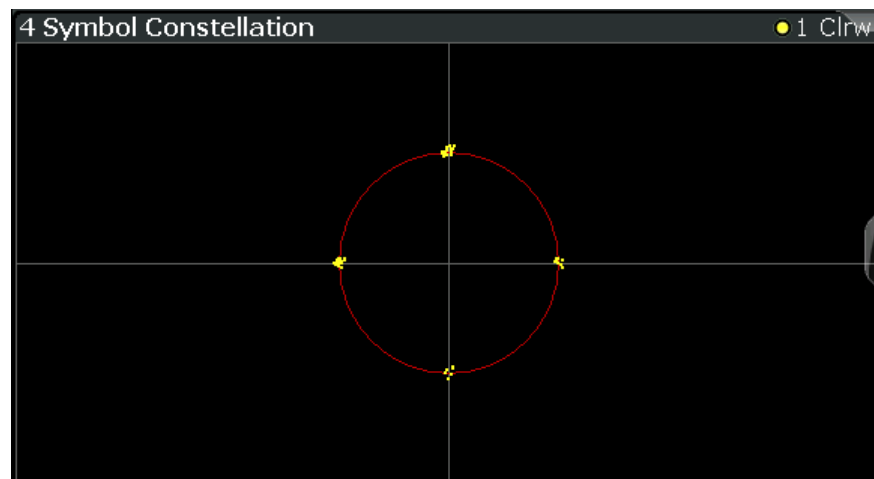
TRACe<n>[:DATA]? on page 166

CALCulate<n>:MARKer:FUNction:CDPower:RESult? on page 162

### 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"



**Fig. 3-12: Symbol Constellation display for TD-SCDMA BTS measurements**

Remote command:

LAY:ADD? '1',RIGH, SCONst, see [LAYout:ADD\[:WINDOW\]?](#) on page 148

TRACe<n>[:DATA]? on page 166

### 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](#)).

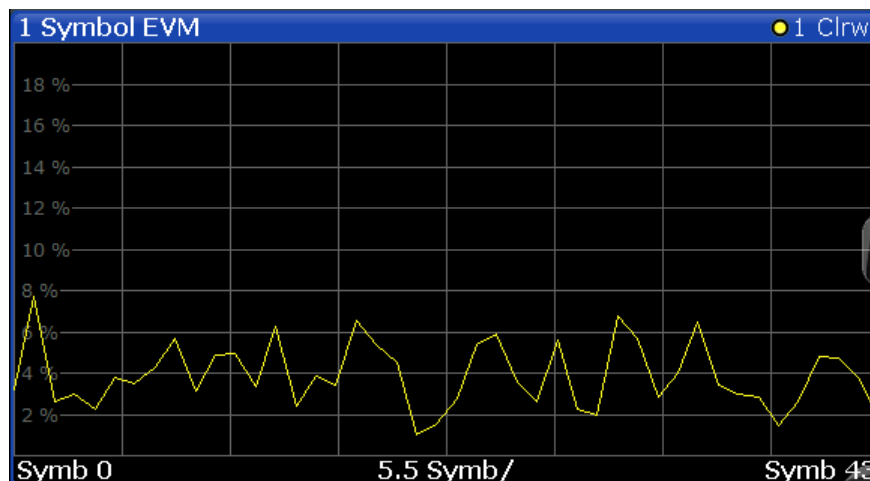


Fig. 3-13: Symbol EVM display for TD-SCDMA BTS measurements

Remote command:

LAY:ADD? '1',RIGH, SEVM, see [LAYout:ADD\[:WINDow\]?](#) on page 148  
[TRACe<n>\[:DATA\]?](#) on page 166

### 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 ideal one. 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.

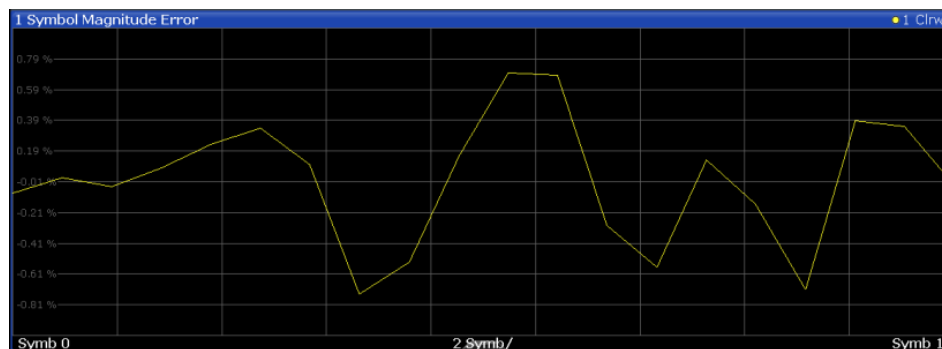


Fig. 3-14: Symbol Magnitude Error display for TD-SCDMA BTS measurements

Remote command:

LAY:ADD? '1',RIGH, SMERror, see [LAYout:ADD\[:WINDow\]?](#) on page 148  
[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 ideal one.

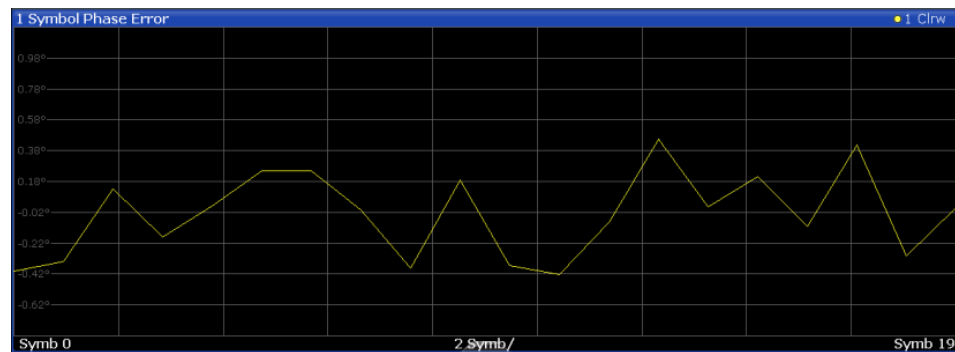


Fig. 3-15: Symbol Phase Error display for TD-SCDMA BTS measurements

Remote command:

LAY:ADD? '1',RIGH, SPERror, see LAYout:ADD[:WINDow]? on page 148  
[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 according to the selected channel, slot or frame to analyze which is defined for the evaluation range, depending 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

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**

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

Power vs Time..... 26  
 Power..... 28  
 Ch Power ACLR..... 28  
 Spectrum Emission Mask..... 29  
 Occupied Bandwidth..... 30  
 CCDF..... 31

**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 and 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.



Fig. 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 to be checked during one measurement, and that each uplink device may use 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.

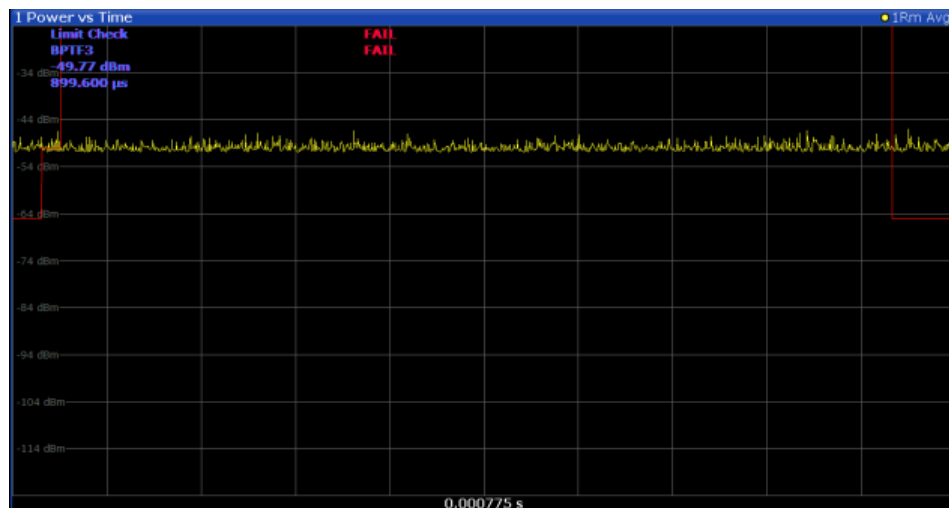


Fig. 3-17: Power vs Time diagram for TD-SCDMA UE application

In order 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 33).

For details see [chapter 6.3.1, "Power vs Time"](#), on page 79.

Remote command:

CONF:CDP[:BTS]:MEAS PVT, see [CONFigure:CDPower:MEASurement](#) on page 113

Querying results:

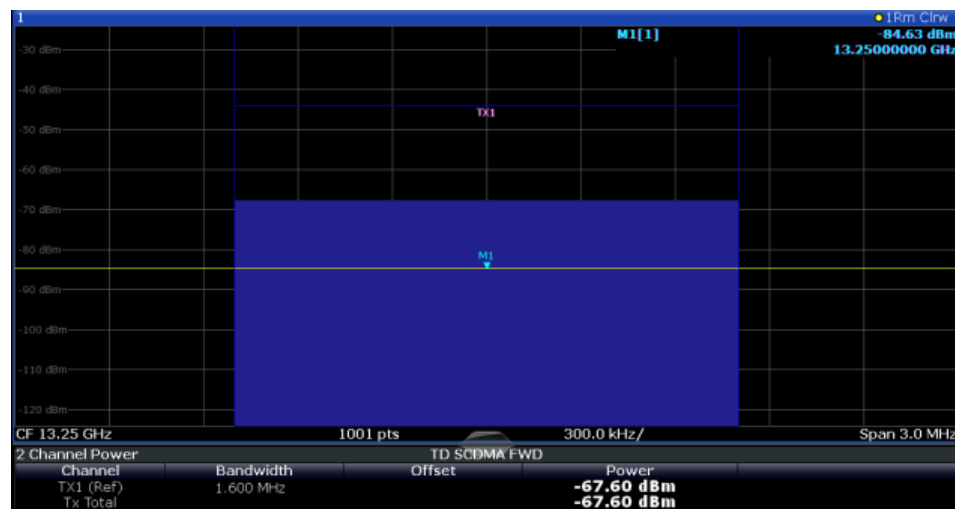
TRAC:DATA? TRACE1, see [TRACe<n>\[:DATA\]?](#) on page 166

[CALCulate<n>:LIMit<k>:FAIL?](#) on page 174

[CONFigure:CDPower\[:BTS\]:PVTime:LIST:RESult?](#) on page 164

### 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.



**Fig. 3-18: Signal channel power measurement in TD-SCDMA BTS application**

For details see [chapter 6.3.2, "Signal Channel Power Measurements"](#), on page 82.

Remote command:

CONF:CDP[:BTS]:MEAS POW, see [CONFigure:CDPower:MEASurement](#) on page 113

Querying results: CALC:MARK:FUNC:POW:RES? CPOW, see [CALCulate<n>:MARKer<m>:FUNctIon:POWer<sb>:RESult?](#) on page 174

[CALC:MARK:FUNC:POW:RES? ACP](#), see [CALCulate<n>:MARKer<m>:FUNctIon:POWer<sb>:RESult?](#) on page 174

### Ch 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.

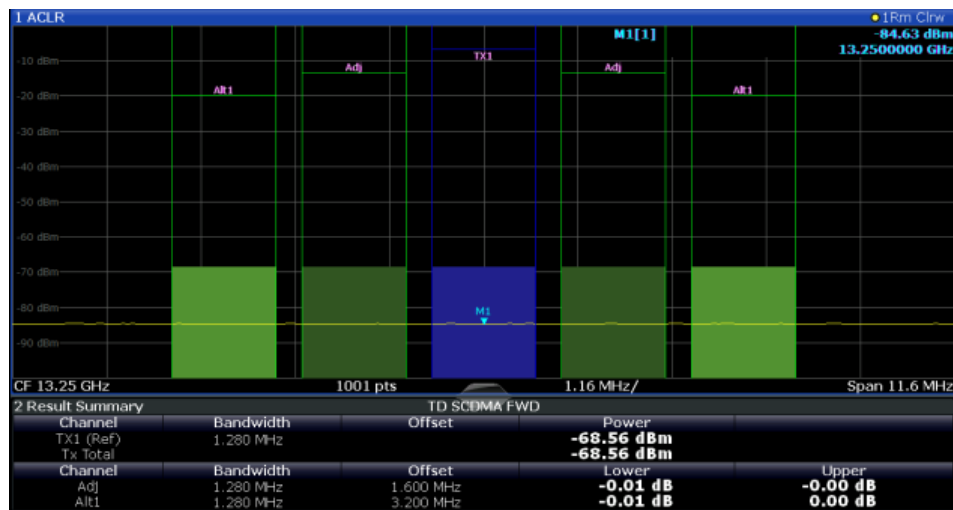


Fig. 3-19: ACLR measurement in TD-SCDMA BTS application

For details see [chapter 6.3.3, "Channel Power \(ACLR\) Measurements"](#), on page 83.

Remote command:

CONF:CDP[:BTS]:MEAS ACLR, see [CONFigure:CDPower:MEASurement](#)  
on page 113

Querying results:

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNCtion:POWER<sb>:RESult?](#) on page 174

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNCtion:POWER<sb>:RESult?](#) on page 174

### 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 84.

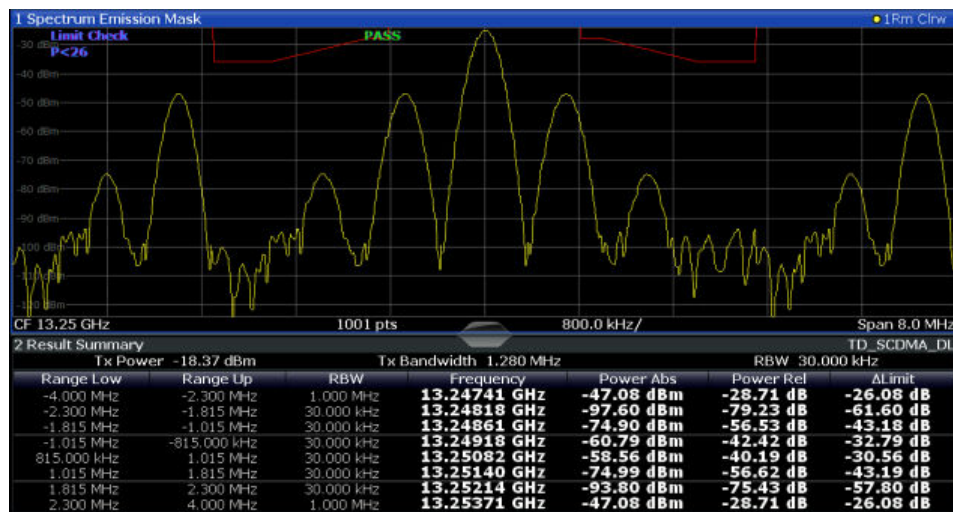


Fig. 3-20: SEM measurement results for TD-SCDMA BTS measurement

Remote command:

CONF:CDP[:BTS]:MEAS ESP, see [CONFIGure:CDPower:MEASurement](#)

on page 113

Querying results:

CALC:MARK:FUNC:POW:RES? CPOW, see [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESult?](#) on page 174

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNCTION:POWER<sb>:RESult?](#) on page 174

[CALCulate<n>:LIMIT<k>:FAIL?](#) on page 174

### Occupied Bandwidth

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

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

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

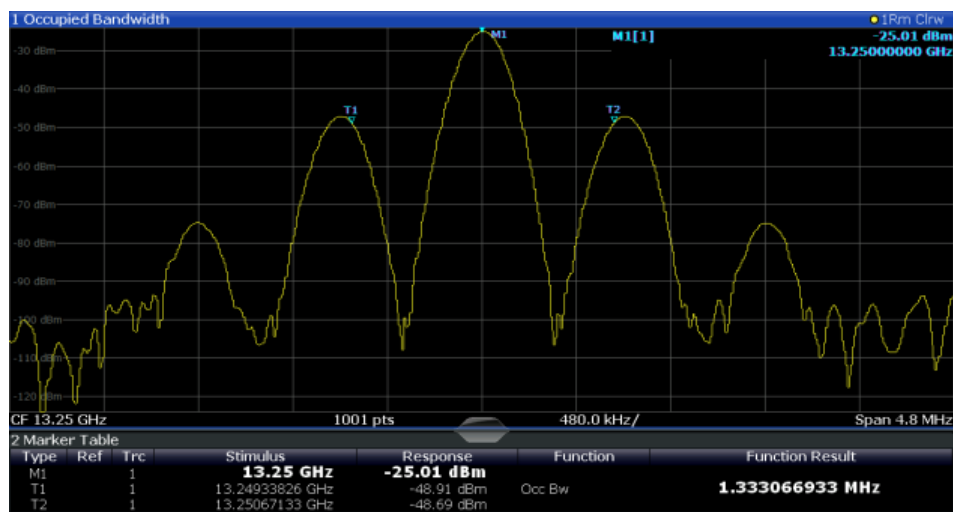


Fig. 3-21: Occupied bandwidth measurement in TD-SCDMA BTS application

For details see [chapter 6.3.5, "Occupied Bandwidth"](#), on page 85.

Remote command:

CONF:CDP[:BTS]:MEAS:OBAN, see [CONFigure:CDPower:MEASurement](#)  
on page 113

Querying results:

CALC:MARK:FUNC:POW:RES? OBW, see [CALCulate<n>:MARKer<m>:FUNCtion:POWER<sb>:RESult?](#) on page 174

CALC:MARK:FUNC:POW:RES? ACP, see [CALCulate<n>:MARKer<m>:FUNCtion:POWER<sb>:RESult?](#) on page 174

### 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 87.



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

Remote command:

CONF:CDP[:BTS]:MEAS CCDF, see CONFIGure:CDPower:MEASurement on page 113

Querying results:

CALCulate<n>:STATistics:RESult<t>? on page 176

### 3.2.2 Evaluation Methods for Frequency and Time Measurements

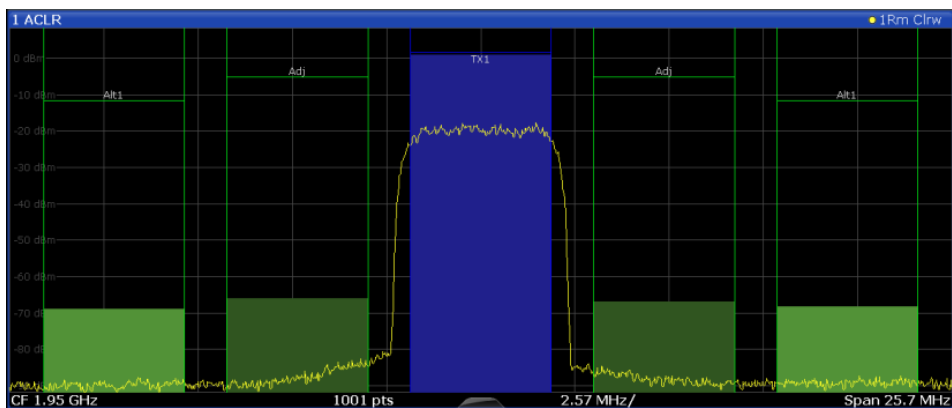
The evaluation methods for frequency and time domain measurements are identical to those in the Spectrum application.

Diagram.....	32
List Evaluation.....	33
Result Summary.....	33
Marker Table.....	34
Marker Peak List.....	34

#### 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 148

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

For details see [chapter 6.3.1, "Power vs Time"](#), on page 79.

Remote command:

LAY:ADD? '1',RIGH, LEV, see LAYout:ADD[:WINDow]? on page 148

### Result Summary

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

2 Result Summary				
Channel	Bandwidth	Offset	Power	
Tx1 (Ref)	1.229 MHz		<b>-0.86 dBm</b>	
Tx Total			<b>-0.86 dBm</b>	
Channel	Bandwidth	Offset	Lower	Upper
Adj	30.000 kHz	750.000 kHz	<b>-79.59 dB</b>	<b>-80.34 dB</b>
Alt1	30.000 kHz	1.980 MHz	<b>-85.04 dB</b>	<b>-83.85 dB</b>

Remote command:

LAY:ADD? '1',RIGH, RSUM, see [LAYout:ADD\[:WINDow\]?](#) on page 148

### Marker Table

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

This table may be displayed automatically if configured accordingly (see "[Marker Table Display](#)" on page 95).

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

Remote command:

LAY:ADD? '1',RIGH, MTAB, see [LAYout:ADD\[:WINDow\]?](#) on page 148

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 178

[CALCulate<n>:MARKer<m>:Y?](#) on page 176

### 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 148

Results:

[CALCulate<n>:MARKer<m>:X](#) on page 178

[CALCulate<n>:MARKer<m>:Y?](#) on page 176

## 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

While many communication standards, such as WCDMA or cdma2000, distribute the data from different users to different frequencies within a specific band (FDD mode), 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. TD-SCDMA, on the other hand, 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 2 *subframes*, with a length of 5 ms each. For the physical communication layer, mostly the subframes are of interest.

Each subframe consists of 7 *slots*, named TS0 to TS6, plus 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  $\mu$ s 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.

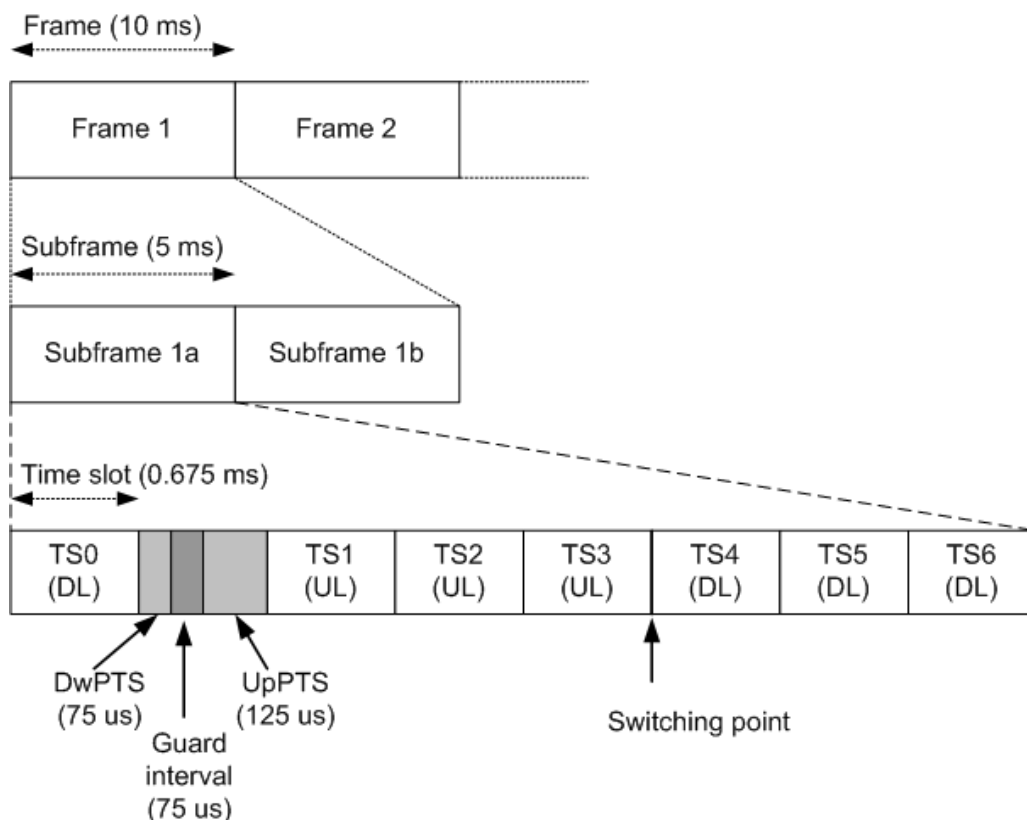


Fig. 4-1: TD-SCDMA signal structure

### Synchronization

The individual channels in the input signal need to 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 may 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 spreaded 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 in order 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.

In order to determine the correct threshold, the Code Domain Power evaluation is a useful instrument (see "[Code Domain Power](#)" on page 15).

### 4.3.1 Special Channels

In order 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, they can be detected easily by the receiver.

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

Name	Description	Slot No.	Spreading factor (SF)	Code No. (1...SF)
P-CCPCH1	Primary common control physical channel 1	0	16	1
P-CCPCH2	Primary common control physical channel 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 **Dedicated Physical Channel (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 sub-frame 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**

Spread- ing Fac- tor	Sym- bols 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 on the basis of the spreading factor 16 is highlighted.

**Example:** Enter 4.8

Channel 4 is marked at spreading factor 8 (35.2 kbps) 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.

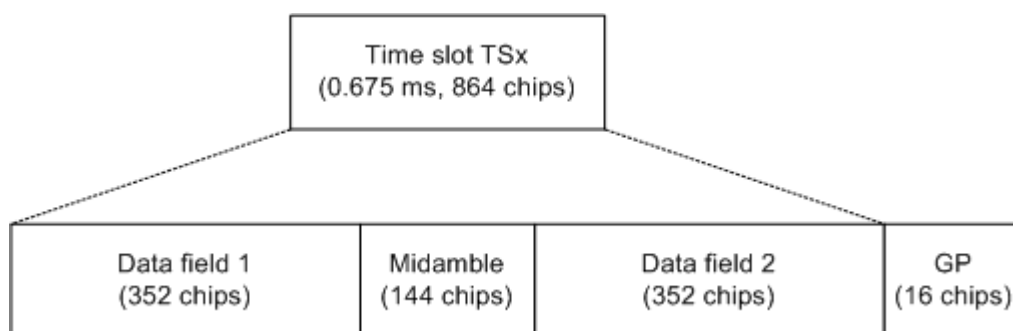


Fig. 4-2: TD-SCDMA slot structure

### 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 separated 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  $\Delta\text{Mid}1/2$  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**.

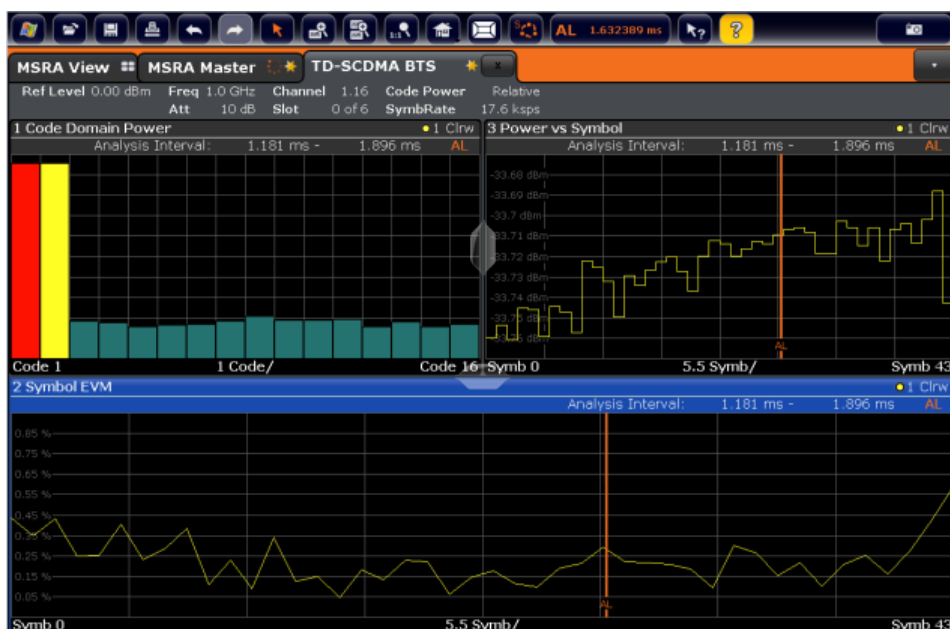
In the TD-SCDMA BTS application the analysis interval is automatically determined according to the selected channel, slot or set to analyze which is defined for the evaluation range, depending on the result display. The analysis interval can not be edited directly in the TD-SCDMA BTS application, but 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 applications. It can be positioned in any MSRA application or the MSRA Master and is then adjusted in all other applications. Thus, you can easily analyze the results at a specific time in the measurement in all applications and determine correlations.

If the marked point in time is contained in the analysis interval of the 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 or not 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. I/Q signals are useful because the specific RF or IF frequencies are not needed. 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.



### Export only in MSRA mode

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

- [Import/Export Functions](#).....43

### 5.1 Import/Export Functions



The following import and export functions are available via softkeys in the "Save/Recall" menu which is displayed when you select the "Save" or "Open" icon in the toolbar.



Some functions for particular data types are (also) available via softkeys or dialog boxes in the corresponding menus, e.g. trace data or marker peak lists.



For a description of the other functions in the "Save/Recall" menu see the R&S FPS User Manual.

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**Import**

Provides functions to import data.

**I/Q Import ← Import**

Opens a file selection dialog box to select an import file that contains IQ 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.

Remote command:

[MMEMory:LOAD:IQ:STATe](#) on page 185

**Export**

Opens a submenu to configure data export.

**I/Q Export ← Export**

Opens a file selection dialog box to select an export file to which the IQ data will be stored. 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:** Secure user mode.

In secure user mode, settings that are to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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 185

[MMEMory:STORe<n>:IQ:COMMeNt](#) on page 185

## 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.


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• <a href="#">Code Domain Analysis</a> .....	46
• <a href="#">Frequency and Time Domain Measurements</a> .....	78

### 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 12.

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

TD-SCDMA measurements require special applications on the R&S FPS, which you activate using the MODE key.



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 (see [chapter 6.2.1, "Default Settings for Code Domain Analysis"](#), on page 47). 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

The I/Q data to be evaluated for TD-SCDMA measurements can not only be measured by the TD-SCDMA applications themselves, it can also be imported to the applications, 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.

The import and export functions are available in the "Save/Recall" menu which is displayed when you select the  "Save" or  "Open" icon in the toolbar.

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

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## 6.2.1 Default Settings for Code Domain Analysis

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
- signal source and digital I/Q input settings
- input coupling

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.

Apart from these settings, the following default settings are activated directly after a TD-SCDMA application is activated, or after a [Preset Channel](#):

The following default settings of the Code Domain Analysis are activated:

**Table 6-1: Default settings for TD-SCDMA channels**

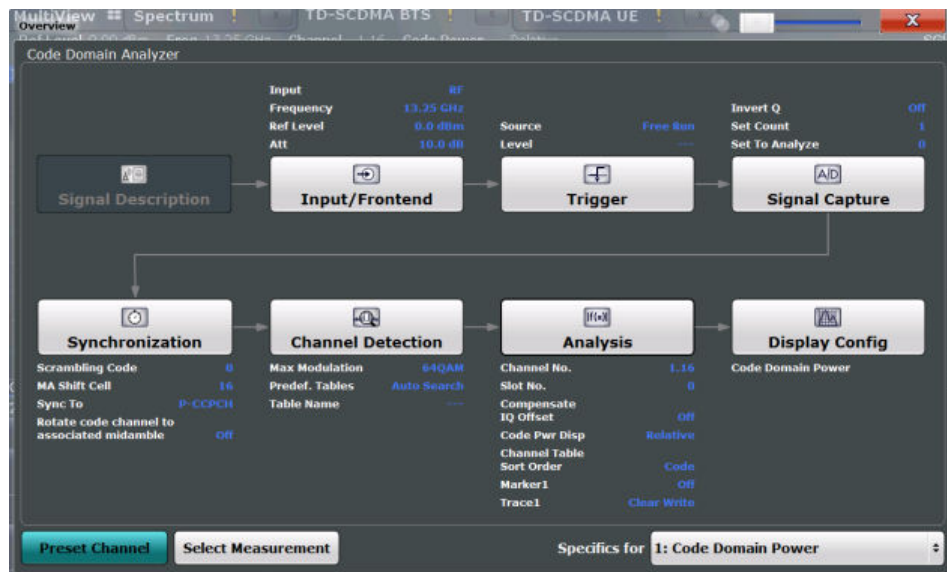
Parameter	Value
Sweep	CONTINUOUS
Channel detection mode	AUTOSEARCH
Trigger settings	FREE RUN
Trigger offset	0
Symbol rate	17.6 ksps
Number of sets to capture	1
Set to analyze	0
Scrambling code	0
MA shift cell	16
Synchronization	P-CCPCH
Max. modulation	64QAM
Predefined tables	Auto search
Selected channel	1.16
Selected slot number	0
I/Q offset compensation	Off
Evaluations	Window 1: Code Domain Power Relative Window 2: Result Summary

## 6.2.2 Configuration Overview



Throughout the measurement channel configuration, an overview of the most important currently defined settings is provided in the "Overview". The "Overview" is displayed when you select the "Overview" icon, which is available at the bottom of all softkey menus.





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 78.

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 10
2. "Input/ Frontend"  
See [chapter 6.2.3, "Data Input and Output Settings"](#), on page 50
3. (Optionally:) "Trigger"  
See [chapter 6.2.5, "Trigger Settings"](#), on page 59
4. "Signal Capture"  
See [chapter 6.2.6, "Signal Capture \(Data Acquisition\)"](#), on page 64
5. "Synchronization"  
See [chapter 6.2.8, "Synchronization"](#), on page 66
6. "Channel Detection"

See [chapter 6.2.9, "Channel Detection"](#), on page 68

7. "Analysis"

See [chapter 7, "Analysis"](#), on page 88

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 lefthand corner of the "Overview" to restore all measurement settings **in the current channel** to their default values.

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

See [chapter 6.2.1, "Default Settings for Code Domain Analysis"](#), on page 47 for details.

Remote command:

`SYSTem:PRESet:CHANnel [:EXECute]` on page 113

### Select Measurement

Selects a different measurement to be performed.

See [chapter 3, "Measurements and Result Display"](#), on page 10.

### Specifics for

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

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

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

## 6.2.3 Data Input and Output Settings

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

- [Input Source Settings](#).....50
- [Output Settings](#)..... 52

### 6.2.3.1 Input Source Settings

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

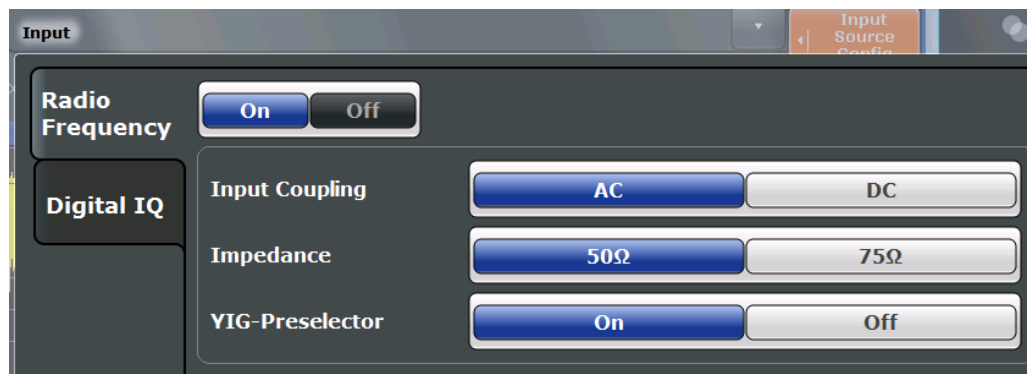
Input settings can be configured in the "Input" dialog box.

Some settings are also available in the "Amplitude" tab of the "Amplitude" dialog box.

- [Radio Frequency Input](#).....51

### Radio Frequency Input

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.



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<a href="#">Input Coupling</a> .....	51
<a href="#">Impedance</a> .....	51
<a href="#">YIG-Preselector</a> .....	52

### Radio Frequency State

Activates input from the RF INPUT connector.

Remote command:

[INPut:SElect](#) on page 116

### 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 115

### Impedance

The reference impedance for the measured levels of the R&S FPS can be set to 50 Ω or 75 Ω.

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

This value also affects the unit conversion (see "Reference Level" on page 55).

Remote command:

`INPut:IMPedance` on page 116

**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. In order to use the maximum bandwidth for signal analysis you can deactivate the YIG-preselector at the input of the R&S FPS, which may 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 115

**6.2.3.2 Output Settings**

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.

Output settings can be configured via the INPUT/OUTPUT key or in the "Outputs" dialog box.



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 Trigger 2.....53  
     L Output Type.....53

L Level.....	53
L Pulse Length.....	54
L Send Trigger.....	54

### Noise Source

Switches the supply voltage for an external noise source on the R&S FPS on or off, if available.

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 a DUT.

Remote command:

[DIAGnostic:SERvice:NSource](#) on page 117

### 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. No further trigger parameters are available for the connector.

"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>:LEVel](#) on page 127

[OUTPut:TRIGger<port>:DIRection](#) on page 126

### 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 user selects "Send Trigger" button.  
In this case, further parameters are available for the output signal.

Remote command:

[OUTPut:TRIGger<port>:OTYPe](#) on page 127

### Level ← Output Type ← Trigger 2

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

Remote command:

[OUTPut:TRIGger<port>:LEVel](#) on page 127

**Pulse Length ← Output Type ← Trigger 2**

Defines the length of the pulse sent as a trigger to the output connector.

Remote command:

`OUTPut:TRIGger<port>:PULSe:LENGth` on page 128

**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, e.g. for "Level = High", a constant high signal is output to the connector until the "Send Trigger" button is selected. 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 128

**6.2.4 Frontend Settings**

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

- [Amplitude Settings](#)..... 54
- [Y-Axis Scaling](#)..... 57
- [Frequency Settings](#)..... 58

**6.2.4.1 Amplitude Settings**

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

**To configure the amplitude settings**

Amplitude settings can be configured via the AMPT key or in the "Amplitude" dialog box.

- ▶ To display the "Amplitude" dialog box, do one of the following:
  - Select "Input/Frontend" from the "Overview" and then switch to the "Amplitude" tab.
  - Select the AMPT key and then the "Amplitude Config" softkey.

<a href="#">Reference Level</a> .....	55
L <a href="#">Shifting the Display (Offset)</a> .....	55
L <a href="#">Unit</a> .....	55
L <a href="#">Setting the Reference Level Automatically (Auto Level)</a> .....	55
<a href="#">RF Attenuation</a> .....	55
L <a href="#">Attenuation Mode / Value</a> .....	56
<a href="#">Using Electronic Attenuation</a> .....	56
<a href="#">Input Settings</a> .....	56
L <a href="#">Preamplifier (option B22/B24)</a> .....	57

**Reference Level**

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

The reference level is also 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 to ensure an optimum measurement (no compression, good signal-to-noise ratio).

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 120

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

Defines an arithmetic level offset. This offset is added to the measured level. 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 will be shifted by this value.

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

Note, however, that the *internal* reference level (used to adjust the hardware settings to the expected signal optimally) ignores any "Reference Level Offset". Thus, it is important to keep in mind the actual power level the R&S FPS must handle, and not to 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 120

**Unit ← Reference Level**

For CDA measurements the unit should not be changed, as this would lead to useless results.

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

Automatically determines the optimal reference level 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, clipping and overload conditions are minimized.

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

You can change the measurement time for the level measurement if necessary (see "[Changing the Automatic Measurement Time \(Meastime Manual\)](#)" on page 77).

Remote command:

`[SENSe:]ADJust:LEVel` on page 141

**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 the optimum RF attenuation is always used. It is the default setting.

By default and when [Using Electronic Attenuation](#) is not 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 122

`INPut:ATTenuation:AUTO` on page 122

### 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) >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 may be set to automatic mode, and the full attenuation is provided by the mechanical attenuator, if possible.

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

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 123

`INPut:EATT:AUTO` on page 123

`INPut:EATT` on page 122

### Input Settings

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

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

See [chapter 6.2.3.1, "Input Source Settings"](#), on page 50.



**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.

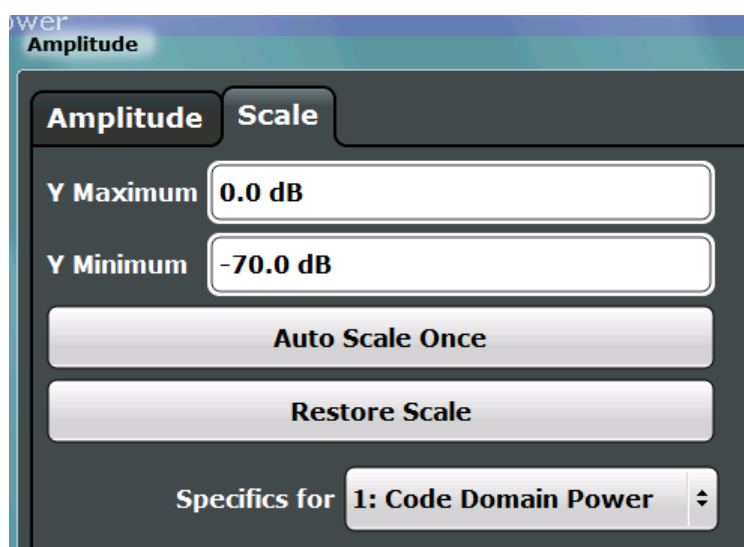
If option R&S FPS-B24 is installed, the preamplifier is active for all frequencies.

Remote command:

`INPut:GAIN:STATe` on page 121

**6.2.4.2 Y-Axis Scaling**

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



[Y-Maximum, Y-Minimum](#).....57  
[Auto Scale Once](#).....57  
[Restore Scale \(Window\)](#).....58

**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 119

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum` on page 120

**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 119

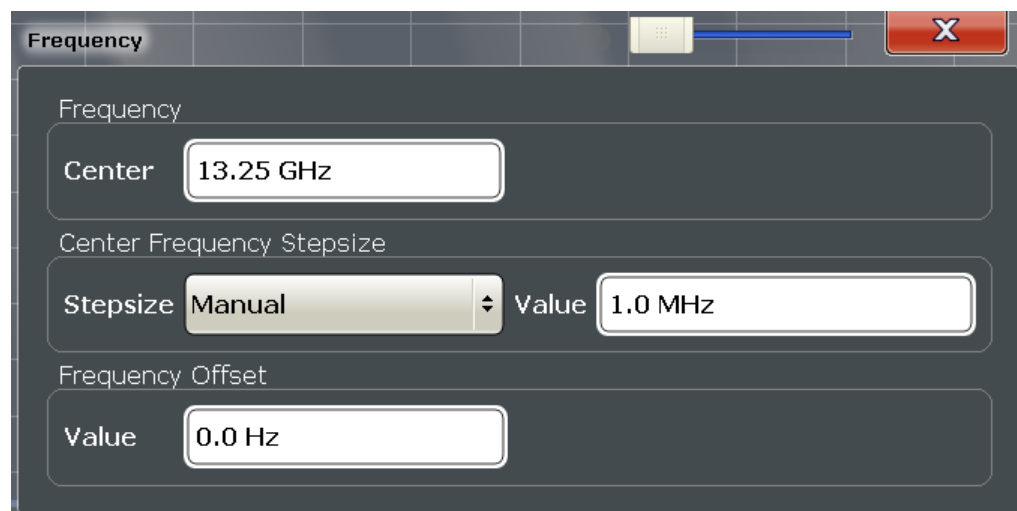
**Restore Scale (Window)**

Restores the default scale settings in the currently selected window.

**6.2.4.3 Frequency Settings**

Frequency settings for the input signal can be configured via the "Frequency" dialog box, which is displayed when you do one of the following:

- Select the **FREQ** key and then the "Frequency Config" softkey.
- Select "Input/Frontend" from the "Overview" and then switch to the "Frequency" tab.



Center frequency.....	58
Center Frequency Stepsize.....	58
Frequency Offset.....	59

**Center frequency**

Defines the normal center frequency of the signal.

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

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

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

Remote command:

[SENSe:] FREQuency:CENTer on page 117

**Center Frequency Stepsize**

Defines the step size by which the center frequency is increased or decreased when the arrow keys are pressed.

When you use the rotary knob the center frequency changes in steps of only 1/10 of the "Center Frequency Stepsize".

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 118

### 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 118

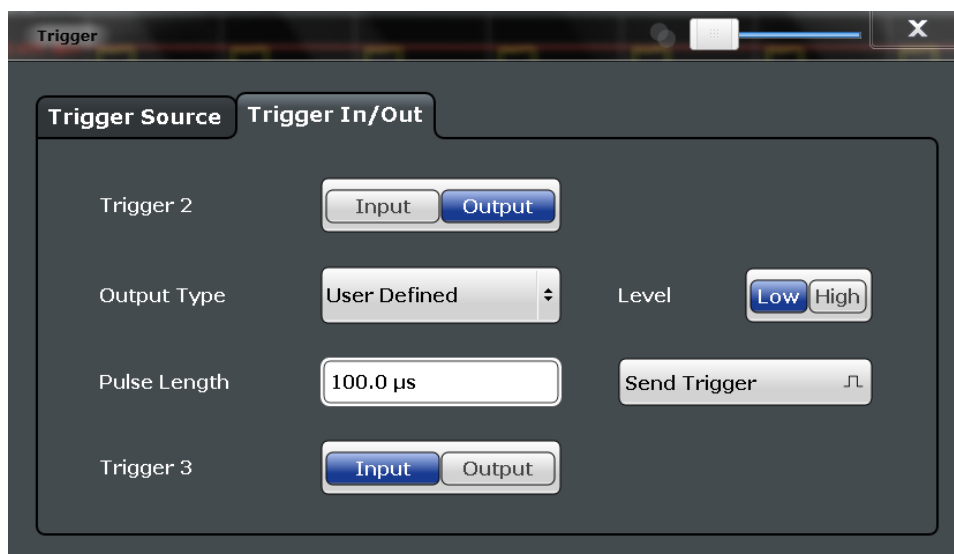
## 6.2.5 Trigger Settings

Trigger settings determine when the input signal is measured.

Trigger settings can be configured via the TRIG key or in the "Trigger" dialog box, which is displayed when you select the "Trigger" button in the "Overview".



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..... 60
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    - L Free Run..... 61
    - L External Trigger 1/2..... 61
    - L IF Power..... 61
  - L Trigger Level..... 61
  - L Trigger Offset..... 62
  - L Slope..... 62
  - L Hysteresis..... 62
  - L Trigger Holdoff..... 62
  - L Capture Offset..... 62
- Trigger 2..... 62
  - L Output Type..... 63
    - L Level..... 63
    - L Pulse Length..... 63
    - L Send Trigger..... 63

**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 126

**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 126

**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 61).

**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 "Outputs" configuration (see "Trigger 2" on page 53).

Remote command:

TRIG:SOUR EXT, TRIG:SOUR EXT2

See TRIGger[:SEquence]:SOURce on page 126

**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 126

**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 125

**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 (pre-trigger)

Remote command:

[TRIGger\[:SEquence\]:HOLDoFF\[:TIME\]](#) on page 124

**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 125

**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 125

**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 124

**Capture Offset ← Trigger Source**

This setting is only available for 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 application data.

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

Remote command:

[\[SENSe:\]MSRA:CAPTure:OFFSet](#) on page 188

**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. No further trigger parameters are available for the connector.

"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>:LEVel](#) on page 127

[OUTPut:TRIGger<port>:DIRection](#) on page 126

### 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 user selects "Send Trigger" button.  
In this case, further parameters are available for the output signal.

Remote command:

[OUTPut:TRIGger<port>:OTYPe](#) on page 127

### Level ← Output Type ← Trigger 2

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

Remote command:

[OUTPut:TRIGger<port>:LEVel](#) on page 127

### Pulse Length ← Output Type ← Trigger 2

Defines the length of the pulse sent as a trigger to the output connector.

Remote command:

[OUTPut:TRIGger<port>:PULSe:LENGth](#) on page 128

### 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, e.g. for "Level = High", a constant high signal is output to the connector until the "Send Trigger" button is selected. Then, a low pulse is sent.

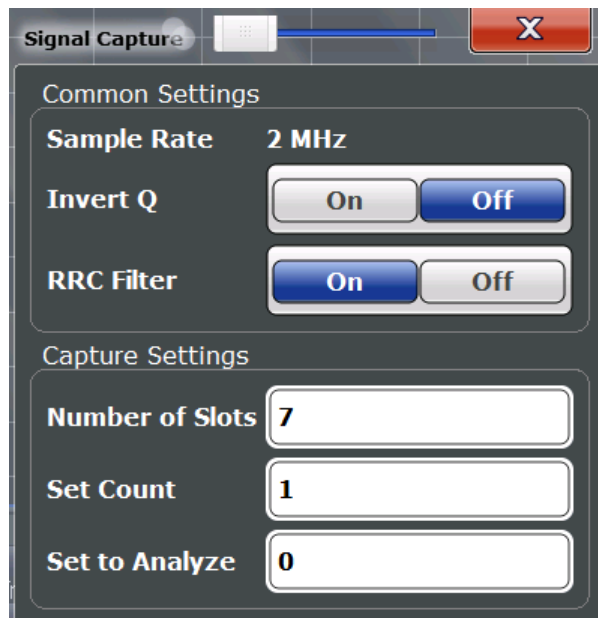
Which pulse level will be sent is indicated by a graphic on the button.

Remote command:

[OUTPut:TRIGger<port>:PULSe:IMMediate](#) on page 128

## 6.2.6 Signal Capture (Data Acquisition)

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 6.2.7, "Application Data \(MSRA\) "](#), on page 65.

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

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<a href="#">Set Count</a> .....	65
<a href="#">Set to Analyze</a> .....	65
<a href="#">Number of Slots to Capture</a> .....	65

### Sample Rate

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

### Invert Q

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

Remote command:

[\[SENSe:\]CDPower:QINVert](#) on page 129



**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 129

**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 129

**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 142

**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 129

**6.2.7 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 6.2.6, "Signal Capture \(Data Acquisition\)"](#), on page 64).

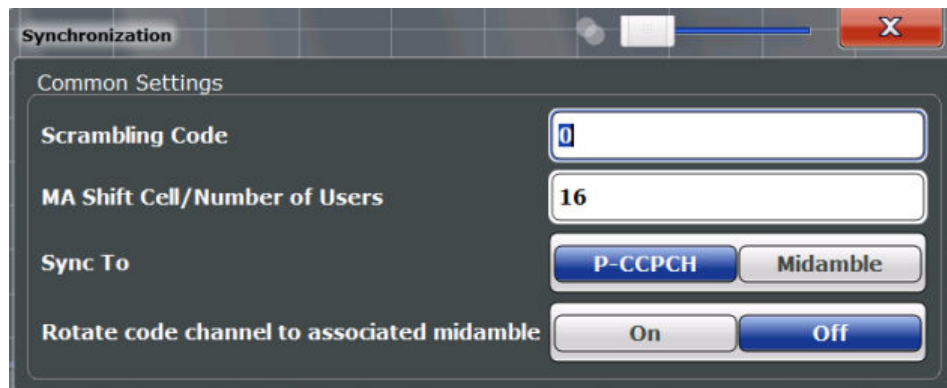
In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the analysis interval for the TD-SCDMA BTS measurement (see ["Capture Offset"](#) on page 62).

The **analysis interval** cannot be edited manually, but 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 41.

## 6.2.8 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.



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Time Reference (BTS mode).....	67
Time Reference (UE mode).....	67
Sync To.....	67
Rotate code channel to associated midamble.....	68

### 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 130

### SYNC-UL Code (UE only)

Defines the code used for synchronization on the UpPTS (see "[Time Reference \(UE mode\)](#)" on page 67).

Remote command:

[SENSe:]CDPower:SULC on page 132

### 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 40.

Remote command:

[\[SENSe:\]CDPower:MSHift](#) on page 130

#### 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 35)

"Slot 0" Uses slot 0 as a time reference.

Remote command:

[\[SENSe:\]CDPower:TREF](#) on page 132

#### 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 35)

"Slot 1" Uses slot 1 as a time reference.

Remote command:

[\[SENSe:\]CDPower:TREF](#) on page 132

#### 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 131

**UE application:** [\[SENSe:\]CDPower:STSLot:MODE](#) on page 131

**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 132

**6.2.9 Channel Detection**

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

- [General Channel Detection Settings](#).....68
- [Channel Table Management](#).....70
- [Channel Table Settings and Functions](#).....71
- [Channel Details](#).....73

**6.2.9.1 General Channel Detection Settings**

Channel detection settings are configured in the "Channel Detection" dialog box which is displayed when you select the "Channel Detection" button in the configuration "Overview".

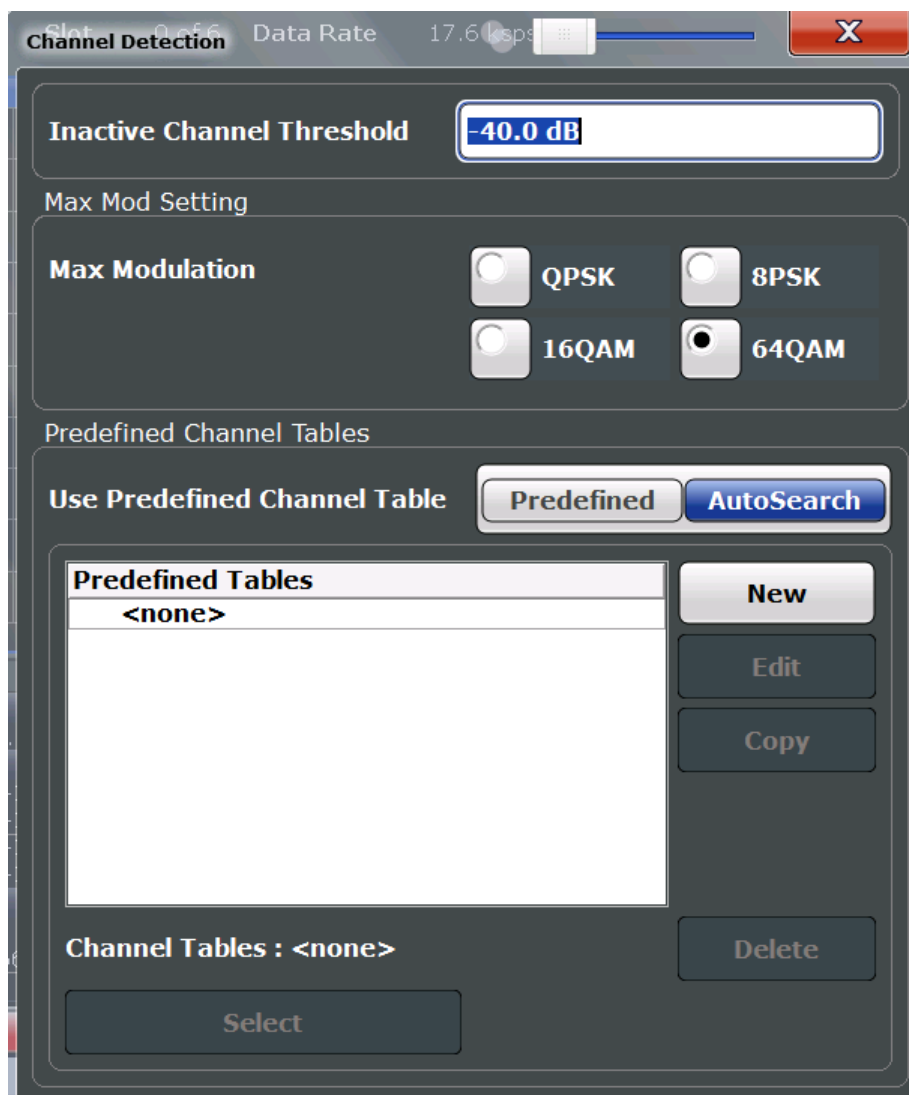


Fig. 6-1: Channel detection configuration for TD-SCDMA BTS application

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 Max Modulation.....69  
 Using Predefined Channel Tables..... 70

**Inactive Channel Threshold**

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

Remote command:

[SENSe:]CDPower:ICTReshold on page 133

**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 133

### 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 on the basis of the active predefined channel table.

Remote command:

[CONFigure:CDPower:CTABLE\[:STATe\]](#) on page 135

## 6.2.9.2 Channel Table Management

Channel tables are managed in the "Channel Detection" dialog box which is displayed when you select the "Channel Detection" button in the configuration "Overview".

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<a href="#">Creating a New Table</a> .....	70
<a href="#">Editing a Table</a> .....	71
<a href="#">Copying a Table</a> .....	71
<a href="#">Deleting a Table</a> .....	71

### 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 134

### 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 135

### Creating a New Table

Creates a new channel table. See [chapter 6.2.9.4, "Channel Details"](#), on page 73.

For step-by-step instructions on creating a new channel table, see ["To define or edit a channel table"](#) on page 100.

**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 6.2.9.4, "Channel Details"](#), on page 73.

**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 6.2.9.4, "Channel Details"](#), on page 73.

Remote command:

`CONFigure:CDPower:CTABLE:COPY` on page 135

**Deleting a Table**

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

Remote command:

`CONFigure:CDPower:CTABLE:DELeTe` on page 135

**6.2.9.3 Channel Table Settings and Functions**

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

Channel tables are configured in the "Channel Table" dialog box which is displayed when you select the "New", "Copy" or "Edit" buttons for a predefined channel table in the "Channel Detection" dialog box.

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**Name**

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

Remote command:

`CONFigure:CDPower:CTABLE:NAME` on page 136

**Comment**

Optional description of the channel table.

Remote command:

`CONFigure:CDPower:CTABLE:COMMeNt` on page 136

**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 66.

For details see [chapter 4.4, "Data Fields and Midambles"](#), on page 40.

Remote command:

[CONFigure:CDPower:CTABLE:MSHift](#) on page 138

**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 113

**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 40.

**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.

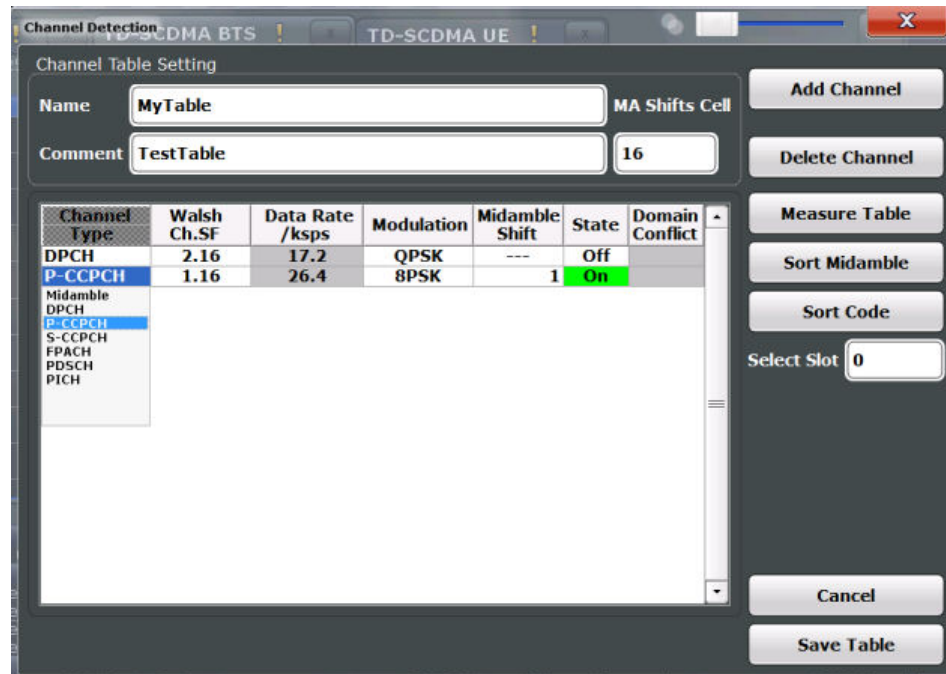
**Saving the Table**

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



### 6.2.9.4 Channel Details

Channel details are configured in the "Channel Table" dialog box which is displayed when you select the "New", "Copy" or "Edit" buttons for a predefined channel table in the "Channel Detection" dialog box.



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.....	73
Channel Number (Ch. SF).....	73
Symbol Rate.....	73
Modulation.....	74
Midamble Shift.....	74
State.....	74
Domain Conflict.....	74

#### Channel Type

Type of channel. For a list of possible channel types see [chapter 4.3.1, "Special Channels"](#), on page 37.

Remote command:

[CONFigure:CDPower:CTABLE:DATA](#) on page 137

#### Channel Number (Ch. SF)

Channel number, defined by code and spreading factor

Remote command:

[CONFigure:CDPower:CTABLE:DATA](#) on page 137

#### 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 40.

Remote command:

[CONFigure:CDPower:CTABLE:MSHift](#) on page 138

#### State

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

Remote command:

[CONFigure:CDPower:CTABLE:DATA](#) on page 137

#### Domain Conflict

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

## 6.2.10 Sweep Settings

The sweep settings define how the data is measured.

<a href="#">Continuous Sweep/RUN CONT</a> .....	74
<a href="#">Single Sweep/ RUN SINGLE</a> .....	75
<a href="#">Continue Single Sweep</a> .....	75
<a href="#">Refresh</a> .....	75
<a href="#">Sweep / Average Count</a> .....	75

#### 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 has an 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 157

### 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 158

### 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 157

### Refresh

This function is only available if the Sequencer is deactivated and only for **MSRA applications**.

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

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

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

Remote command:

[INITiate<n>:REFResh](#) on page 187

### Sweep / Average Count

Defines the number of sweeps to be performed in the single sweep mode. Values from 0 to 200000 are allowed. If the values 0 or 1 are set, one sweep is performed.

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

Remote command:

[\[SENSe:\]SWEep:COUNT](#) on page 138

## 6.2.11 Automatic Settings

Some settings can be adjusted by the R&S FPS automatically according to the current measurement settings. In order to do so, a measurement is performed. The duration of this measurement can be defined automatically or manually.

To activate the automatic adjustment of a setting, select the corresponding function in the AUTO SET menu or in the configuration dialog box for the setting, where available.



### 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 perform data acquisition in MSRA operating mode.

Adjusting all Determinable Settings Automatically (Auto All).....	76
Setting the Reference Level Automatically (Auto Level).....	76
Auto Scale Window.....	76
Auto Scale All.....	76
Restore Scale (Window).....	77
Resetting the Automatic Measurement Time (Meastime Auto).....	77
Changing the Automatic Measurement Time (Meastime Manual).....	77
Upper Level Hysteresis.....	77
Lower Level Hysteresis.....	77

#### 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 76

This function is only available for the MSRA Master, not for the applications.

Remote command:

`[SENSe:]ADJust:ALL` on page 139

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

Automatically determines the optimal reference level 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, clipping and overload conditions are minimized.

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

You can change the measurement time for the level measurement if necessary (see ["Changing the Automatic Measurement Time \(Meastime Manual\)"](#) on page 77).

Remote command:

`[SENSe:]ADJust:LEVel` on page 141

#### Auto Scale Window

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

#### Auto Scale All

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

**Restore Scale (Window)**

Restores the default scale settings in the currently selected window.

**Resetting the Automatic Measurement Time (Meastime Auto)**

Resets the measurement duration for automatic settings to the default value.

Remote command:

[\[SENSe:\]ADJust:CONFigure:DURation:MODE](#) on page 140

**Changing the Automatic Measurement Time (Meastime Manual)**

This function allows you to change the measurement duration for automatic setting adjustments. Enter the value in seconds.

Remote command:

[\[SENSe:\]ADJust:CONFigure:DURation:MODE](#) on page 140

[\[SENSe:\]ADJust:CONFigure:DURation](#) on page 139

**Upper Level Hysteresis**

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

Remote command:

[\[SENSe:\]ADJust:CONFigure:HYSTeresis:UPPer](#) on page 141

**Lower Level Hysteresis**

When the reference level is adjusted automatically using the [Auto Level](#) function, 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.

Remote command:

[\[SENSe:\]ADJust:CONFigure:HYSTeresis:LOWer](#) on page 140

**6.2.12 Zoom Functions**

The zoom functions are only available from the toolbar.

<a href="#">Single Zoom</a> .....	77
<a href="#">Multiple Zoom</a> .....	78
<a href="#">Restore Original Display</a> .....	78
 <a href="#">Deactivating Zoom (Selection mode)</a> .....	78

**Single Zoom**

A single zoom replaces the current diagram by a new diagram which displays an enlarged extract of the trace. This function can be used repetitively until the required details are visible.

Remote command:

`DISPlay[:WINDow<n>]:ZOOM:STATe` on page 155

`DISPlay[:WINDow<n>]:ZOOM:AREA` on page 154

### Multiple Zoom



In multiple zoom mode, you can enlarge several different areas of the trace simultaneously. An overview window indicates the zoom areas in the original trace, while the zoomed trace areas are displayed in individual windows. The zoom area that corresponds to the individual zoom display is indicated in the lower right corner, between the scrollbars.

Remote command:

`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 156

`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA` on page 155

### Restore Original Display



Restores the original display and closes all zoom windows.

Remote command:

`DISPlay[:WINDow<n>]:ZOOM:STATe` on page 155 (single zoom)

`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 156 (for each multiple zoom window)

### Deactivating Zoom (Selection mode)

Deactivates any zoom mode.

Selecting a point in the display no longer invokes a zoom, but selects an object.

Remote command:

`DISPlay[:WINDow<n>]:ZOOM:STATe` on page 155 (single zoom)

`DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe` on page 156 (for each multiple zoom window)

## 6.3 Frequency and Time Domain Measurements

TD-SCDMA measurements require a special application on the R&S FPS, which you activate using the MODE key.

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.

### Selecting the measurement type

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

Some parameters are set automatically according to the TD-SCDMA standard the first time a measurement is selected (since the last PRESET operation). A list of these parameters is given with each measurement type. The parameters can be changed, but are not reset automatically the next time you re-enter the measurement.

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

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

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

- [Power vs Time](#)..... 79
- [Signal Channel Power Measurements](#).....82
- [Channel Power \(ACLR\) Measurements](#).....83
- [Spectrum Emission Mask](#).....84
- [Occupied Bandwidth](#).....85
- [CCDF](#).....87

## 6.3.1 Power vs Time

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

- [Default Settings for PvT Measurements](#)..... 79
- [PvT Configuration Overview](#)..... 80
- [PvT Measurement Settings](#).....81

### 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

Parameter	Default Value
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 10
2. "Input/ Frontend"  
See [chapter 6.2.3, "Data Input and Output Settings"](#), on page 50
3. (Optionally:) "Trigger"  
See [chapter 6.2.5, "Trigger Settings"](#), on page 59
4. "Synchronization"  
See [chapter 6.2.8, "Synchronization"](#), on page 66
5. "Analysis"  
See [chapter 7, "Analysis"](#), on page 88
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 lefthand corner of the "Overview" to restore all measurement settings **in the current channel** to their default values.

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



See [chapter 6.2.1, "Default Settings for Code Domain Analysis"](#), on page 47 for details.

Remote command:

`SYSTem:PRESet:CHANnel[:EXECute]` on page 113

### Select Measurement

Selects a different measurement to be performed.

See [chapter 3, "Measurements and Result Display"](#), on page 10.

### Specifics for

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

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

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

#### 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.....	81
Start Meas.....	81
No of Subframes.....	82
Adapting the Measurement to the Current Signal.....	82
L Start Slot / Stop Slot.....	82
L Auto Level & Time.....	82

### 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 145

### 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 157

`INITiate<n>[:IMMediate]` on page 158

**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 75.

Remote command:

`CONFigure:CDPower[:BTS]:PVTime:SFRames` on page 145

**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 145

`[SENSe:]POWER:ACHannel:SLOT:STOP` on page 146

**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 145

**6.3.2 Signal Channel Power Measurements**

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 6-2: Predefined settings for TD-SCDMA Signal Channel Power measurements**

Standard	TD SCDMA FWD ( <b>UE</b> : 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 145

[SENSe:]POWer:ACHannel:SLOT:STOP on page 146

**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 145

**6.3.3 Channel Power (ACLR) Measurements**

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 6-3: 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.....	84
L Start Slot / Stop Slot.....	84
L Auto Level & Time.....	84

### 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 145

[SENSe:]POWER:ACHannel:SLOT:STOP on page 146

#### 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 145

## 6.3.4 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 6-4: 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 145

[\[SENSe:\]POWER:ACHannel:SLOT:STOP](#) on page 146

#### **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 145

### **6.3.5 Occupied Bandwidth**

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

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

**Table 6-5: Predefined settings for TD-SCDMA OBW measurements**

Setting	Default value
% Power Bandwidth	99 %
Channel bandwidth	1.28 MHz
Sweep Time	676 ms
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 145

[\[SENSe:\] POWER:ACHannel:SLOT:STOP](#) on page 146

#### 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 145

### 6.3.6 CCDF

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

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

**Table 6-6: 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 145

[\[SENSe:\] POWER:ACHannel:SLOT:STOP](#) on page 146

#### 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 145

# 7 Analysis

General result analysis settings concerning the evaluation range, trace, markers, etc. can be configured via the "Analysis" button in the "Overview".



## Analysis of RF Measurements

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

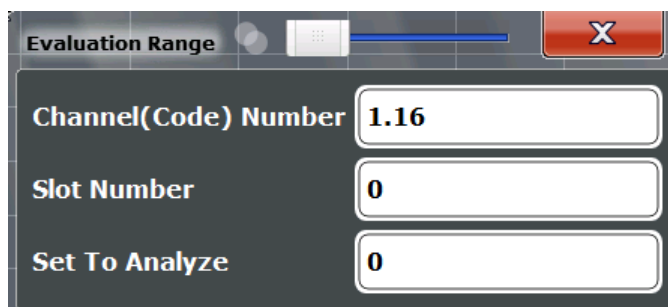
For details see the "Common Analysis and Display Functions" chapter in the R&S FPS User Manual.

The remote commands required to perform these tasks are described in [chapter 10.10, "Analysis"](#), on page 177.

- [Evaluation Range](#).....88
- [Code Domain Analysis Settings](#).....89
- [Traces](#).....91
- [Markers](#).....92

## 7.1 Evaluation Range

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



- [Channel \(Code\) Number](#).....88
- [Slot Number](#).....89
- [Set to Analyze](#).....89

### 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 on the basis of 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 kbps) if the channel is active, otherwise code 7 at spreading factor 16.

Remote command:

[SENSe:]CDPower:CODE on page 141

### 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 12):

- 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 142

### 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 142

## 7.2 Code Domain Analysis Settings

Some evaluations provide further settings for the results.



Fig. 7-1: Code Domain Settings (BTS mode)

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Code Power Display.....	90
Channel Table Sort Order.....	90
Show DwPTS Results (BTS mode).....	91
Show UpPTS Results (UE mode).....	91

**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 143

**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 143

**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 40).

Remote command:

`CONFigure:CDPower:CTABLE:ORDer` on page 142

#### 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 35) in the Result Summary.

Remote command:

`[SENSe:]CDPower:PTS` on page 143

#### Show UpPTS Results (UE mode)

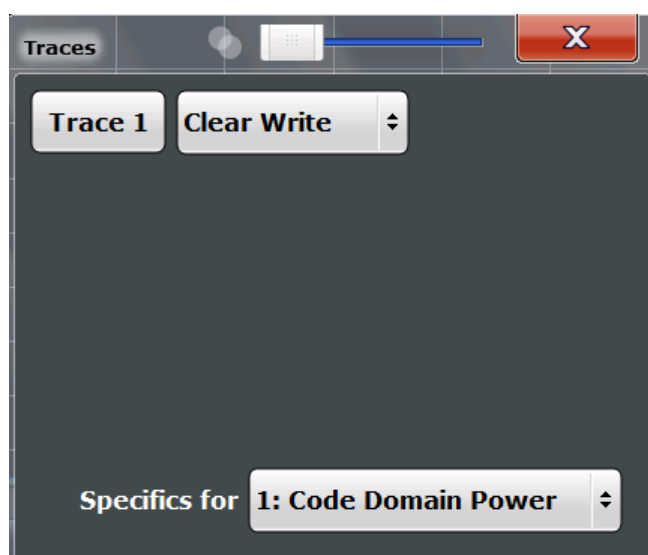
Displays additional information on the "Uplink Pilot Time Slot" (UpPTS, see also [chapter 4.2, "Frames, Subframes and Slots"](#), on page 35) in the Result Summary.

Remote command:

`[SENSe:]CDPower:PTS` on page 143

## 7.3 Traces

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: the trace is overwritten by each measurement. This is the default setting.
"Max Hold"	The maximum value is determined over several measurements and displayed. The R&S 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 177

## 7.4 Markers

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 are configured in the "Marker" dialog box which is displayed when you do one of the following:

- In the "Overview", select "Analysis", and switch to the vertical "Marker" tab.
- Press the MKR key, then select the "Marker Config" softkey.



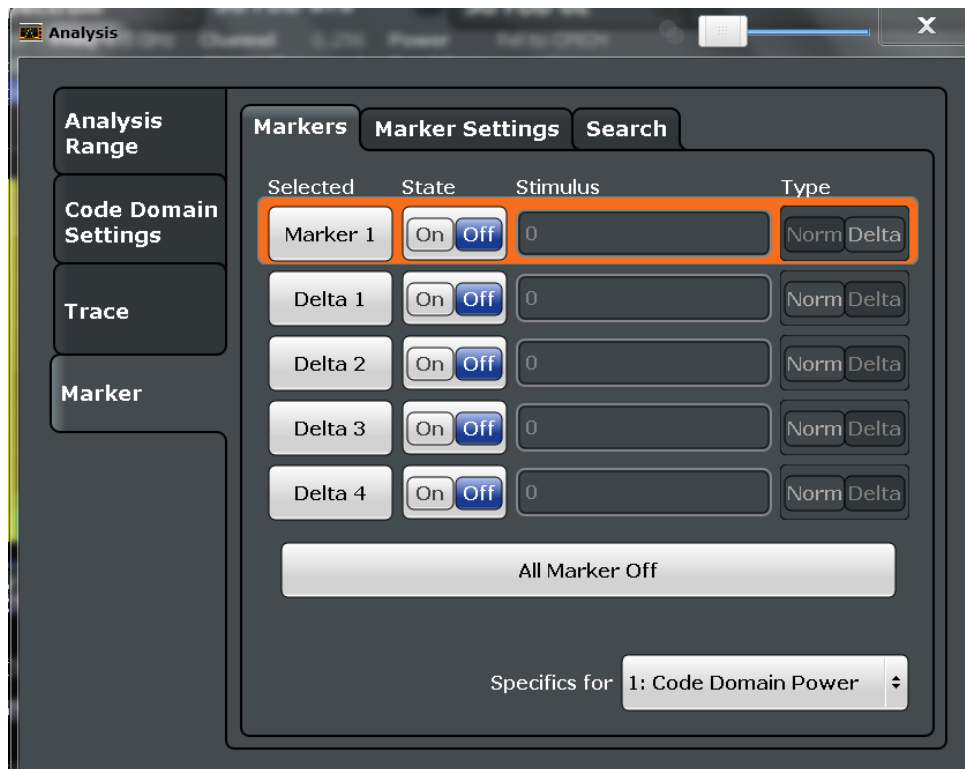
### Markers in Code Domain Analysis measurements

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

- [Individual Marker Settings](#).....93
- [General Marker Settings](#)..... 94
- [Marker Search Settings](#).....95
- [Marker Positioning Functions](#).....96

### 7.4.1 Individual Marker Settings

In CDA evaluations, up to 4 markers can be activated in each diagram at any time.



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All Markers Off.....	94

**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 178

[CALCulate<n>:DELTAmarker<m>\[:STATE\]](#) on page 179

**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 180

[CALCulate<n>:MARKer<m>:X](#) on page 178

**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 178

[CALCulate<n>:DELTAmarker<m>\[:STATe\]](#) on page 179

**All Markers Off**

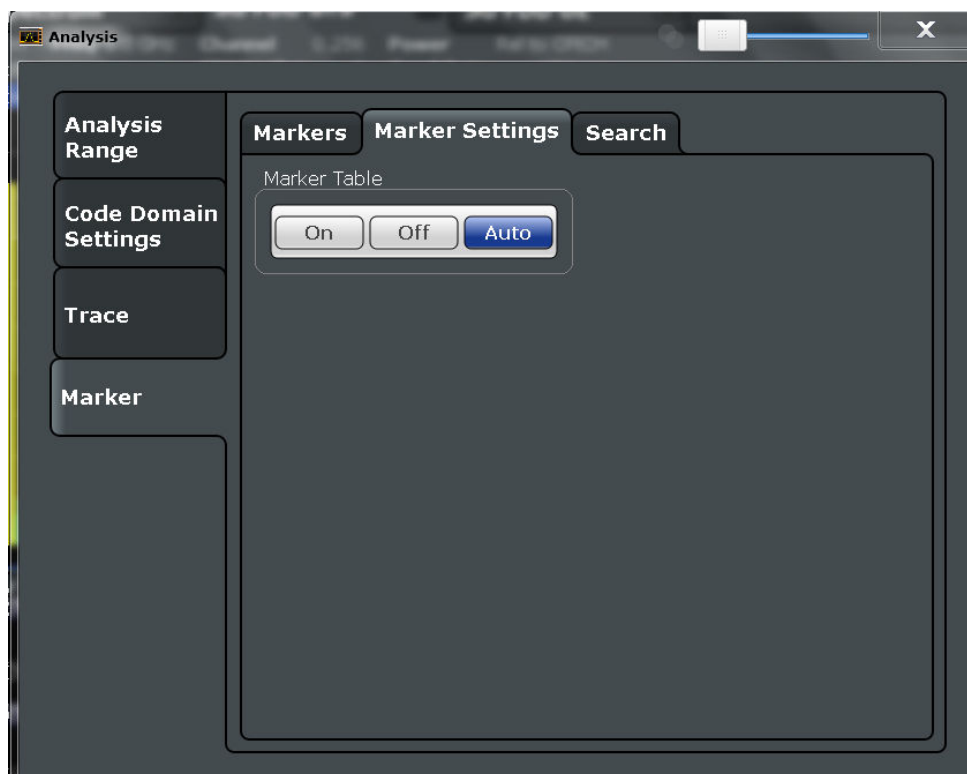
Deactivates all markers in one step.

Remote command:

[CALCulate<n>:MARKer<m>:AOFF](#) on page 179

**7.4.2 General Marker Settings**

General marker settings are defined in the "Marker Config" tab of the "Marker" dialog box.



### Marker Table Display

Defines how the marker information is displayed.

- |        |   |
|--------|---|
| "On"   | Displays the marker information in a table in a separate area beneath the diagram.  |
| "Off"  | Displays the marker information within the diagram area.  |
| "Auto" | (Default) Up to two markers are displayed in the diagram area. If more markers are active, the marker table is displayed automatically. |

Remote command:

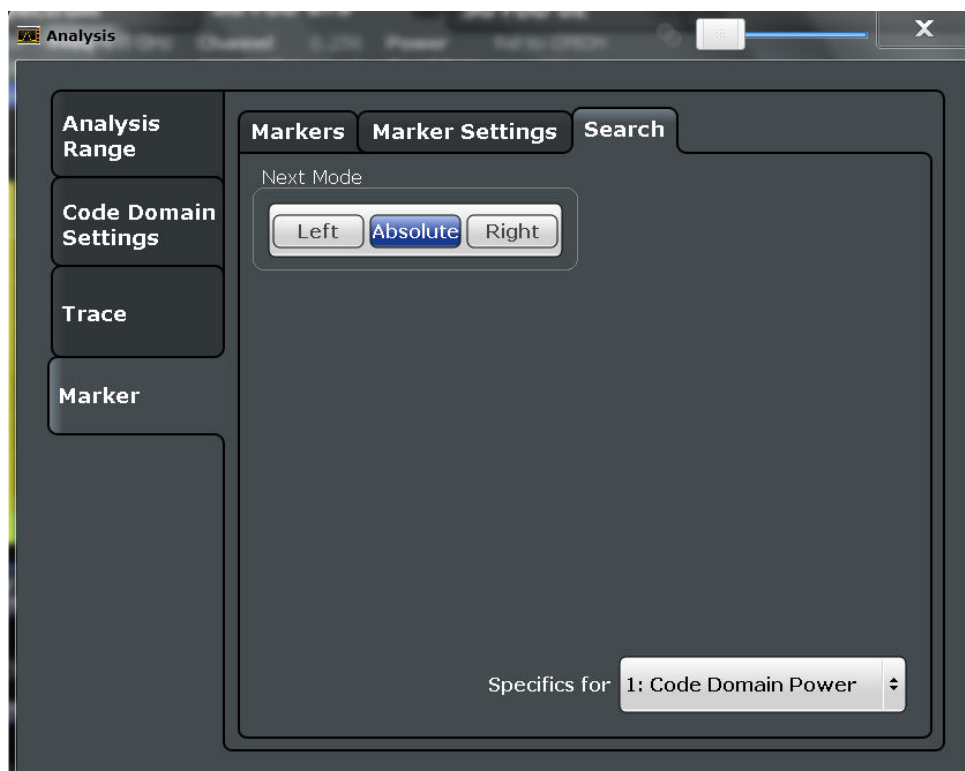
[DISPlay:MTABLE](#) on page 181

### 7.4.3 Marker Search Settings

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 may be performed. The search results can be influenced by special settings.

These settings are available as softkeys in the "Marker To" menu, or in the "Search" tab of the "Marker" dialog box. To display this tab, do one of the following:

- Press the MKR key, then select the "Marker Config" softkey. Then select the horizontal "Search" tab.
- In the "Overview", select "Analysis", and switch to the vertical "Marker Config" tab. Then select the horizontal "Search" tab.



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**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 181

**7.4.4 Marker Positioning Functions**

The following functions set the currently selected marker to the result of a peak search. These functions are available as softkeys in the "Marker To" menu, which is displayed when you press the MKR -> key.





### 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.

<a href="#">Search Next Peak</a> .....	97
<a href="#">Search Next Minimum</a> .....	97
<a href="#">Peak Search</a> .....	97
<a href="#">Search Minimum</a> .....	97

#### 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 182

[CALCulate<n>:DELTamarker<m>:MAXimum:NEXT](#) on page 183

#### 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 182

[CALCulate<n>:DELTamarker<m>:MINimum:NEXT](#) on page 184

#### 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 182

[CALCulate<n>:DELTamarker<m>:MAXimum\[:PEAK\]](#) on page 183

#### 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 182

[CALCulate<n>:DELTamarker<m>:MINimum\[:PEAK\]](#) on page 184

## 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 11)  
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 102.
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 100.
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 26).

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:  
$$\text{capture offset} = \text{starting point for application} - \text{starting point in capture buffer}$$
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:

• <a href="#">Introduction</a> .....	104
• <a href="#">Common Suffixes</a> .....	109
• <a href="#">Activating the TD-SCDMA Applications</a> .....	109
• <a href="#">Selecting a Measurement</a> .....	113
• <a href="#">Configuring Code Domain Analysis</a> .....	114
• <a href="#">Configuring Frequency and Time Domain Measurements</a> .....	144
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### 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.

- [Numeric Values](#)..... 107
- [Boolean](#)..... 108
- [Character Data](#)..... 108
- [Character Strings](#)..... 109
- [Block Data](#)..... 109

#### 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 106.

### 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 a 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 TD-SCDMA applications, the following common suffixes are used in remote commands:

Suffix	Value range	Description
<n>	1..16	Window
<t>	1 (CDA) 6 (Frequency and time domain)	Trace
<m>	1..4 (CDA) 1..16 (Frequency and time domain)	Marker

**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.

<a href="#">INSTrument:CREate:DUPLicate</a> .....	110
<a href="#">INSTrument:CREate[:NEW]</a> .....	110
<a href="#">INSTrument:CREate:REPLace</a> .....	110
<a href="#">INSTrument:DELeTe</a> .....	111
<a href="#">INSTrument:LIST?</a> .....	111
<a href="#">INSTrument:REName</a> .....	112
<a href="#">INSTrument[:SELeCt]</a> .....	113
<a href="#">SYSTem:PRESet:CHANnel[:EXECute]</a> .....	113

---

### **INSTrument:CREate:DUPLicate**

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

```
INST:CRE:DUPL
```

Duplicates the channel named 'Spectrum' and creates a new measurement channel named 'Spectrum 2'.

**Usage:** Event

---

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

This command adds an additional measurement channel.

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

#### **Parameters:**

<ChannelType> Channel type of the new channel.  
For a list of available channel types see [INSTrument:LIST?](#) on page 111.

<ChannelName> String containing the name of the channel. The channel name is displayed as the tab label for the measurement channel.  
Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see [INSTrument:LIST?](#) on page 111).

**Example:**

```
INST:CRE SAN, 'Spectrum 2'
```

Adds an additional spectrum display named "Spectrum 2".

---

### **INSTrument:CREate:REPLace <ChannelName1>,<ChannelType>,<ChannelName2>**

This command replaces a measurement channel with another one.

**Setting parameters:**

- <ChannelName1> String containing the name of the measurement channel you want to replace.
- <ChannelType> Channel type of the new channel.  
For a list of available channel types see [INSTrument:LIST?](#) on page 111.
- <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 111).

**Example:** `INST:CRE:REPL 'Spectrum2',IQ,'IQAnalyzer'`  
Replaces the channel named 'Spectrum2' by a new measurement channel of type 'IQ Analyzer' named 'IQAnalyzer'.

**Usage:** Setting only

**INSTrument:DELeTe** <ChannelName>

This command deletes a measurement channel.

If you delete the last measurement channel, the default "Spectrum" channel is activated.

**Parameters:**

- <ChannelName> String containing the name of the channel you want to delete.  
A measurement channel must exist in order to be able delete it.

**Example:** `INST:DEL 'Spectrum4'`  
Deletes the channel with the name 'Spectrum4'.

**Usage:** Event

**INSTrument:LIST?**

This command queries all active measurement channels. This is useful in order to obtain the names of the existing measurement channels, which are required in order to replace or delete the channels.

**Return values:**

- <ChannelType>,  
<ChannelName> For each channel, the command returns the channel type and channel name (see tables below).  
Tip: to change the channel name, use the [INSTrument:REName](#) command.

**Example:** `INST:LIST?`  
Result for 3 measurement channels:  
'ADEM', 'Analog Demod', 'IQ', 'IQ Analyzer', 'IQ', 'IQ Analyzer2'

**Usage:** Query only

**Table 10-1: Available measurement channel types and default channel names in Signal and Spectrum Analyzer mode**

Application	<ChannelType> Parameter	Default Channel Name*)
Spectrum	SANALYZER	Spectrum
I/Q Analyzer	IQ	IQ Analyzer
Analog Demodulation (R&S FPS-K7)	ADEM	Analog Demod
GSM (R&S FPS-K10)	GSM	GSM
Noise (R&S FPS-K30)	NOISE	Noise
Phase Noise (R&S FPS-K40)	PNOISE	Phase Noise
VSA (R&S FPS-K70)	DDEM	VSA
3GPP FDD BTS (R&S FPS-K72)	BWCD	3G FDD BTS
3GPP FDD UE (R&S FPS-K73)	MWCD	3G FDD UE
TD-SCDMA BTS (R&S FPS-K76)	BTDS	TD-SCDMA BTS
TD-SCDMA UE (R&S FPS-K77)	MTDS	TD-SCDMA UE
cdma2000 BTS (R&S FPS-K82)	BC2K	CDMA2000 BTS
cdma2000 MS (R&S FPS-K83)	MC2K	CDMA2000 MS
1xEV-DO BTS (R&S FPS-K84)	BDO	1xEV-DO BTS
1xEV-DO MS (R&S FPS-K85)	MDO	1xEV-DO MS
WLAN (R&S FPS-K91)	WLAN	WLAN
LTE (R&S FPS-K10x)	LTE	LTE

Note: the default channel name is also listed in the table. If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel.

**INSTrument:REName** <ChannelName1>, <ChannelName2>

This command renames a measurement channel.

**Parameters:**

<ChannelName1> String containing the name of the channel you want to rename.

<ChannelName2> String containing the new channel name.  
Note that you can not assign an existing channel name to a new channel; this will cause an error.

**Example:** `INST:REN 'Spectrum2', 'Spectrum3'`  
Renames the channel with the name 'Spectrum2' to 'Spectrum3'.

**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 110

**Parameters:**

<Mode>	<b>BTDS</b> TD-SCDMA BTS mode (R&S FPS-K76 option)
	<b>MTDS</b> TD-SCDMA UE mode (R&S FPS-K77 option)

**SYSTem:PRESet:CHANnel[:EXECute]**

This command restores the default instrument settings in the current channel.

Use `INST:SEL` to select the channel.

**Example:**

```
INST 'Spectrum2'
```

Selects the channel for "Spectrum2".

```
SYST:PRESet:CHAN:EXEC
```

Restores the factory default settings to the "Spectrum2" channel.

**Usage:** Event

**Manual operation:** See ["Preset Channel"](#) on page 50

## 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 10.

[CONFigure:CDPower:MEASurement](#)..... 113

**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 25.

**Parameters:**

<Measurement>	<b>ACLR</b> Adjacent Channel Power
	<b>CCDF</b> Complementary Cumulative Distribution Function
	<b>CDPower</b> Code Domain Power
	<b>ESpectrum</b> Spectrum Emission Mask
	<b>OBWidth</b> Occupied Bandwidth
	<b>POWer</b> Channel Power
	<b>PVTime</b> Power vs Time
	*RST: CDPower

**Example:**

CONF:CDP:MEAS POW  
Selects Signal Channel Power measurement.

**Manual operation:**

See "Power vs Time" on page 26  
See "Power" on page 28  
See "Ch Power ACLR" on page 28  
See "Spectrum Emission Mask" on page 29  
See "Occupied Bandwidth" on page 30  
See "CCDF" on page 31  
See "Creating a New Channel Table from the Measured Signal (Measure Table)" on page 72

## 10.5 Configuring Code Domain Analysis

The following commands are required to configure Code Domain Analysis.

- [Configuring the Data Input and Output](#)..... 115
- [Frontend Configuration](#)..... 117
- [Configuring Triggered Measurements](#).....123
- [Signal Capturing](#).....128
- [Synchronization](#).....130
- [Channel Detection](#).....133
- [Sweep Settings](#)..... 138
- [Automatic Settings](#)..... 139
- [Evaluation Range](#)..... 141
- [Code Domain Analysis Settings](#)..... 142

## 10.5.1 Configuring the Data Input and Output

- [RF Input](#)..... 115
- [Configuring the Outputs](#)..... 116

### 10.5.1.1 RF Input

<a href="#">INPut:COUPling</a> .....	115
<a href="#">INPut:DPATH</a> .....	115
<a href="#">INPut:FILTer:YIG[:STATe]</a> .....	115
<a href="#">INPut:IMPedance</a> .....	116
<a href="#">INPut:SELEct</a> .....	116

---

#### 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

**Usage:**                SCPI confirmed

**Manual operation:** See "[Input Coupling](#)" on page 51

---

#### INPut:DPATH <State>

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

##### Parameters:

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

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

\*RST:                1

**Example:**            INP:DPAT OFF

**Usage:**                SCPI confirmed

---

#### INPut:FILTer:YIG[:STATe] <State>

This command turns the YIG-preselector on and off.

Note the special conditions and restrictions for the YIG filter described in "YIG-Preselector" on page 52.

**Parameters:**

<State> ON | OFF | 0 | 1  
 \*RST: 1 (0 for I/Q Analyzer, GSM, VSA and MC Group Delay measurements)

**Example:**

INP:FILT:YIG OFF  
 Deactivates the YIG-preselector.

**Manual operation:** See "YIG-Preselector" on page 52

**INPut:IMPedance** <Impedance>

This command selects the nominal input impedance of the RF input.

75  $\Omega$  should be selected if the 50  $\Omega$  input impedance is transformed to a higher impedance using a matching pad of the RAZ type (= 25  $\Omega$  in series to the input impedance of the instrument). The power loss correction value in this case is 1.76 dB = 10 log (75 $\Omega$ /50 $\Omega$ ).

**Parameters:**

<Impedance> 50 | 75  
 \*RST: 50  $\Omega$

**Example:**

INP:IMP 75

**Usage:**

SCPI confirmed

**Manual operation:** See "Impedance" on page 51

**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 51

### 10.5.1.2 Configuring the Outputs



Configuring trigger input/output is described in [chapter 10.5.3.2, "Configuring the Trigger Output"](#), on page 126.

DIAGnostic:SERvice:NSource..... 117

**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.

**Parameters:**

<State> ON | OFF  
\*RST: OFF

**Example:** DIAG:SERV:NSO ON

**Manual operation:** See "Noise Source" on page 53

## 10.5.2 Frontend Configuration

The following commands configure frequency, amplitude and y-axis scaling settings, which represent the "frontend" of the measurement setup.

- [Frequency](#)..... 117
- [Amplitude and Scaling Settings](#)..... 119
- [Configuring the Attenuation](#)..... 122

### 10.5.2.1 Frequency

<a href="#">[SENSe:]FREQuency:CENTer</a> .....	117
<a href="#">[SENSe:]FREQuency:CENTer:STEP</a> .....	118
<a href="#">[SENSe:]FREQuency:CENTer:STEP:AUTO</a> .....	118
<a href="#">[SENSe:]FREQuency:OFFSet</a> .....	118

**[SENSe:]FREQuency:CENTer** <Frequency>

This command defines the center frequency.

**Parameters:**

<Frequency> The allowed range and  $f_{\max}$  is specified in the data sheet.

**UP**

Increases the center frequency by the step defined using the [\[SENSe:\]FREQuency:CENTer:STEP](#) command.

**DOWN**

Decreases the center frequency by the step defined using the [\[SENSe:\]FREQuency:CENTer:STEP](#) command.

\*RST:  $f_{\max}/2$

Default unit: Hz

**Example:**

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
Sets the center frequency to 110 MHz.
```

**Usage:** SCPI confirmed

**Manual operation:** See "[Center frequency](#)" on page 58

---

**[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:**

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
Sets the center frequency to 110 MHz.
```

**Manual operation:** See "[Center Frequency Stepsize](#)" on page 58

---

**[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 applications, only the query command is available.

**Parameters:**

<Offset> Range: -100 GHz to 100 GHz  
 \*RST: 0 Hz

**Example:**

```
FREQ:OFFS 1GHZ
```

**Usage:** SCPI confirmed

**Manual operation:** See "[Frequency Offset](#)" on page 59

### 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 115
- `INPut:IMPedance` on page 116
- `[SENSe:]ADJust:LEVel` on page 141

#### Remote commands exclusive to amplitude settings:

<code>DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:AUTO ONCE</code> .....	119
<code>DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:MAXimum</code> .....	119
<code>DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:MINimum</code> .....	120
<code>DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:PDIVision</code> .....	120
<code>DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:RLEVel</code> .....	120
<code>DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:RLEVel:OFFSet</code> .....	120
<code>DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:RPOSition</code> .....	121
<code>DISPlay[:WINDow&lt;n&gt;]:TRACe&lt;t&gt;:Y[:SCALe]:RVALue</code> .....	121
<code>INPut:GAIN:STATE</code> .....	121

---

#### `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, <t> is irrelevant).

**Usage:** SCPI confirmed

**Manual operation:** See "[Auto Scale Once](#)" on page 57

---

#### `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.

The suffix <t> is 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 57

**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.

The suffix <t> is 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 57

**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.

The suffix <t> is 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, <t> is irrelevant).

**Example:**                    DISP:TRAC:Y:RLEV -60dBm

**Usage:**                    SCPI confirmed

**Manual operation:** See "[Reference Level](#)" on page 55

**DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Offset>**

This command defines a reference level offset (for all traces, <t> is 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 55

---

#### 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, <t> is irrelevant).

The R&S FPS adjusts the scaling of the y-axis accordingly.

**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

**Usage:**                    SCPI confirmed

---

#### 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, <t> is irrelevant).

For external generator calibration measurements (requires the optional External Generator Control), this command defines the power offset value assigned to the reference position.

**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  
 \*RST:                    OFF

**Example:**                    INP:GAIN:STAT ON  
 Switches on 20 dB preamplification.

**Usage:**                    SCPI confirmed

**Manual operation:** See ["Preamplifier \(option B22/B24\)"](#) on page 57

### 10.5.2.3 Configuring the Attenuation

INPut:ATTenuation.....	122
INPut:ATTenuation:AUTO.....	122
INPut:EATT.....	122
INPut:EATT:AUTO.....	123
INPut:EATT:STATe.....	123

---

#### 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 123).

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
	*RST:	10 dB (AUTO is set to ON)

**Example:** `INP:ATT 30dB`  
Defines a 30 dB attenuation and decouples the attenuation from the reference level.

**Usage:** SCPI confirmed

**Manual operation:** See "[Attenuation Mode / Value](#)" on page 56

---

#### 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.

**Usage:** SCPI confirmed

**Manual operation:** See "[Attenuation Mode / Value](#)" on page 56

---

#### 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 123).

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 56

**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>                   ON | OFF | 0 | 1  
                               \*RST:        1

**Example:**                INP:EATT:AUTO OFF

**Manual operation:**    See "[Using Electronic Attenuation](#)" on page 56

**INPut:EATT:STATe <State>**

This command turns the electronic attenuator on and off.

This command requires the electronic attenuation hardware option.

**Parameters:**

<State>                   ON | OFF  
                               \*RST:        OFF

**Example:**                INP:EATT:STAT ON  
                               Switches the electronic attenuator into the signal path.

**Manual operation:**    See "[Using Electronic Attenuation](#)" on page 56

### 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 6.2.5, "Trigger Settings"](#), on page 59.



The \*OPC command should be used after commands that retrieve data so that subsequent commands to change the selected trigger source are held off until after the sweep is completed and the data has been returned.

- [Configuring the Triggering Conditions](#).....124
- [Configuring the Trigger Output](#).....126

### 10.5.3.1 Configuring the Triggering Conditions

TRIGger[:SEquence]:HOLDoff[:TIME].....	124
TRIGger[:SEquence]:IFPower:HOLDoff.....	124
TRIGger[:SEquence]:IFPower:HYSteresis.....	125
TRIGger[:SEquence]:LEVel[:EXternal<port>].....	125
TRIGger[:SEquence]:SLOPe.....	125
TRIGger[:SEquence]:SOURce.....	126

#### 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 62

#### 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 62

**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 62

**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 61

**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 62

**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>	<b>IMMediate</b> Free Run
	<b>EXTernal</b> Trigger signal from the TRIGGER IN connector.
	<b>EXT2</b> Trigger signal from the TRIGGER AUX connector.
	<b>RFPower</b> First intermediate frequency (Frequency and time domain measurements only.)
	<b>IFPower</b> 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 60  
See ["Free Run"](#) on page 61  
See ["External Trigger 1/2"](#) on page 61  
See ["IF Power"](#) on page 61

**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.

OUTPut:TRIGger<port>:DIRection.....	126
OUTPut:TRIGger<port>:LEVel.....	127
OUTPut:TRIGger<port>:OTYPe.....	127
OUTPut:TRIGger<port>:PULSe:IMMediate.....	128
OUTPut:TRIGger<port>:PULSe:LENGth.....	128

**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 53

**OUTPut:TRIGger<port>:LEVel <Level>**

This command defines the level of the 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**  
TTL signal.

**LOW**  
0 V

\*RST:           LOW

**Manual operation:** See "[Trigger 2](#)" on page 53  
See "[Level](#)" on page 53

**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 53

**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 54

**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.

**Manual operation:**    See ["Pulse Length"](#) on page 54

## 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 Application Data Range \(MSRA mode only\)"](#), on page 186).

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 142

**Remote commands exclusive to defining signal capturing:**

<a href="#">[SENSe:]CDPower:FILTer[:STATe]</a> .....	129
<a href="#">[SENSe:]CDPower:IQLength</a> .....	129
<a href="#">[SENSe:]CDPower:QINVert</a> .....	129
<a href="#">[SENSe:]CDPower:SET:COUNT</a> .....	129



**[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:**

&lt;State&gt;

**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 65

**[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 129), the number of slots is automatically set to the maximum of 64.

**Parameters:**

&lt;CaptureLength&gt;

Range: 2 to 64

\*RST: 7

**Example:**

SENS:CDP:IQLength 3

**Manual operation:** See "[Number of Slots to Capture](#)" on page 65

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

This command inverts the Q-branch of the signal.

**Parameters:**

ON | OFF

\*RST: OFF

**Example:**

CDP:QINV ON

Activates inversion of Q-branch

**Manual operation:** See "[Invert Q](#)" on page 64

**[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 65 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 65

## 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.....	130
[SENSe:]CDPower:SCODE.....	130
[SENSe:]CDPower:STSLot.....	131
[SENSe:]CDPower:STSLot:MODE.....	131
[SENSe:]CDPower:STSLot:ROTate.....	132
[SENSe:]CDPower:SULC.....	132
[SENSe:]CDPower:TREF.....	132

---

### [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 138).

**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 66

---

### [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 66

#### [SENSe:]CDPower:STSLot <State>

This command selects the phase reference for synchronization (see "[Sync To](#)" on page 67).

**Parameters:**

<State> ON | OFF

**ON**

The instrument synchronizes to the midamble of the selected slot.

**OFF**

**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: OFF

**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 67

#### [SENSe:]CDPower:STSLot:MODE <Mode>

This command selects the phase reference for synchronization (see "[Sync To](#)" on page 67).

**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 67

**[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  
\*RST: OFF

**Example:**

CDP:STSL:ROT ON  
Allows phase rotations between channels.

**Manual operation:** See "[Rotate code channel to associated midamble](#)" on page 68

**[SENSe:]CDPower:SULC <SyncUL>**

Defines the code used for synchronization on the UpPTS (see "[Time Reference \(UE mode\)](#)" on page 67).

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 66

**[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 67  
See "Time Reference (UE mode)" on page 67

## 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.

- [General Channel Detection](#)..... 133
- [Managing Channel Tables](#)..... 134
- [Configuring Channel Tables](#)..... 136

### 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 135

**Remote commands exclusive to general channel detection:**

<a href="#">[SENSe:]CDPower:ICTReshold</a> .....	133
<a href="#">[SENSe:]CDPower:MMAx</a> .....	133

---

#### **[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 69

---

#### **[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>	<b>QPSK</b> Consider QPSK modulation only
	<b>PSK8</b> Consider QPSK and 8PSK modulation.
	<b>QAM16</b> Consider QPSK, 8PSK and 16QAM modulation
	<b>QAM64</b> 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 69

**10.5.6.2 Managing Channel Tables**

CONFigure:CDPower:CTABLE:CATalog?	134
CONFigure:CDPower:CTABLE:COpy	135
CONFigure:CDPower:CTABLE:DELeTe	135
CONFigure:CDPower:CTABLE:SELeCt	135
CONFigure:CDPower:CTABLE[:STATe]	135

**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 70

**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 71

**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 71

**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 135.

**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 70

**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 135.

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:** CONF:CDP:CTAB ON

**Manual operation:** See "Using Predefined Channel Tables" on page 70

### 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.....	136
CONFigure:CDPower:CTABLE:NAME.....	136
CONFigure:CDPower:CTABLE:DATA.....	137
CONFigure:CDPower:CTABLE:MSHift.....	138

---

#### 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 71

---

#### 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 cre-
ated.
```

**Manual operation:** See "Name" on page 71



**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>	<p><b>0 ... 7</b>  Type of the channel  <b>0</b> = inactive  <b>1</b> = midamble  <b>2</b> = DPCH  <b>3</b> = P-CCPCH  <b>4</b> = S-CCPCH  <b>5</b> = FPACH  <b>6</b> = PDSCH  <b>7</b> = PICH  Note that <b>values 2 to 7</b> are not distinguished by the application; all these values are mapped to the value 2 (DPCH).</p>
<CodeClass>	<p><b>0 ... 4</b>  Code class of the channel. The code class specifies the spreading factor of the channel.  <b>0</b> = spreading factor 1  <b>1</b> = spreading factor 2  <b>2</b> = spreading factor 4  <b>3</b> = spreading factor 8  <b>4</b> = spreading factor 16</p>
<CodeNo>	<p><b>1 ... 16</b>  Code number of the channel. The number of codes depends on the spreading factor (see <a href="#">table 4-2</a>).</p>
<ModType>	<p>Modulation type of the channel  <b>0</b> = invalid (for midamble)  <b>1</b> = QPSK  <b>2</b> = 8PSK  <b>3</b> = 16QAM  <b>4</b> = 64QAM</p>
<MAShift>	<p><b>0 ... 38400</b>  Midamble shift of the channel</p>
<ActiveFlag>	<p>0   1  Flag to indicate whether a channel is active (1) or not (0)</p>

<Reserved1>, Placeholder values; Currently not used.  
<Reserved2>

**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 73  
See "Channel Number (Ch. SF)" on page 73  
See "State" on page 74

#### 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 130.

##### 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 72  
See "Midamble Shift" on page 74

## 10.5.7 Sweep Settings

`[SENSe:]AVERage<n>:COUNT`..... 138  
`[SENSe:]SWEep:COUNT`..... 138

**[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.

**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.

**Usage:** SCPI confirmed

**Manual operation:** See "[Sweep / Average Count](#)" on page 75

## 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 119

### Remote commands exclusive to adjusting settings automatically:

<code>[SENSe:]ADJust:ALL</code> .....	139
<code>[SENSe:]ADJust:CONFigure:DURation</code> .....	139
<code>[SENSe:]ADJust:CONFigure:DURation:MODE</code> .....	140
<code>[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer</code> .....	140
<code>[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer</code> .....	141
<code>[SENSe:]ADJust:LEVel</code> .....	141

### `[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 76

### `[SENSe:]ADJust:CONFigure: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: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 77

#### [SENSe:]ADJust:CONFigure: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:DURation](#) on page 139.

\*RST:        AUTO

**Manual operation:** See ["Resetting the Automatic Measurement Time \(Meastime Auto\)"](#) on page 77  
 See ["Changing the Automatic Measurement Time \(Meastime Manual\)"](#) on page 77

#### [SENSe:]ADJust:CONFigure:HYSTeresis:LOWer <Threshold>

When the reference level is adjusted automatically using the [\[SENSe:\]ADJust:LEVe1](#) on page 141 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 77

**[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 77

**[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 55

## 10.5.9 Evaluation Range

The evaluation range defines which data is evaluated in the result display.

<a href="#">[SENSe:]CDPower:CODE</a> .....	141
<a href="#">[SENSe:]CDPower:SET</a> .....	142
<a href="#">[SENSe:]CDPower:SLOT</a> .....	142

**[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 88

**[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 65

**[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 89

## 10.5.10 Code Domain Analysis Settings

Some evaluations provide further settings for the results.

<code>CONFigure:CDPower:CTABLE:ORDER</code> .....	142
<code>[SENSe:]CDPower:NORMALize</code> .....	143
<code>[SENSe:]CDPower:PDISplay</code> .....	143
<code>[SENSe:]CDPower:PTS</code> .....	143

**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 90

#### **[SENSe:]CDPower:NORMalize <State>**

If enabled, the I/Q offset is eliminated from the measured signal. This is useful to deduct a DC offset to the baseband caused by the DUT, thus improving the EVM. Note, however, that for EVM measurements according to standard, compensation must be disabled.

**Parameters:**  
<State> ON | OFF  
\*RST: OFF

**Example:** `SENS:CDP:NORM ON`  
Activates the elimination of the I/Q offset.

**Manual operation:** See "[Compensate IQ Offset](#)" on page 90

#### **[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 90

#### **[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 35.)

This parameter only affects the Code Domain Power evaluation.

**Parameters:**

<State> ON | OFF  
**ON**  
 PTS evaluation is activated.  
**OFF**  
 PTS evaluation is disabled.  
 \*RST: OFF

**Example:** SENS:CDP:PTS ON

**Manual operation:** See "Show DwPTS Results (BTS mode)" on page 91  
 See "Show UpPTS Results (UE mode)" on page 91

## 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 78.

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 109.

The individual measurements are activated using the `CONFigure:CDPower:MEASurement` on page 113 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.

- [Configuring Power vs Time Measurements](#) ..... 144
- [Configuring the Slot Range for Frequency Sweeps on Downlink Data](#)..... 145

### 10.6.1 Configuring Power vs Time Measurements

<code>CONFigure:CDPower[:BTS]:PVTime:SFRames</code> .....	145
<code>CONFigure:CDPower[:BTS]:PVTime:SPOint</code> .....	145
<code>[SENSe:]POWer:ACHannel:AUTO:LTIME</code> .....	145



**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 82

**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 81

**[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 82

## 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..... 145  
[SENSe:]POWer:ACHannel:SLOT:STOP..... 146

**[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 82

**[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 82

## 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.

- [General Window Commands](#)..... 146
- [Working with Windows in the Display](#)..... 147
- [Zooming into the Display](#)..... 154

### 10.7.1 General Window Commands

The following commands are required to configure general window layout, independent of the application.

- [DISPlay:FORMat](#)..... 146
- [DISPlay\[:WINDow<n>\]:SIZE](#)..... 147

**DISPlay:FORMat <Format>**

This command determines which tab is displayed.

**Parameters:**

&lt;Format&gt;

**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 151).

**Parameters:**

&lt;Size&gt;

**LARGe**

Maximizes the selected window to full screen. Other windows are still active in the background.

**SMALI**

Reduces the size of the selected window to its original size. If more than one measurement window was displayed originally, these are visible again.

\*RST: SMALI

**Example:**

DISP:WIND2: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 measurement channel as you do using the SmartGrid in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected measurement channel.

<a href="#">LAYout:ADD[:WINDow]?</a> .....	148
<a href="#">LAYout:CATalog[:WINDow]?</a> .....	150
<a href="#">LAYout:IDENtify[:WINDow]?</a> .....	150
<a href="#">LAYout:REMove[:WINDow]</a> .....	150
<a href="#">LAYout:REPLace[:WINDow]</a> .....	151
<a href="#">LAYout:SPLitter</a> .....	151
<a href="#">LAYout:WINDow&lt;n&gt;:ADD?</a> .....	153
<a href="#">LAYout:WINDow&lt;n&gt;:IDENtify?</a> .....	153
<a href="#">LAYout:WINDow&lt;n&gt;:REMove</a> .....	153
<a href="#">LAYout:WINDow&lt;n&gt;:REPLace</a> .....	154

---

**LAYout:ADD[:WINDow]?** <WindowName>,<Direction>,<WindowType>

This command adds a window to the display in the active measurement channel.

This command is always used as a query so that you immediately obtain the name of the new window as a result.

To replace an existing window, use the `LAYout:REPLace[:WINDow]` command.

**Parameters:**

<code>&lt;WindowName&gt;</code>	String containing the name of the existing window the new window is inserted next to. By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the <code>LAYout:CATalog[:WINDow]?</code> query.
<code>&lt;Direction&gt;</code>	LEFT   RIGHT   ABOVE   BELOW Direction the new window is added relative to the existing window.
<code>&lt;WindowType&gt;</code>	text value Type of result display (evaluation method) you want to add. See the table below for available parameter values.

**Return values:**

<code>&lt;NewWindowName&gt;</code>	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 13  
 See "Channel Table" on page 13  
 See "Code Domain Power" on page 15  
 See "Code Domain Error Power" on page 15  
 See "Composite Constellation" on page 16  
 See "Composite EVM" on page 17  
 See "Mag Error vs Chip" on page 18  
 See "Marker Table" on page 19  
 See "Peak Code Domain Error" on page 19  
 See "Phase Error vs Chip" on page 20  
 See "Power vs Slot" on page 21  
 See "Power vs Symbol" on page 22  
 See "Result Summary" on page 23  
 See "Symbol Constellation" on page 23  
 See "Symbol EVM" on page 24  
 See "Symbol Magnitude Error" on page 24  
 See "Symbol Phase Error" on page 25  
 See "Diagram" on page 32  
 See "List Evaluation" on page 33  
 See "Result Summary" on page 33  
 See "Marker Peak List" on page 34

**Table 10-2:** <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 measurement channel from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName\_1>,<WindowIndex\_1>..<WindowName\_n>,<WindowIndex\_n>

**Return values:**

<WindowName>      string  
Name of the window.  
In the default state, the name of the window is its index.

<WindowIndex>    **numeric value**  
Index of the window.

**Example:**

LAY:CAT?

Result:

'2',2,'1',1

Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).

**Usage:**            Query only

**LAYout:IDENtify[:WINDow]? <WindowName>**

This command queries the **index** of a particular display window in the active measurement channel.

**Note:** to query the **name** of a particular window, use the [LAYout:WINDow<n>:IDENtify?](#) query.

**Query parameters:**

<WindowName>      String containing the name of a window.

**Return values:**

<WindowIndex>    Index number of the window.

**Usage:**            Query only

**LAYout:REMOve[:WINDow] <WindowName>**

This command removes a window from the display in the active measurement channel.

**Parameters:**

<WindowName>      String containing the name of the window.  
In the default state, the name of the window is its index.

**Usage:**            Event

---

**LAYout:REPLace[:WINDow]** <WindowName>,<WindowType>

This command replaces the window type (for example from "Diagram" to "Result Summary") of an already existing window in the active measurement channel while keeping its position, index and window name.

To add a new window, use the `LAYout:ADD[:WINDow]?` command.

**Parameters:**

- <WindowName> String containing the name of the existing window.  
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active measurement channel, use the `LAYout:CATalog[:WINDow]?` query.
- <WindowType> Type of result display you want to use in the existing window.  
See `LAYout:ADD[:WINDow]?` on page 148 for a list of available window types.

**Example:**

```
LAY:REPL:WIND '1',MTAB
```

Replaces the result display in window 1 with a marker table.

---

**LAYout:SPLitter** <Index1>,<Index2>,<Position>

This command changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

Compared to the `DISPlay[:WINDow<n>]:SIZE` on page 147 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.

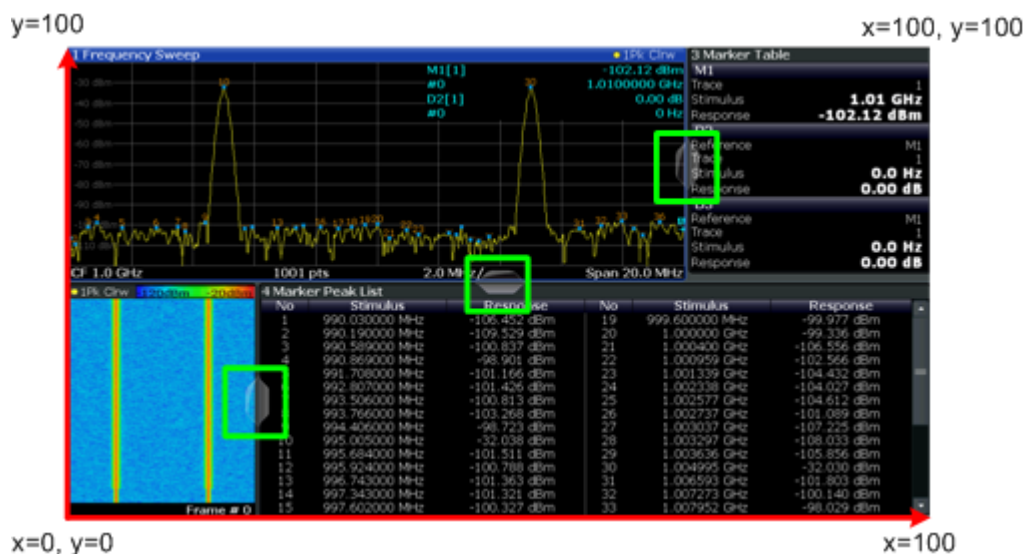


Fig. 10-1: SmartGrid coordinates for remote control of the splitters

#### 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.

**Parameters:**

<Direction> LEFT | RIGHT | ABOVE | BELOW  
 <WindowType> Type of measurement window you want to add.  
 See [LAYout:ADD\[:WINDow\]?](#) on page 148 for a list of available window types.

**Return values:**

<NewWindowName> When adding a new window, the command returns its name (by default the same as its number) as a result.

**Example:**

```
LAY:WIND1:ADD? LEFT,MTAB
```

Result:

```
'2'
```

Adds a new window named '2' with a marker table to the left of window 1.

**Usage:** Query only

**LAYout:WINDow<n>:IDENTify?**

This command queries the **name** of a particular display window (indicated by the <n> suffix) in the active measurement channel.

**Note:** to query the **index** of a particular window, use the [LAYout:IDENTify\[:WINDow\]?](#) command.

**Return values:**

<WindowName> String containing the name of a window.  
 In the default state, the name of the window is its index.

**Usage:** Query only

**LAYout:WINDow<n>:REMOve**

This command removes the window specified by the suffix <n> from the display in the active measurement channel.

The result of this command is identical to the [LAYout:REMOve\[:WINDow\]](#) command.

**Usage:** Event

**LAYout:WINDow<n>:REPLace <WindowType>**

This command changes the window type of an existing window (specified by the suffix <n>) in the active measurement channel.

The result of this command is identical to the `LAYout:REPLace[:WINDow]` command.

To add a new window, use the `LAYout:WINDow<n>:ADD?` command.

**Parameters:**

<WindowType>      Type of measurement window you want to replace another one with.  
See `LAYout:ADD[:WINDow]?` on page 148 for a list of available window types.

## 10.7.3 Zooming into the Display

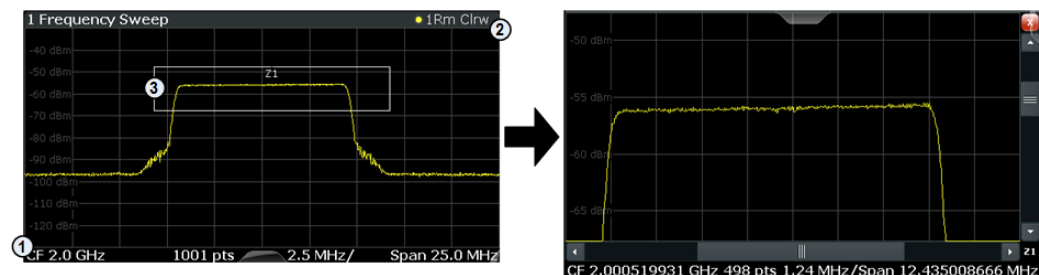
### 10.7.3.1 Using the Single Zoom

<code>DISPlay[:WINDow&lt;n&gt;]:ZOOM:AREA.....</code>	154
<code>DISPlay[:WINDow&lt;n&gt;]:ZOOM:STATE.....</code>	155

**DISPlay[:WINDow<n>]:ZOOM:AREA <x1>,<y1>,<x2>,<y2>**

This command defines the zoom area.

To define a zoom area, you first have to turn the zoom on.



- 1 = origin of coordinate system (x1 = 0, y1 = 0)
- 2 = end point of system (x2 = 100, y2 = 100)
- 3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

**Parameters:**

<x1>,<y1>,  
<x2>,<y2>      Diagram coordinates in % of the complete diagram that define the zoom area.  
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.  
Range:      0 to 100  
Default unit: PCT

**Manual operation:** See "Single Zoom" on page 77

**DISPlay[:WINDow<n>]:ZOOM:STATe <State>**

This command turns the zoom on and off.

**Parameters:**

<State> ON | OFF  
\*RST: OFF

**Example:**

DISP:ZOOM ON  
Activates the zoom mode.

**Manual operation:** See ["Single Zoom"](#) on page 77  
See ["Restore Original Display"](#) on page 78  
See ["Deactivating Zoom \(Selection mode\)"](#) on page 78

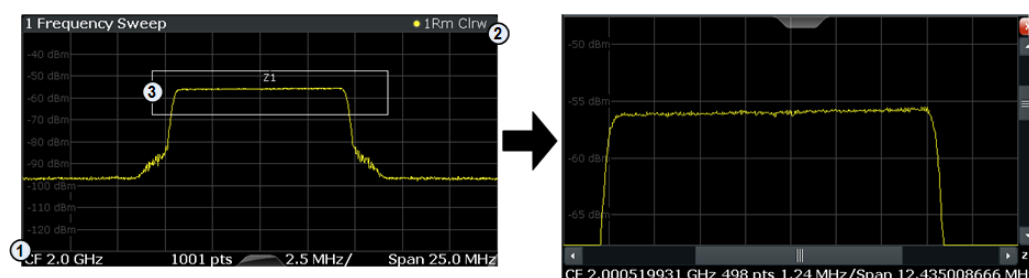
**10.7.3.2 Using the Multiple Zoom**

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA..... 155  
DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe..... 156

**DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA <x1>,<y1>,<x2>,<y2>**

This command defines the zoom area for a multiple zoom.

To define a zoom area, you first have to turn the zoom on.



1 = origin of coordinate system (x1 = 0, y1 = 0)  
2 = end point of system (x2 = 100, y2 = 100)  
3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

**Suffix:**

<zoom> 1...4  
Selects the zoom window.

**Parameters:**

<x1>,<y1>,<x2>,<y2> Diagram coordinates in % of the complete diagram that define the zoom area.  
The lower left corner is the origin of coordinate system. The upper right corner is the end point of the system.  
Range: 0 to 100  
Default unit: PCT

**Manual operation:** See ["Multiple Zoom"](#) on page 78

**DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe <State>**

This command turns the multiple zoom on and off.

**Suffix:**

<zoom> 1...4  
Selects the zoom window.  
If you turn off one of the zoom windows, all subsequent zoom windows move up one position.

**Parameters:**

<State> ON | OFF  
\*RST: OFF

**Manual operation:** See "Multiple Zoom" on page 78  
See "Restore Original Display" on page 78  
See "🖱️ Deactivating Zoom (Selection mode)" on page 78

## 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.....	156
INITiate<n>:CONMeas.....	157
INITiate<n>:CONTinuous.....	157
INITiate<n>[:IMMEDIATE].....	158
INITiate<n>:SEQuencer:ABORT.....	158
INITiate<n>:SEQuencer:IMMEDIATE.....	159
INITiate<n>:SEQuencer:MODE.....	159
INITiate<n>:SEQuencer:REFResh[:ALL].....	160
SYSTem:SEQuencer.....	160

**ABORT**

This command aborts the measurement in the current measurement channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the \*OPC? or \*WAI command after ABORT 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  
SCPI confirmed

#### **INITiate<n>:CONMeas**

This command restarts a (single) measurement that has been stopped (using `ABORT`) or finished in single measurement mode.

The measurement is restarted at the beginning, not where the previous measurement was stopped.

As opposed to `INITiate<n>[:IMMEDIATE]`, this command does not reset traces in maxhold, minhold or average mode. Therefore it can be used to continue measurements using maxhold or averaging functions.

**Suffix:**  
<n> irrelevant

**Usage:** Event

**Manual operation:** See ["Continue Single Sweep"](#) on page 75

#### **INITiate<n>:CONTInuous <State>**

This command controls the measurement mode for an individual measurement channel.

Note that in single measurement mode, you can synchronize to the end of the measurement with `*OPC`, `*OPC?` or `*WAI`. In continuous measurement mode, synchronization to the end of the measurement is not possible. Thus, it is not recommended that you use continuous measurement mode in remote control, as results like trace data or markers are only valid after a single measurement end synchronization.

For details on synchronization see the "Remote Basics" chapter in the R&S FPS User Manual.

If the measurement mode is changed for a measurement channel while the Sequencer is active (see [INITiate<n>:SEQuencer:IMMediate](#) on page 159) 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 74  
 See "[Start Meas](#)" on page 81

**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 75  
 See "[Start Meas](#)" on page 81

**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 159.

To deactivate the Sequencer use [SYSTem:SEQuencer](#) on page 160.

**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 160).

**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 160).

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:**

&lt;Mode&gt;

**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 applications.

(The suffix <n> is 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 133.

- [Retrieving Calculated Measurement Results](#)..... 161
- [Retrieving Trace Results](#)..... 165
- [Measurement Results for TRACe<n>\[:DATA\]? TRACE<n>](#)..... 169
- [Exporting Trace Results](#)..... 173
- [Retrieving RF Results](#)..... 174

### 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?](#)..... 162

[CONFigure:CDPower\[:BTS\]:PVTime:LIST:RESult?](#)..... 164

---

**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 11 for a detailed description of all results.

(The suffix <n> is irrelevant.)

**Query parameters:**

&lt;ResultType&gt;

**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 15

See "[Result Summary](#)" on page 23

**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. <b>0</b> Passed <b>1</b> Failed
<Reserved1>	0; currently not used
<Reserved2>	0; currently not used
<b>Usage:</b>	Query only
<b>Manual operation:</b>	See " <a href="#">Power vs Time</a> " on page 26

## 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>	<b>ASCII</b> 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.
	<b>REAL,32</b> 32-bit IEEE 754 floating-point numbers in the "definite length block format". In the Spectrum application, the format setting <code>REAL</code> is used for the binary transmission of trace data. For I/Q data, 8 bytes per sample are returned for this format setting.
	*RST: ASCII

**Example:** `FORM REAL,32`

**Usage:** SCPI confirmed

**TRACe<n>[:DATA]? <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 169.

**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 169.

**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 10-3](#).

**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 143)

<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>	<b>0 ... 4</b> Code class of the channel. The code class specifies the spreading factor of the channel. <b>0</b> = spreading factor 1 <b>1</b> = spreading factor 2 <b>2</b> = spreading factor 4 <b>3</b> = spreading factor 8 <b>4</b> = spreading factor 16
<CodeNo>	<b>1 ... 16</b> Code number of the channel. The number of codes depends on the spreading factor (see <a href="#">table 4-2</a> ).
<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>	<b>0 ... 38400</b> 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 <b>0</b> = invalid (for midamble) <b>1</b> = QPSK <b>2</b> = 8PSK <b>3</b> = 16QAM <b>4</b> = 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>	<b>1 ... 16</b> 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>	<b>0</b> = inactive channel <b>1</b> = active channel <b>2</b> = 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 13  
See ["Channel Table"](#) on page 13  
See ["Code Domain Power"](#) on page 15  
See ["Code Domain Error Power"](#) on page 15  
See ["Composite Constellation"](#) on page 16  
See ["Composite EVM"](#) on page 17  
See ["Mag Error vs Chip"](#) on page 18  
See ["Peak Code Domain Error"](#) on page 19  
See ["Phase Error vs Chip"](#) on page 20  
See ["Power vs Slot"](#) on page 21  
See ["Power vs Symbol"](#) on page 22  
See ["Result Summary"](#) on page 23  
See ["Symbol Constellation"](#) on page 23  
See ["Symbol EVM"](#) on page 24  
See ["Symbol Magnitude Error"](#) on page 24  
See ["Symbol Phase Error"](#) on page 25  
See ["Power vs Time"](#) on page 26

**Table 10-3: 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.

**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 166).

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 12.

• Bitstream.....	169
• Channel Table.....	170
• Code Domain Power / Code Domain Error Power.....	170
• Composite Constellation.....	171
• Composite EVM (RMS).....	171
• Peak Code Domain Error.....	171
• Power vs Slot.....	171
• Power vs Symbol.....	172
• Power vs Time.....	172
• Result Summary.....	172
• Symbol Constellation.....	172
• Symbol EVM.....	172

#### 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 166](#).

The output depends on the channel sorting order (see [CONFigure:CDPower:CTABLE:ORDER on page 142](#)).

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 143](#)
- the state of the channel (<ActiveFlag>)

For details on these parameters see [TRACe<n>\[:DATA\]?](#) on page 166.

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 143).

#### 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 82).

#### 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>, <EVM-Peak>, <reserved1>, <reserved2>, <reserved3>, <reserved4>

For details on these parameters see [TRACe<n>\[:DATA\]?](#) on page 166.

#### 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<sub>0</sub>>, <Im<sub>0</sub>>, <Re<sub>1</sub>>, <Im<sub>1</sub>>, ..., <Re<sub>n</sub>>, <Im<sub>n</sub>>

The number of 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.

<a href="#">MMEMory:STORe&lt;n&gt;:TRACe.....</a>	173
<a href="#">FORMat:DEXPort:DSEParator.....</a>	173

### **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 to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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.

#### **Parameters:**

<Trace>	Number of the trace to be stored
<FileName>	String containing the path and name of the target file.

#### **Example:**

```
MMEM:STOR1:TRAC 3, 'C:\TEST.ASC'
```

Stores trace 3 from window 1 in the file TEST.ASC.

#### **Usage:**

SCPI confirmed

### **FORMat:DEXPort:DSEParator** <Separator>

This command selects the decimal separator for data exported in ASCII format.

#### **Parameters:**

<Separator>	<b>COMMa</b> Uses a comma as decimal separator, e.g. 4,05.
	<b>POINT</b> 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 169.

<a href="#">CALCulate&lt;n&gt;:LIMit&lt;k&gt;:FAIL?</a> .....	174
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:FUNction:POWer&lt;sb&gt;:RESult?</a> .....	174
<a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:Y?</a> .....	176
<a href="#">CALCulate&lt;n&gt;:STATistics:RESult&lt;t&gt;?</a> .....	176

---

### CALCulate<n>:LIMit<k>:FAIL?

This command queries the result of a limit check.

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 157.

#### Return values:

<Result>	0
	PASS
	1
	FAIL

#### Example:

```
INIT; *WAI
Starts a new sweep and waits for its end.
CALC:LIM3:FAIL?
Queries the result of the check for limit line 3.
```

#### Usage:

Query only  
SCPI confirmed

#### Manual operation:

See ["Power vs Time"](#) on page 26  
See ["Spectrum Emission Mask"](#) on page 29

---

### CALCulate<n>:MARKer<m>:FUNction:POWer<sb>:RESult? <Measurement>

This command queries the results of power measurements (<n>, <m> are irrelevant).

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 157.

#### Suffix:

<sb>	1   2   3 (4   5)
	irrelevant

**Query parameters:**

&lt;Measurement&gt;

**ACPower | MCACpower**

ACLR measurements (also known as adjacent channel power or multicarrier adjacent channel measurements).

Returns the power for every active transmission and adjacent channel. The order is:

- power of the transmission channels
- power of adjacent channel (lower,upper)
- power of alternate channels (lower,upper)

**MSR ACLR results:**

For MSR ACLR measurements, the order of the returned results is slightly different:

- power of the transmission channels
- total power of the transmission channels for each sub block
- power of adjacent channels (lower, upper)
- power of alternate channels (lower, upper)
- power of gap channels (lower1, upper1, lower2, upper2)

The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

**CN**

Carrier-to-noise measurements.

Returns the C/N ratio in dB.

**CNO**

Carrier-to-noise measurements.

Returns the C/N ratio referenced to a 1 Hz bandwidth in dBm/Hz.

**CPOWer**

Channel power measurements.

Returns the channel power. The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

For SEM measurements, the return value is the channel power of the reference range (in the specified sub block).

**PPOWer**

Peak power measurements.

Returns the peak power. The unit of the return values depends on the scaling of the y-axis:

- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

For SEM measurements, the return value is the peak power of the reference range (in the specified sub block).

**OBANdwidth | OBWidth**

Occupied bandwidth.

Returns the occupied bandwidth in Hz.

**Usage:**

Query only

**Manual operation:** See "Power" on page 28  
 See "Ch Power ACLR" on page 28  
 See "Spectrum Emission Mask" on page 29  
 See "Occupied Bandwidth" on page 30

---

### 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 157.

#### 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 19  
 See "Marker Peak List" on page 34

---

### CALCulate<n>:STATistics:RESult<t>? <ResultType>

This command queries the results of a CCDF or ADP measurement for a specific trace.

(<n> is irrelevant.)

#### 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 31

## 10.10 Analysis

The following commands define general result analysis settings concerning the traces and markers.

- [Traces](#)..... 177
- [Markers](#)..... 178

### 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](#)..... 177
- [DISPlay\[:WINDow<n>\]:TRACe<t>\[:STATe\]](#)..... 177

---

#### **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.

- 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 92

---

#### **DISPlay[:WINDow<n>]:TRACe<t>[:STATe] <State>**

This command turns a trace on and off.

The measurement continues in the background.

**Parameters:**

<State> ON | OFF | 0 | 1  
 \*RST: 1 for TRACe1, 0 for TRACe 2 to 6

**Example:** DISP:TRAC3 ON

**Usage:** SCPI confirmed

## 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.

- [Individual Marker Settings](#)..... 178
- [General Marker Settings](#)..... 181
- [Positioning the Marker](#)..... 181

### 10.10.2.1 Individual Marker Settings

|                                                                           |     |
|---------------------------------------------------------------------------|-----|
| <a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;[:STATe]</a> .....          | 178 |
| <a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:X</a> .....                | 178 |
| <a href="#">CALCulate&lt;n&gt;:MARKer&lt;m&gt;:AOFF</a> .....             | 179 |
| <a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;[:STATe]</a> .....     | 179 |
| <a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:AOFF</a> .....        | 179 |
| <a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:X</a> .....           | 180 |
| <a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:X:RELative?</a> ..... | 180 |
| <a href="#">CALCulate&lt;n&gt;:DELTamarker&lt;m&gt;:Y?</a> .....          | 180 |

---

#### **CALCulate<n>:MARKer<m>[:STATe]** <State>

This command turns markers on and off. If the corresponding marker number is currently active as a deltamarker, it is turned into a normal marker.

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:** CALC:MARK3 ON  
 Switches on marker 3.

**Manual operation:** See "[Marker State](#)" on page 93  
 See "[Marker Type](#)" on page 94

---

#### **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.

**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 19  
See "[Marker Peak List](#)" on page 34  
See "[X-value](#)" on page 94

**CALCulate<n>:MARKer<m>:AOFF**

This command turns all markers off.

**Example:** CALC:MARK:AOFF  
Switches off all markers.

**Usage:** Event

**Manual operation:** See "[All Markers Off](#)" on page 94

**CALCulate<n>:DELTamarker<m>[:STATe] <State>**

This command turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTmarker turns on delta marker 1.

**Parameters:**

<State> ON | OFF  
\*RST: OFF

**Example:** CALC:DELT2 ON  
Turns on delta marker 2.

**Manual operation:** See "[Marker State](#)" on page 93  
See "[Marker Type](#)" on page 94

**CALCulate<n>:DELTamarker<m>:AOFF**

This command turns *all* delta markers off.

(<m> is irrelevant)

**Example:** CALC:DELT:AOFF  
Turns all delta markers off.

**Usage:** Event

**CALCulate<n>:DELTaMarker<m>:X <Position>**

This command moves a delta marker to a particular coordinate on the x-axis.

If necessary, the command activates the delta marker and positions a reference marker to the peak power.

**Example:**                    `CALC:DELT:1?`  
Outputs the absolute x-value of delta marker 1.

**Manual operation:** See "X-value" on page 94

**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.

**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 157.

The unit depends on the application of the command.

**Return values:**  
<Position>                    Position of the delta marker in relation to the reference marker or the fixed reference.

**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:MTABLE..... | 181 |
|---------------------|-----|

---

#### DISPlay:MTABLE <DisplayMode>

This command turns the marker table on and off.

##### Parameters:

|               |             |                                                            |
|---------------|-------------|------------------------------------------------------------|
| <DisplayMode> | <b>ON</b>   | Turns the marker table on.                                 |
|               | <b>OFF</b>  | Turns the marker table off.                                |
|               | <b>AUTO</b> | Turns the marker table on if 3 or more markers are active. |
| *RST:         | AUTO        |                                                            |

**Example:**           DISP:MTAB ON  
Activates the marker table.

**Manual operation:** See "Marker Table Display" on page 95

### 10.10.2.3 Positioning the Marker

This chapter contains remote commands necessary to position the marker on a trace.

- [Positioning Normal Markers](#) ..... 181
- [Positioning Delta Markers](#)..... 183

#### Positioning Normal Markers

The following commands position markers on the trace.

|                                            |     |
|--------------------------------------------|-----|
| CALCulate<n>:MARKer<m>:MAXimum:LEFT.....   | 181 |
| CALCulate<n>:MARKer<m>:MAXimum:NEXT.....   | 182 |
| CALCulate<n>:MARKer<m>:MAXimum[:PEAK]..... | 182 |
| CALCulate<n>:MARKer<m>:MAXimum:RIGHT.....  | 182 |
| CALCulate<n>:MARKer<m>:MINimum:LEFT.....   | 182 |
| CALCulate<n>:MARKer<m>:MINimum:NEXT.....   | 182 |
| CALCulate<n>:MARKer<m>:MINimum[:PEAK]..... | 182 |
| CALCulate<n>:MARKer<m>:MINimum:RIGHT.....  | 183 |

---

#### 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.

**Usage:**               Event

---

**CALCulate<n>:MARKer<m>:MAXimum:NEXT**

This command moves a marker to the next lower peak.

**Usage:** Event

**Manual operation:** See "[Search Next Peak](#)" on page 97

---

**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.

**Usage:** Event

**Manual operation:** See "[Peak Search](#)" on page 97

---

**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.

**Usage:** Event

---

**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.

**Usage:** Event

---

**CALCulate<n>:MARKer<m>:MINimum:NEXT**

This command moves a marker to the next minimum value.

**Usage:** Event

**Manual operation:** See "[Search Next Minimum](#)" on page 97

---

**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.

**Usage:** Event

**Manual operation:** See "[Search Minimum](#)" on page 97

---

---

**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.

**Usage:** Event

**Positioning Delta Markers**

The following commands position delta markers on the trace.

|                                                 |     |
|-------------------------------------------------|-----|
| CALCulate<n>:DELTamarker<m>:MAXimum:LEFT.....   | 183 |
| CALCulate<n>:DELTamarker<m>:MAXimum:NEXT.....   | 183 |
| CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]..... | 183 |
| CALCulate<n>:DELTamarker<m>:MAXimum:RIGHT.....  | 183 |
| CALCulate<n>:DELTamarker<m>:MINimum:LEFT.....   | 184 |
| CALCulate<n>:DELTamarker<m>:MINimum:NEXT.....   | 184 |
| CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]..... | 184 |
| CALCulate<n>:DELTamarker<m>:MINimum:RIGHT.....  | 184 |

---

**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.

**Usage:** Event

---

**CALCulate<n>:DELTamarker<m>:MAXimum:NEXT**

This command moves a marker to the next higher value.

**Usage:** Event

**Manual operation:** See "[Search Next Peak](#)" on page 97

---

**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.

**Usage:** Event

**Manual operation:** See "[Peak Search](#)" on page 97

---

**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.

**Usage:** Event

#### **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.

**Usage:** Event

#### **CALCulate<n>:DELTamarker<m>:MINimum:NEXT**

This command moves a marker to the next higher minimum value.

**Usage:** Event

**Manual operation:** See "[Search Next Minimum](#)" on page 97

#### **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.

**Usage:** Event

**Manual operation:** See "[Search Minimum](#)" on page 97

#### **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.

**Usage:** Event

## 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 43.

|                                                         |     |
|---------------------------------------------------------|-----|
| <a href="#">MMEMory:LOAD:IQ:STATE</a> .....             | 185 |
| <a href="#">MMEMory:STORe&lt;n&gt;:IQ:COMMeNt</a> ..... | 185 |
| <a href="#">MMEMory:STORe&lt;n&gt;:IQ:STATe</a> .....   | 185 |



**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 44

**MMEMory:STORe<n>:IQ:COMMeNt** <Comment>

This command adds a comment to a file that contains I/Q data.

The suffix <n> is 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 44

**MMEMory:STORe<n>:IQ:STATe** 1, <FileName>

This command writes the captured I/Q data to a file.

The suffix <n> is irrelevant.

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 to be stored on the instrument are stored to volatile memory, which is restricted to 256 MB. Thus, a "Memory full" error may 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.

**Parameters:**

1

<FileName> String containing the path and name of the target file.

**Example:** MMEM:STOR:IQ:STAT 1, 'C:  
 \R\_S\Instr\user\data.iq.tar'  
 Stores the captured I/Q data to the specified file.

**Manual operation:** See "[I/Q Export](#)" on page 44

## 10.12 Configuring the Application Data Range (MSRA mode only)

In MSRA operating mode, only the MSRA Master actually captures data; the MSRA applications define an extract of the captured data for analysis, referred to as the **application data**.

For the TD-SCDMA BTS application, the 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 128). 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 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 applications

The following commands are only available for MSRA application channels:

|                                                                     |     |
|---------------------------------------------------------------------|-----|
| <a href="#">CALCulate&lt;n&gt;:MSRA:ALINe:SHOW</a> .....            | 186 |
| <a href="#">CALCulate&lt;n&gt;:MSRA:ALINe[:VALue]</a> .....         | 187 |
| <a href="#">CALCulate&lt;n&gt;:MSRA:WINDow&lt;n&gt;:IVAL?</a> ..... | 187 |
| <a href="#">INITiate&lt;n&gt;:REFresh</a> .....                     | 187 |
| <a href="#">[SENSe:]MSRA:CAPTure:OFFSet</a> .....                   | 188 |

---

### **CALCulate<n>:MSRA:ALINe:SHOW**

This command defines whether or not the analysis line is displayed in all time-based windows in all MSRA applications and the MSRA Master.

(<n> is irrelevant.)

**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 application remains in the window title bars.

#### **Parameters:**

<State> ON | OFF  
 \*RST: ON

**CALCulate<n>:MSRA:ALINe[:VALue] <Position>**

This command defines the position of the analysis line for all time-based windows in all MSRA applications and the MSRA Master.

(<n> is 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 application measurement channels, not the MSRA View or MSRA Master.

**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 applications in MSRA mode, not the MSRA Master.

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

(The suffix <n> is 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](#)" on page 75

**[SENSe:]MSRA:CAPTure:OFFSet <Offset>**

This setting is only available for applications in MSRA mode, not for the MSRA Master. It has a similar effect as the trigger offset in other measurements.

**Parameters:**

&lt;Offset&gt;

This parameter defines the time offset between the capture buffer start and the start of the extracted application data. The offset must be a positive value, as the application can only analyze data that is contained in the capture buffer.

Range: 0 to &lt;Record length&gt;

\*RST: 0

**Manual operation:** See "[Capture Offset](#)" on page 62

## 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.

- [STATus:QUEStionable:SYNC Register](#)..... 188

### 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 10-4: Status error bits in STATus:QUEStionable:SYNC register for TD-SCDMA applications*

| Bit | Definition                                                                                                                                                                                                                                                                                                                                                                         |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0   | Not used.                                                                                                                                                                                                                                                                                                                                                                          |
| 1   | Frame Sync failed<br>This bit is set when synchronization is not possible within the application.<br>Possible reasons: <ul style="list-style-type: none"> <li>• Invalid frequency</li> <li>• Invalid level</li> <li>• Invalid scrambling code</li> <li>• Invalid max. number of MA shift cell</li> <li>• Invalid values for INVERT Q</li> <li>• Invalid signal at input</li> </ul> |

| Bit     | Definition            |
|---------|-----------------------|
| 2 to 14 | Not used.             |
| 15      | This bit is always 0. |

|                                                            |     |
|------------------------------------------------------------|-----|
| <a href="#">STATus:QUESTionable:SYNC[:EVENT]? .....</a>    | 189 |
| <a href="#">STATus:QUESTionable:SYNC:CONDition? .....</a>  | 189 |
| <a href="#">STATus:QUESTionable:SYNC:ENABle .....</a>      | 189 |
| <a href="#">STATus:QUESTionable:SYNC:NTRansition .....</a> | 190 |
| <a href="#">STATus:QUESTionable:SYNC:PTRansition .....</a> | 190 |

---

### **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.

#### **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.

#### **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.

#### **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.

**Parameters:**

|                 |                                                                                                                                              |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <BitDefinition> | Range: 0 to 65535                                                                                                                            |
| <ChannelName>   | String containing the name of the channel.<br>The parameter is optional. If you omit it, the command works for the currently active channel. |

**STATus:QUESTIONable:SYNC:PTRansition** <BitDefinition>,<ChannelName>

These commands control the Positive TRansition part of a register.

Setting a bit causes a 0 to 1 transition in the corresponding bit of the associated register. The transition also writes a 1 into the associated bit of the corresponding EVENT register.

**Parameters:**

|                 |                                                                                                                                              |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <BitDefinition> | Range: 0 to 65535                                                                                                                            |
| <ChannelName>   | String containing the name of the channel.<br>The parameter is optional. If you omit it, the command works for the currently active channel. |

## 10.14 Commands for Compatibility

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.....                           | 190 |
| CONFigure:CDPower[:BTS]:PVTime:LIST[:STATE]..... | 191 |
| [SENSe:]CDPower:LEVel:ADJust.....                | 192 |

**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 147).

**Parameters:**

|              |                                                                                                |
|--------------|------------------------------------------------------------------------------------------------|
| <Evaluation> | Type of evaluation you want to display.<br>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 10-5: <Evaluation> parameter values for TD-SCDMA applications**

| String Parameter                                                    | Enum Parameter | Evaluation                              |
|---------------------------------------------------------------------|----------------|-----------------------------------------|
| 'XTIM:CDP:BSTream'                                                  | BITStream      | Bitstream                               |
| 'XTIM:CDP:COMP:CONStellation'                                       | CCONst         | Composite Constellation                 |
| 'XPOW:CDEPower'                                                     | CDEPower       | Code Domain Error Power                 |
| 'XPOW:CDP'<br>'XPOW:CDP:ABSolute'                                   | CDPower        | Code Domain Power (absolute scaling)    |
| 'XPOW:CDP:RATio'                                                    | CDPower        | Code Domain Power (relative scaling) *) |
| 'XTIM:CDP:MACCuracy'                                                | CEVM           | Composite EVM                           |
| 'XTIM:CDP:ERR:CTable'                                               | CTABLE         | Channel Table                           |
| 'XTIM:CDP:ERR:PCDomain'                                             | PCDerror       | Peak Code Domain Error                  |
| 'XTIM:CDP:PVSLot'<br>'XTIM:CDP:PVSLot:ABSolute'                     | PSLot          | Power vs Slot (absolute scaling)        |
| 'XTIM:CDP:PVSLot:RATio'                                             | PSLot          | Power vs Slot (relative scaling)*)      |
| 'XTIM:CDP:PVSYmbol'                                                 | PSYMBOL        | Power vs Symbol                         |
| 'XTIM:CDP:ERR:SUMMary'                                              | RSUMmary       | Result Summary                          |
| 'XPOW:CDP:RATio'                                                    | SCONst         | Symbol Constellation                    |
| 'XTIM:CDP:SYMB:EVM'                                                 | SEVM           | Symbol EVM                              |
| *) 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 147).

#### **Parameters:**

<State>               ON | OFF  
                           \*RST:       OFF

**[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 141.

## 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 |



| Setting                  | Value |
|--------------------------|-------|
| User equipment           | UE 1  |
| Digital standard - State | ON    |
| Scrambling code          | 0000  |

The following measurements are described:

- [Measurement 1: Measuring the Signal Channel Power](#)..... 193
- [Measurement 2: Determining the Spectrum Emission Mask](#)..... 194
- [Measurement 3: Measuring the Relative Code Domain Power](#)..... 195
- [Measurement 4: Triggered Measurement of Relative Code Domain Power](#)..... 197
- [Measurement 5: Measuring the Composite EVM](#)..... 198
- [Measurement 6: Determining the Peak Code Domain Error](#).....199
- [Measurement 7: Checking the Power vs Time](#)..... 200

### 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 10-6: 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,+0.000000000

//+2.000000000,-8.500000000E+006,-7.500000000E+006,+1.000000000E+006,+2.109000064E+009,
//-8.158547211E+001,-7.984169006E+001,-3.084169006E+001,+0.000000000,+0.000000000,+0.000000000

//+3.000000000,-7.500000000E+006,-3.500000000E+006,+1.000000000E+006,+2.113987200E+009,
//-4.202708435E+001,-4.028330231E+001,-5.270565033,+0.000000000,+0.000000000,+0.000000000,

[...]
```

**Table 10-7: Trace results for Relative Code Domain Power measurement**

| R<br>a<br>n<br>g<br>e<br>N<br>o. | Start<br>freq.<br>[Hz] | Stop<br>freq.<br>[Hz] | RBW<br>[Hz]       | Freq.<br>peak<br>power<br>[Hz] | Abs.<br>peak<br>power<br>[dBm] | Rel.<br>peak<br>power<br>[%] | Delta to<br>margin<br>[dB] | Limit<br>check<br>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 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 0. | 0. | .  |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 0  | 0  | 0  |
| 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 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 0. | 0. | .  |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 0  | 0  | 0  |
| 3                                | +3.000000000           | -7.500000000E+006     | -3.500000000E+006 | +1.000000000E+006              | +2.113987200E+009              | -4.202708435E+001            | -4.028330231E+001          | -5.270565033             | +  | +  | +0 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 0. | 0. | .  |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 00 | 00 | 00 |
|                                  |                        |                       |                   |                                |                                |                              |                            |                          | 0  | 0  | 0  |
| ...                              | ...                    |                       |                   |                                |                                |                              |                            |                          |    |    |    |

### 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:MMAK 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 10-8: 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 referencelevel 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 10-9: 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 10-10: 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 26).

```
//----- 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 10-11: 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](http://en.wikipedia.org/wiki/Comparison_of_file_archivers)) available for most operating systems. The advantage of `.tar` files is that the archived files inside the `.tar` file are not changed (not compressed) and thus it is possible to read the I/Q data directly within the archive without the need to unpack (untar) the `.tar` file first.

### Contained files

An iq-tar file must contain the following files:

- **I/Q parameter XML file**, e.g. `xyz.xml`  
Contains meta information about the I/Q data (e.g. sample rate). The filename can be defined freely, but there must be only one single I/Q parameter XML file inside an iq-tar file.
- **I/Q data binary file**, e.g. `xyz.complex.float32`  
Contains the binary I/Q data of all channels. There must be only one single I/Q data binary file inside an iq-tar file.

Optionally, an iq-tar file can contain the following file:

- **I/Q preview XSLT file**, e.g. `open_IqTar_xml_file_in_web_browser.xslt`  
Contains a stylesheet to display the I/Q parameter XML file and a preview of the I/Q data in a web browser.  
A sample stylesheet is available at [http://www.rohde-schwarz.com/file/open\\_IqTar\\_xml\\_file\\_in\\_web\\_browser.xslt](http://www.rohde-schwarz.com/file/open_IqTar_xml_file_in_web_browser.xslt).

### 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>FSV-K10</Name>
  <Comment>Here is a comment</Comment>
  <DateTime>2011-01-24T14:02:49</DateTime>
  <Samples>68751</Samples>
  <Clock unit="Hz">6.5e+006</Clock>
  <Format>complex</Format>
  <DataType>float32</DataType>
  <ScalingFactor unit="V">1</ScalingFactor>
  <NumberOfChannels>1</NumberOfChannels>
  <DataFilename>xyz.complex.float32</DataFilename>
  <UserData>
    <UserDefinedElement>Example</UserDefinedElement>
  </UserData>
  <PreviewData>...</PreviewData>
</RS_IQ_TAR_FileFormat>

```

| Element               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RS_IQ_TAR_File-Format | The root element of the XML file. It must contain the attribute <code>fileFormatVersion</code> that contains the number of the file format definition. Currently, <code>fileFormatVersion "2"</code> is used.                                                                                                                                                                                                                                                                                                                                                                                                       |
| Name                  | Optional: describes the device or application that created the file.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Comment               | Optional: contains text that further describes the contents of the file.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| DateTime              | Contains the date and time of the creation of the file. Its type is <code>xs:dateTime</code> (see <code>RsIqTar.xsd</code> ).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Samples               | Contains the number of samples of the I/Q data. For multi-channel signals all channels have the same number of samples. One sample can be: <ul style="list-style-type: none"> <li>• A complex number represented as a pair of I and Q values</li> <li>• A complex number represented as a pair of magnitude and phase values</li> <li>• A real number represented as a single real value</li> </ul> See also <code>Format</code> element.                                                                                                                                                                           |
| Clock                 | Contains the clock frequency in Hz, i.e. the sample rate of the I/Q data. A signal generator typically outputs the I/Q data at a rate that equals the clock frequency. If the I/Q data was captured with a signal analyzer, the signal analyzer used the clock frequency as the sample rate. The attribute <code>unit</code> must be set to "Hz".                                                                                                                                                                                                                                                                   |
| Format                | Specifies how the binary data is saved in the I/Q data binary file (see <code>DataFilename</code> element). Every sample must be in the same format. The format can be one of the following: <ul style="list-style-type: none"> <li>• <code>complex</code>: Complex number in cartesian format, i.e. I and Q values interleaved. I and Q are unitless</li> <li>• <code>real</code>: Real number (unitless)</li> <li>• <code>polar</code>: Complex number in polar format, i.e. magnitude (unitless) and phase (rad) values interleaved. Requires <code>DataType = float32</code> or <code>float64</code></li> </ul> |

| Element          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DataType         | <p>Specifies the binary format used for samples in the I/Q data binary file (see <code>DataFilename</code> element and <a href="#">chapter 11.2, "I/Q Data Binary File"</a>, on page 206).</p> <p>The following data types are allowed:</p> <ul style="list-style-type: none"> <li>• <code>int8</code>: 8 bit signed integer data</li> <li>• <code>int16</code>: 16 bit signed integer data</li> <li>• <code>int32</code>: 32 bit signed integer data</li> <li>• <code>float32</code>: 32 bit floating point data (IEEE 754)</li> <li>• <code>float64</code>: 64 bit floating point data (IEEE 754)</li> </ul>                                                                                                                                                                                                                                                                                                                                  |
| ScalingFactor    | <p>Optional: describes how the binary data can be transformed into values in the unit Volt. The binary I/Q data itself has no unit. To get an I/Q sample in the unit Volt the saved samples have to be multiplied by the value of the <code>ScalingFactor</code>. For polar data only the magnitude value has to be multiplied. For multi-channel signals the <code>ScalingFactor</code> must be applied to all channels.</p> <p>The attribute <code>unit</code> must be set to "v".</p> <p>The <code>ScalingFactor</code> must be &gt; 0. If the <code>ScalingFactor</code> element is not defined, a value of 1 V is assumed.</p>                                                                                                                                                                                                                                                                                                             |
| NumberOfChannels | <p>Optional: specifies the number of channels, e.g. of a MIMO signal, contained in the I/Q data binary file. For multi-channels, the I/Q samples of the channels are expected to be interleaved within the I/Q data file (see <a href="#">chapter 11.2, "I/Q Data Binary File"</a>, on page 206). If the <code>NumberOfChannels</code> element is not defined, one channel is assumed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| DataFilename     | <p>Contains the filename of the I/Q data binary file that is part of the iq-tar file.</p> <p>It is recommended that the filename uses the following convention:<br/> <code>&lt;xyz&gt;.&lt;Format&gt;.&lt;Channels&gt;ch.&lt;Type&gt;</code></p> <ul style="list-style-type: none"> <li>• <code>&lt;xyz&gt;</code> = a valid Windows file name</li> <li>• <code>&lt;Format&gt;</code> = complex, polar or real (see <code>Format</code> element)</li> <li>• <code>&lt;Channels&gt;</code> = Number of channels (see <code>NumberOfChannels</code> element)</li> <li>• <code>&lt;Type&gt;</code> = float32, float64, int8, int16, int32 or int64 (see <code>DataType</code> element)</li> </ul> <p>Examples:</p> <ul style="list-style-type: none"> <li>• <code>xyz.complex.1ch.float32</code></li> <li>• <code>xyz.polar.1ch.float64</code></li> <li>• <code>xyz.real.1ch.int16</code></li> <li>• <code>xyz.complex.16ch.int8</code></li> </ul> |
| UserData         | <p>Optional: contains user, application or device-specific XML data which is not part of the iq-tar specification. This element can be used to store additional information, e.g. the hardware configuration. User data must be valid XML content.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| PreviewData      | <p>Optional: contains further XML elements that provide a preview of the I/Q data. The preview data is determined by the routine that saves an iq-tar file (e.g. R&amp;S FPS). For the definition of this element refer to the <code>RsIqTar.xsd</code> schema. Note that the preview can be only displayed by current web browsers that have JavaScript enabled and if the XSLT stylesheet <code>open_IqTar_xml_file_in_web_browser.xslt</code> is available.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**Example: ScalingFactor**

Data stored as int16 and a desired full scale voltage of 1 V

ScalingFactor = 1 V / maximum int16 value = 1 V / 2<sup>15</sup> = 3.0517578125e-5 V

| Scaling Factor                 | Numerical value             | Numerical value x ScalingFactor |
|--------------------------------|-----------------------------|---------------------------------|
| Minimum (negative) int16 value | - 2 <sup>15</sup> = - 32768 | -1 V                            |
| Maximum (positive) int16 value | 2 <sup>15</sup> -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>
    </Channel>
  </ArrayOfChannel>
</PreviewData>

```

```

        </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 `Data Type` 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. iqiqli...  
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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