R&S®FSW-K82/-K83
cdma2000 Measurements
User Manual

1173.9334.02 ─ 04

ROHDE&SCHWARZ

This manual applies to the following R&S®FSW models with firmware version 1.41 and higher:

- R&S®FSW 8 (1312.8000K08)
- R&S®FSW 13 (1312.8000K013)
- R&S®FSW 26 (1312.8000K026)

The following firmware options are described:

- R&S FSW-K82 (1313.1468.02)
- R&S FSW-K83 (1313.1474.02)

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.

The following abbreviations are used throughout this manual: R&S®FSW is abbreviated as R&S FSW. R&S®FSW-K82 / R&S®FSW-K83 is abbreviated as R&S FSW-K82/-K83

Contents

1 Preface

1.1 About this Manual

This R&S FSW-K82/-K83 User Manual provides all the information **specific to the cdma2000 applications**. All general instrument functions and settings common to all applications and operating modes are described in the main R&S FSW User Manual.

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

- **Welcome to the cdma2000 Measurements Application**
  Introduction to and getting familiar with the application

- **Measurements and Result Displays**
  Details on supported measurements and their result types

- **Measurement Basics**
  Background information on basic terms and principles in the context of the measurement

- **Configuration + Analysis**
  A concise description of all functions and settings available to configure measurements and analyze results with their corresponding remote control command

- **Optimizing and Troubleshooting the Measurement**
  Hints and tips on how to handle errors and optimize the test setup

- **How to Perform Measurements in cdma2000 Applications**
  The basic procedure to perform each measurement and step-by-step instructions for more complex tasks or alternative methods

- **Measurement Examples**
  Detailed measurement examples to guide you through typical measurement scenarios and allow you to try out the application immediately

- **Remote Commands for cdma2000 Measurements**
  Remote commands required to configure and perform cdma2000 measurements in a remote environment, sorted by tasks
  (Commands required to set up the environment or to perform common tasks on the instrument are provided in the main R&S FSW User Manual)
  Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes

- **Annex**
  Reference material

- **List of remote commands**
  Alpahabetical list of all remote commands described in the manual

- **Index**

1.2 Documentation Overview

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

- "Getting Started" printed manual
- Online Help system on the instrument
- Documentation CD-ROM with:
    - Getting Started
    - User Manuals for base unit and options
    - 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 FSW.

Getting Started

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

The Getting Started manual in various languages is also available for download from the R&S website, on the R&S FSW product page at http://www2.rohde-schwarz.com/product/FSW.html.

User Manuals

User manuals are provided for the base unit and each additional (software) option.

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

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

Service Manual

This manual is available in PDF format on the CD delivered with the instrument. It describes how to check compliance with rated specifications, instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S FSW 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 R&S website, on the R&S FSW product page at http://www2.rohde-schwarz.com/product/FSW.html > Downloads > Firmware.

1.3 Conventions Used in the Documentation

1.3.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

1.3.2 Conventions for Procedure Descriptions

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

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

2 Welcome to the cdma2000 Applications

The cdma2000 options are firmware applications that add functionality to the R&S FSW to perform measurements on downlink or uplink signals according to the cdma2000 standard.

R&S FSW-K82 performs **B**ase **T**ransceiver **S**tation (**BTS**) measurements on forward link signals on the basis of the 3GPP2 Standard (Third Generation Partnership Project 2).

R&S FSW-K83 performs **M**obile **S**tation (MS) measurements on reverse link signals on the basis of the 3GPP2 Standard (Third Generation Partnership Project 2).

The measurements are based on the "Physical Layer Standard for cdma2000 Spread Spectrum Systems Release C" of version C.S0002-C V1.0 dated May 2002 and "Recommended Minimum Performance Standard for cdma2000 Spread Spectrum Base Stations" of version C.S0010-B dated December 2002. This standard has been adopted by the following authorities with the specified norm:

TIA: TIA/EIA-97-E dated February 2003 (also known as IS-97-E)

Reference made to the cdma2000 specification in the following text alludes to these standards.

The application firmware R&S FSW-82 supports radio configurations 1 to 5 and 10. Thus, IS95A/B signals conforming to radio configurations 1&2 can also be measured with this application firmware. Channels and modulation types of the 1xEV– DV enhancement are supported as well.

The application firmware R&S FSW-83 supports the radio configurations 3 and 4. Apart from cdma2000 reverse link signals, the 1xEV-DV reverse link channels of Release C are also supported. Code Domain Analysis is also possible at signals where the pilot channel is active in at least one of the captured power control groups (pilot gating).

In addition to the code domain measurements described in the cdma2000 standard, the cdma2000 applications feature measurements in the spectral range such as channel power, adjacent channel power, occupied bandwidth and spectrum emission mask with predefined settings.

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

All functions not discussed in this manual are the same as in the base unit and are described in the R&S FSW User Manual. The latest version is available for download at the product homepage (http://www2.rohde-schwarz.com/product/FSW.html).

Installation

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

2.1 Starting the cdma2000 Applications

The cdma2000 measurements require special applications on the R&S FSW.

To activate the cdma2000 applications

1. Press the MODE key on the front panel of the R&S FSW.

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

2. Select the "cdma2000 BTS" or "cdma2000 MS" item.

   The R&S FSW opens a new measurement channel for the cdma2000 application.

The measurement is started immediately with the default settings. It can be configured in the cdma2000 "Overview" dialog box, which is displayed when you select the "Overview" softkey from any menu (see chapter 5.2.2, "Configuration Overview", on page 50).

Multiple Measurement Channels and Sequencer Function

When you activate a cdma2000 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.

The number of channels that can be configured at the same time depends on the available memory on the instrument.

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 independant of the currently *displayed* tab.

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

2.2 Understanding the Display Information

The following figure shows a measurement diagram during a cdma2000 BTS measurement. All different information areas are labeled. They are explained in more detail in the following sections. (The basic screen elements are identical for cdma2000 MS measurements:)
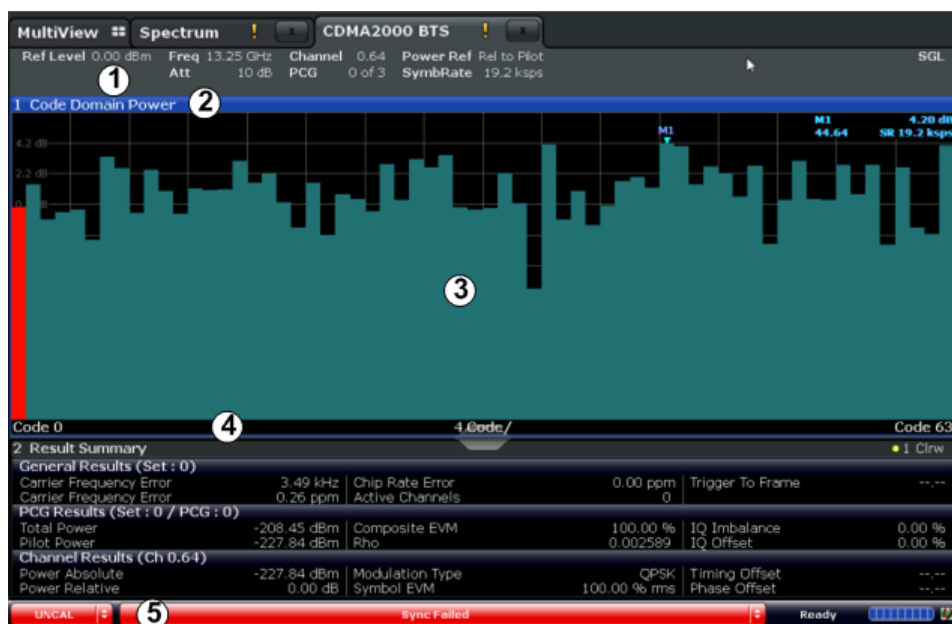
1 = Channel bar for firmware and measurement settings
2 = Window title bar with diagram-specific (trace) information
3 = Diagram area with marker information
4 = Diagram footer with diagram-specific information, depending on measurement
5 = Instrument status bar with error messages, progress bar and 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. RF measurements are not available in MSRA operating mode.

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

Channel bar information

In cdma2000 applications, the R&S FSW shows the following settings:

Table 2-1: Information displayed in the channel bar in cdma2000 applications

Ref Level	Reference level
Freq	Center frequency for the RF signal
Att	Mechanical and electronic RF attenuation
Channel	Channel number (code number and spreading factor)
PCG	Power control group (see chapter 4.1, "PCGs and Sets", on page 34)
Power Ref	Reference used for power results
SymbRate	Symbol rate of the currently selected channel

In addition, the channel bar also displays information on instrument settings that affect the measurement results even though this is not immediately apparent from the display of the measured values (e.g. transducer or trigger settings). This information is displayed

only when applicable for the current measurement. For details see the R&S FSW Getting Started manual.

Window title bar information

For each diagram, the header provides the following information:

Fig. 2-1: Window title bar information in cdma2000 applications

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

Diagram footer information

The diagram footer (beneath the diagram) contains the following information, depending on the evaluation:

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 Displays

The cdma2000 applications provide several different measurements for signals according to the cdma2000 standard. The main and default measurement is Code Domain Analysis. In addition to the code domain power measurements specified by the cdma2000 standard, the cdma2000 applications offer measurements with predefined settings in the frequency domain, e.g. RF power measurements.

For details on selecting measurements see "Selecting the measurement type" on page 47.

Evaluation methods

The captured and processed data for each measurement can be evaluated with various different methods. All evaluation methods available for the selected cdma2000 measurement are displayed in the evaluation bar in SmartGrid mode.

The evaluation methods for CDA are described in chapter 3.1.2, "Evaluation Methods for Code Domain Analysis", on page 16.

3.1 Code Domain Analysis

The cdma2000 firmware applications feature a Code Domain Analyzer. It can be used used to perform the measurements required in the cdma2000 standards with regard to the power of the different codes and code channels (concentrated codes). In addition, the modulation quality (EVM and RHO factor), frequency errors and trigger–to–frame time, as well as the peak code domain errors are determined. Constellation evaluations and bitstream evaluations are also available. Furthermore, the timing and phase offsets of the channels to the pilot can also be calculated. The observation period can be set as multiples of the power control group (PCG).

Basically, the firmware differentiates between the following result classes for the evaluations:

- Results which take the overall signal into account over the whole observation period (all PCGs)

- Results which take the overall signal into account over a power control group (PCG)

- Results which take one channel into account over the whole observation period (all PCGs)

- Results which take one channel into account over a power control group (PCG)

SCPI command:

`CONF:CDP:MEAS CDP,` see `CONFigure:CDPower[:BTS]:MEASurement`
on page 129

3.1.1 Code Domain Parameters

In the Result Summary, three different types of measurement results are determined and displayed:

- General results for the current set
- PCG results for the current set and PCG
- Channel results for the selected channel

In the Channel Table, channel results for *all* channels are displayed.

General Results

Under "General Results", the measurement results that concern the total signal (that is, all channels) for the entire period of observation (that is, all PCGs) are displayed:

Table 3-1: General code domain power results for the current set

Parameter	Description
Carrier Frequency Error	Shows the frequency error referred to the center frequency of the R&S FSW. The absolute frequency error is the sum of the frequency error of the R&S FSW and that of the device under test. 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. The frequency error is available in the units Hz or ppm referred to the carrier frequency.
Chip Rate Error	Shows the chip rate error (1.2288 Mcps) in ppm. A large chip rate error results in symbol errors and, therefore, in possible synchronization errors for Code Domain Power measurements. This measurement result is also valid if the R&S FSW could not synchronize to the cdma2000 signal.
Trigger to Frame	Reflects the time offset from the beginning of the recorded signal section to the start of the first PCG. In case of triggered data recording, this corresponds to the timing offset: *timing offset = frame trigger (+ trigger offset) – start of first PCG* If it was not possible to synchronize the R&S FSW to the cdma2000 signal, this measurement result is meaningless. For the "Free Run" trigger mode, dashes are displayed.
Active Channels	Specifies the number of active channels found in the signal. Detected data channels as well as special channels are regarded as active. With transmit diversity, the result applies to the selected Antenna Diversity - Antenna Number.

PCG Results

PCG results concern the total signal (that is, all channels) for the selected PCG.

Table 3-2: Code domain power results for the current PCG

Parameter	Description
Total Power	Shows the total power of the signal.
Pilot Power	Shows the power of the pilot channel. If antenna 2 is selected, the power of the F-TDPICH is displayed, in all other cases that of the F-PICH. For details on antenna selection refer to "Antenna Diversity - Antenna Number" on page 53.
RHO	Shows the quality parameter RHO. According to the cdma2000 standard, RHO is the normalized, correlated power between the measured and the ideally generated reference signal. When RHO is measured, the cdma2000 standard requires that only the pilot channel be supplied.
Composite EVM	The composite EVM is the difference between the test signal and the ideal reference signal. For further details refer to the Composite EVM result display.
IQ Imbalance	Shows the IQ imbalance of the signal in %.
Offset	Shows the IQ offset of the signal in %.

Channel results

In the Result Summary, channel results of the selected channel and the selected PCG are displayed.

In the Channel Table, channel results for *all* channels are displayed. For details see "Channel Table" on page 17.

Not all channel results displayed in the Result Summary are also displayed in the Channel Table and vice versa.

Table 3-3: Channel-specific parameters

Parameter	Description
Channel	Channel number including the spreading factor (in the form <Channel>.<SF>)
Modulation Type	**(BTS mode only):** Displays the modulation type of the channel and PCG: BPSK, QPSK, 8PSK, or 16QAM
Mapping	**(MS mode only):** Indicates the selected branch (I or Q)
Phase Offset	Phase offset between the selected channel and the pilot channel If enabled (see "Timing and phase offset calculation " on page 96), the maximum value of the phase offset is displayed together with the associated channel in the last two lines. Since the phase offset values of each active channel can be either negative or positive, the absolute values are compared and the maximum is displayed with the original sign.
Power Absolute	Absolute (dBm) power of the channel
Power Relative	Relative (dB) power of the channel (refers either to the pilot channel or the total power of the signal)

Parameter	Description
Symbol EVM	Peak or mean value of the EVM measurement result For further details refer to the result display "Symbol EVM" on page 25.
Timing Offset	Timing offset between the selected channel and the pilot channel If enabled (see "Timing and phase offset calculation " on page 96), the maximum value of the timing offset is displayed together with the associated channel in the last two lines. Since the timing offset values of each active channel can be either negative or positive, the absolute values are compared and the maximum is displayed with the original sign.

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 cdma2000 measurement are displayed in the evaluation bar in SmartGrid mode.

To activate SmartGrid mode, do one of the following:

*

    Select the "SmartGrid" icon from the toolbar.
*   Select the "Display Config" button in the configuration "Overview".
*   Select the "Display Config" softkey from the MEAS CONFIG menu.

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 on the front panel.

The selected evaluation not only affects the result display, but also the results of the trace data query (see `TRACe<n>[:DATA]?` on page 196).

The Code Domain Analyzer provides the following evaluation methods for measurements in the code domain:

Bitstream

The "Bitstream" evaluation displays the demodulated bits of a selected channel over a selected PCG.

All bits that are part of inactive channels are marked as being invalid using dashes.

Fig. 3-1: Bitstream result display for BTS mode

To select a specific symbol press the MKR key. If you enter a number, the marker jumps to the selected symbol. If there are more symbols than the screen is capable of displaying, use the marker to scroll inside the list.

The number of symbols per PCG depends on the spreading factor (symbol rate) and the antenna diversity. The number of bits per symbol depends on the modulation type.

For details see chapter 4, "Measurement Basics", on page 34.

SCPI command:
LAY:ADD? '1',RIGH, 'XTIM:CDP:BSTR', see LAYout:ADD[:WINDow]? on page 180

Channel Table

The "Channel Table" evaluation displays the detected channels and the results of the code domain power measurement over the selected PCG. The analysis results for all channels are displayed. Thus, the Channel Table may contain up to 128 entries, corresponding to the highest base spreading factor of 128.

The first entries of the table indicate the channels that must be available in the signal to be analyzed and any other control channels (PICH, SYNC etc.).

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

If the type of a channel can be fully recognized, based on pilot sequences or modulation type, the type is indicated in the table. In BTS mode, all other channels are of type CHAN.

The channels are in descending order according to symbol rates and, within a symbol rate, in ascending order according to the channel numbers. Therefore, the inactive codes are always displayed at the end of the table (if "Show inactive channels" is enabled, see "Table Configuration" on page 18.

Fig. 3-2: Channel Table display for BTS mode

SCPI command:

`LAY:ADD? '1',RIGH, CTABle,` see `LAYout:ADD[:WINDow]?` on page 180

Table Configuration ← Channel Table

You can configure which parameters are displayed in the Channel Table by double-click-ing the table header. A "Table Configuration" dialog box is displayed in which you select the columns to be displayed.
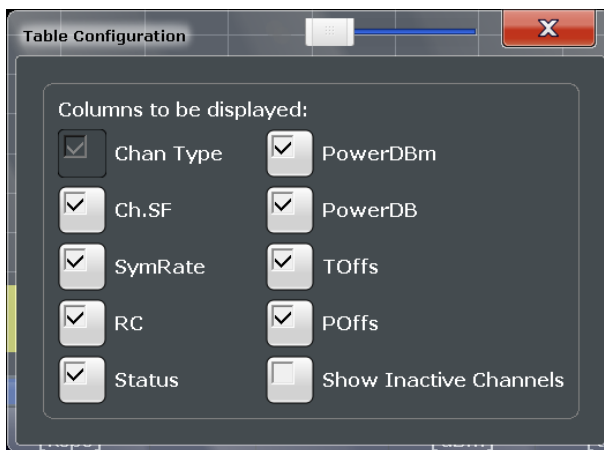
By default, only active channels are displayed. In order to display all channels, including the inactive ones, enable the "Show Inactive Channels" option.

The following parameters of the detected channels are determined by the CDP mea-surement and can be displayed in the Channel Table result display. (For details see chapter 3.1.1, "Code Domain Parameters", on page 14.)

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

Parameter	Description
Channel Type	Shows the channel type ('---' for inactive channels)
Walsh Ch.SF	Channel number including the spreading factor (in the form <Channel>.<SF>)
(P Offs [mrad])	Phase offset between the selected channel and the pilot channel
	If enabled (see "Timing and phase offset calculation " on page 96), the maximum value of the phase offset is displayed together with the associated channel in the last two lines. Since the phase offset values of each active channel can be either negative or positive, the absolute values are compared and the maximum is displayed with the original sign.
Pwr [dBm])	Absolute (dBm) power of the channel
Pwr [dB]	Relative (dB) power of the channel (refers either to the pilot channel or the total power of the signal)

Parameter	Description
RC	**(BTS mode only):** Radio configuration
Mapping	**(MS mode only):** Branch the data is mapped to
Status	Channel status; Unassigned codes are identified as inactive channels
Symbol Rate [ksps]	Symbol rate at which the channel is transmitted (9.6 ksps to 307.2 ksps)
(T Offs [ns])	Timing offset between the selected channel and the pilot channel
	If enabled (see "Timing and phase offset calculation " on page 96), the maximum value of the timing offset is displayed together with the associated channel in the last two lines. Since the timing offset values of each active channel can be either negative or positive, the absolute values are compared and the maximum is displayed with the original sign.

Code Domain Power / Code Domain Error Power

The "Code Domain Power" evaluation shows the power of all possible code channels in the total signal over the selected PCG.

"Code Domain Error Power" is the difference in power between the measured and the ideal signal.

The x-axis represents the channel (code) number, which corresponds to the base spreading factor. The y-axis is a logarithmic level axis that shows the (error) power of each channel. With the error power, both active and inactive channels can be evaluated at a glance.

Both evaluations support either Hadamard or BitReverse code sorting order (see chapter 4.3, "Code Display and Sort Order", on page 36).

MS mode only: the (error) power is calculated only for the selected branch (I or Q).
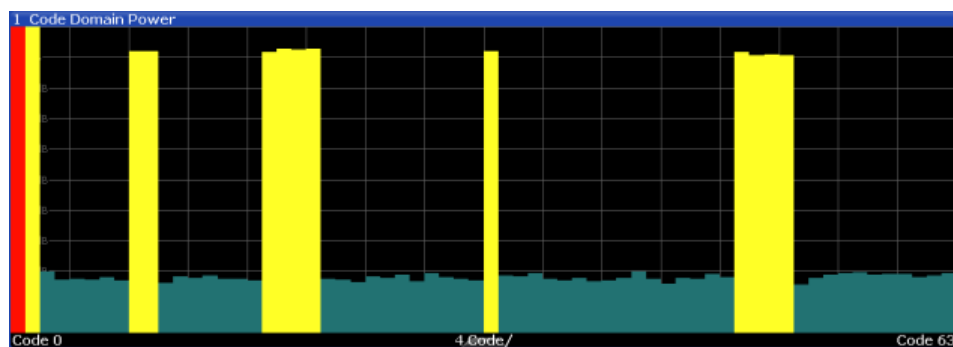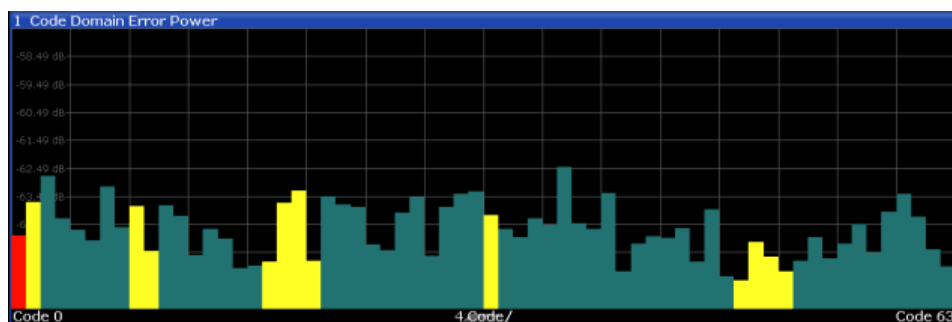

Fig. 3-3: Code Domain Power Display for BTS mode

Fig. 3-4: Code Domain Error Power result display

Active and inactive data channels are defined via the Inactive Channel Threshold. The power values of the active and inactive channels are shown in different colors. In addition, codes with alias power can occur (see "Alias power" on page 37).

Table 3-5: Assignment of colors in CDEP result display

Color	Usage
Red	Selected channel (code number)
Yellow	Active channel
Green	Inactive channel
Light blue	Alias power of higher spreading factor
Magenta	Alias power as a result of transmit diversity

Note: If codes with alias power are displayed, set the highest base spreading factor available in the Base Spreading Factor field.

It is not recommended that you select more detailed result displays (such as "Symbol Constell") for unassigned or inactive codes, since the results are not valid.

SCPI command:

CDP:

`LAY:ADD? '1',RIGH, CDPower,` see `LAYout:ADD[:WINDow]?` on page 180

`CALC:MARK:FUNC:CDP:RES?  CDP` or `CALC:MARK:FUNC:CDP:RES?  CDPR;` see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 193

CDEP:

`LAY:ADD? '1',RIGH, CDEPower,` see `LAYout:ADD[:WINDow]?` on page 180

`CALC:MARK:FUNC:CDP:RES?  ;` see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 193.

Composite Constellation

In "Composite Constellation" evaluation the constellation points of the 1536 chips are displayed for the specified PCG. 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.
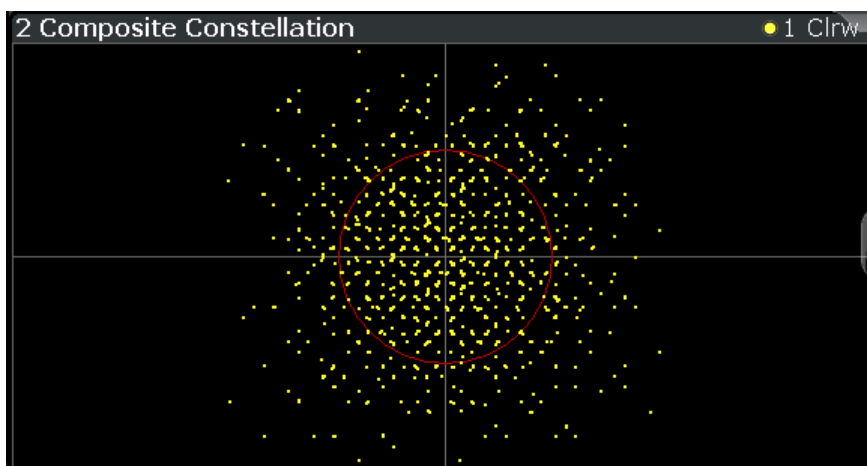
Fig. 3-5: Composite Constellation display for BTS mode

SCPI command:

LAY:ADD? '1',RIGH, CCON, see LAYout:ADD[:WINDow]? on page 180

CALC:MARK:FUNC:CDP:RES? ; see CALCulate<n>:MARKer<m>:FUNCtion: CDPower[:BTS]:RESult? on page 193

Composite EVM

This result display measures the modulation accuracy. It determines the error vector magnitude (EVM) over the total signal. The EVM is the root of the ratio of the mean error power (root mean square) to the power of an ideally generated reference signal. Thus, the EVM is shown in %. The diagram consists of a composite EVM for each PCG.

The measurement evaluates the total signal over the entire period of observation. The selected PCG is highlighted red. You can set the number of PCGs in the "Signal Capture" settings (see "Number of PCGs" on page 75).

Fig. 3-6: Composite EVM result display

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 via the Inactive Channel Threshold setting.
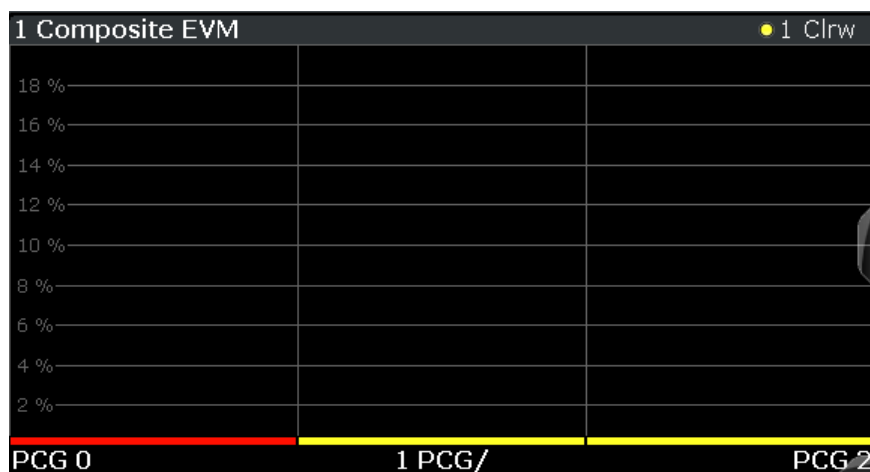
SCPI command:

`LAY:ADD? '1',RIGH, CEVM,` see `LAYout:ADD[:WINDow]?` on page 180

`CALC:MARK:FUNC:CDP:RES?  MACCuracy;` see `CALCulate<n>:MARKer<m>: FUNCtion:CDPower[:BTS]:RESult?` on page 193

Peak Code Domain Error

The Peak Code Domain Error is defined as the maximum value for the Code Domain Power / Code Domain Error Power for all codes. Thus, the error between the measurement signal and the ideal reference signal is projected onto the code domain at a specific base spreading factor. In the diagram, each bar of the x-axis represents one PCG. The y-axis represents the error power.

The measurement evaluates the total signal over the entire period of observation. The currently selected PCG is highlighted red.

You can select the Base Spreading Factor and the number of evaluated PCGs in the Signal Capture settings (see "Number of PCGs" on page 75).

MS mode: the error is calculated only for the selected branch (I or Q).
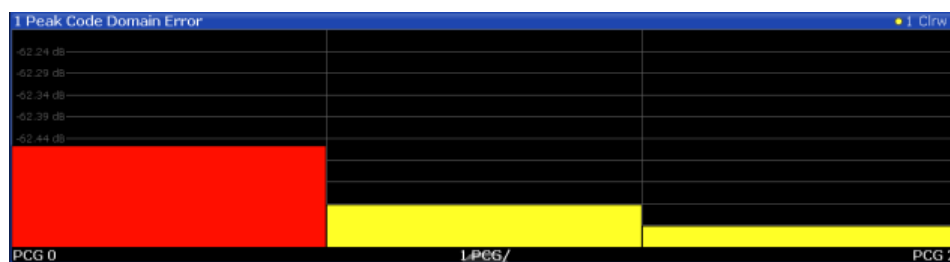
Fig. 3-7: Peak Code Domain Error display for BTS mode

Note: 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 very large. The result display therefore shows a peak code domain error that is too high. Distortions also occur if unassigned codes are wrongly given the status of "active channel". To obtain reliable measurement results, select an adequate channel threshold via the Inactive Channel Threshold setting.

SCPI command:

`LAY:ADD? '1',RIGH, PCDerror,` see `LAYout:ADD[:WINDow]?` on page 180

`CALC:MARK:FUNC:CDP:RES?  PCDerror;` see `CALCulate<n>:MARKer<m>: FUNCtion:CDPower[:BTS]:RESult?` on page 193

Power vs PCG

In this result display, the power of the selected channel is averaged for each measured PCG and referred to the pilot power of the PCG. Therefore the unit of the y-axis is dB (relative to the Pilot Channel). The result display consists of the number of the PCGs in the measurement and the power value of each one.

For measurements in which antenna diversity is inactive (OFF) or set to "Antenna 1", the F-PICH channel is used as reference, while the F-TDPICH channel is used for measurements in which antenna diversity is set to "Antenna 2".

Note: For signals with enabled power control, use the default reference power setting. For details refer to "Power Reference" on page 96.

The measurement evaluates one code channel over the entire period of observation. The selected PCG is highlighted red.

MS mode: the power is calculated only for the selected branch (I or Q).
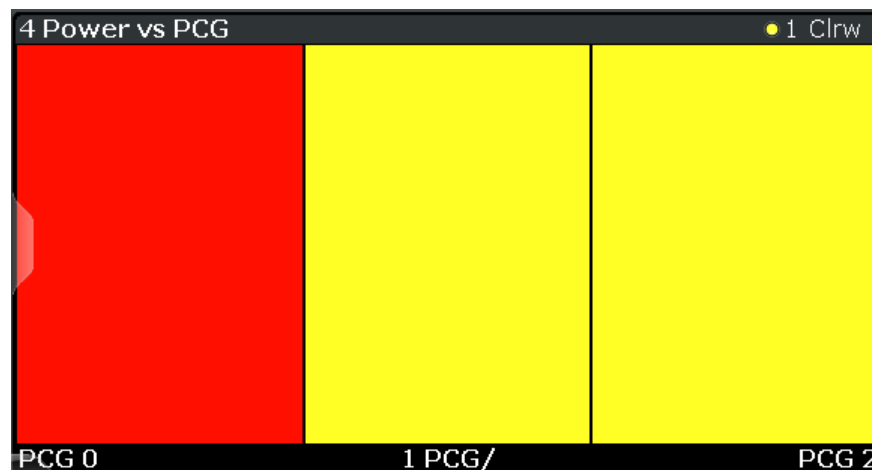
Fig. 3-8: Power vs PCG Display for BTS mode

Note: To detect the start of a power control group correctly, the external trigger must be used for power-regulated signals.

SCPI command:
`LAY:ADD? '1',RIGH, PSLot,` see `LAYout:ADD[:WINDow]?` on page 180

Power vs Symbol

The "Power vs. Symbol" evaluation calculates the absolute power in dBm for each symbol in the selected channel and the selected PCG.
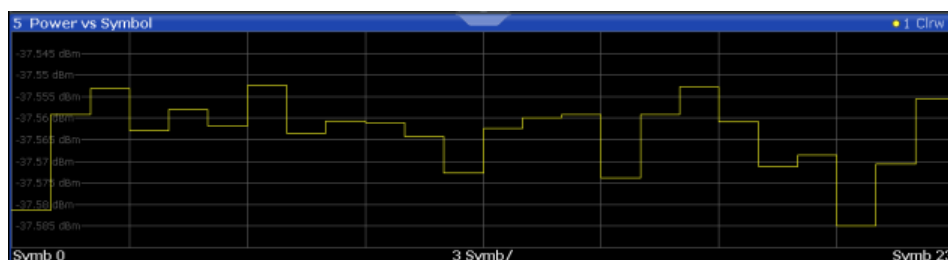
Fig. 3-9: Power vs Symbol result display

SCPI command:

`LAY:ADD? '1',RIGH, PSYMbol,` see `LAYout:ADD[:WINDow]?` on page 180

`CALC:MARK:FUNC:CDP:RES?  ;` see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 193

Result Summary

The "Result Summary" evaluation displays a list of measurement results on the screen. For details on the displayed values see chapter 3.1.1, "Code Domain Parameters", on page 14.

Fig. 3-10: Result Summary result display

SCPI command:

`LAY:ADD? '1',RIGH, RSUMmary,` see `LAYout:ADD[:WINDow]?` on page 180

`CALC:MARK:FUNC:CDP:RES?  ;` see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 193

Symbol Constellation

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

The BTS mode supports BPSK, QPSK, 8PSK and 16QAM modulation types. The modulation type itself depends on the channel type. Refer to chapter 4.8.1, "BTS Channel Types", on page 41 for further information.

Note: QPSK constellation points are located on the diagonals (not x and y-axis) of the constellation diagram. BPSK constellation points are always on the x-axis.
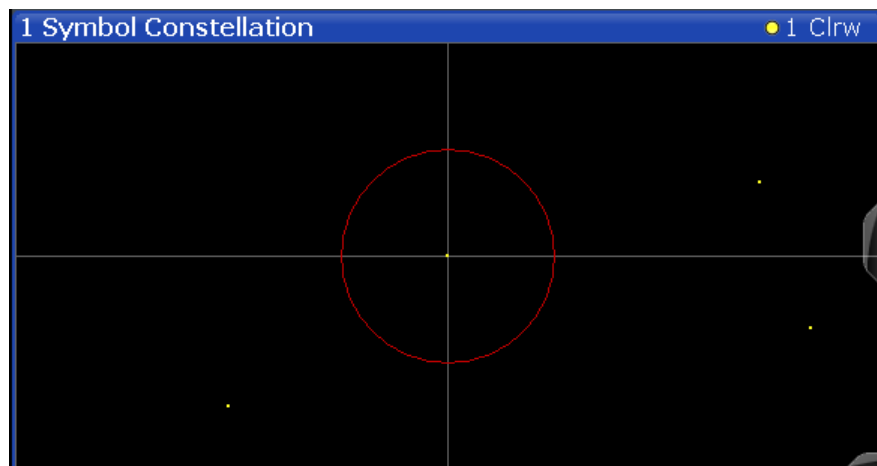
Fig. 3-11: Symbol Constellation display for BTS mode

The number of symbols is in the range from 6 (min) to 384 (max), depending on the symbol rate of the channel (see chapter 4, "Measurement Basics", on page 34).

SCPI command:

`LAY:ADD? '1',RIGH, SCONst,` see `LAYout:ADD[:WINDow]?` on page 180

`CALC:MARK:FUNC:CDP:RES?  ;` see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 193

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 PCG. A trace over all symbols of a PCG is drawn.
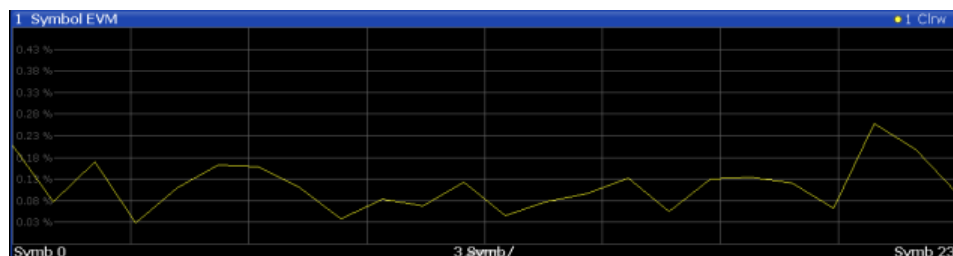
Fig. 3-12: Symbol EVM display for BTS mode

The number of symbols is in the range from 6 (min) to 384 (max), depending on the symbol rate of the channel (see chapter 4, "Measurement Basics", on page 34).

Inactive channels can be measured, but the result is meaningless since these channels do not contain data.

SCPI command:

`LAY:ADD? '1',RIGH, SEVM,` see `LAYout:ADD[:WINDow]?` on page 180

`CALC:MARK:FUNC:CDP:RES?  ;` see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 193

3.2 RF Measurements

In addition to the Code Domain Analysis measurements, the cdma2000 firmware applications also provide some RF measurements as defined in the cdma2000 standard. RF measurements are identical to the corresponding measurements in the base unit, but configured according to the requirements of the cdma2000 standard.

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

3.2.1 RF Measurement Types and Results

The cdma2000 applications provide the following RF measurements:

Power

The Power measurement determines the cdma2000 signal channel power.

To do so, the cdma2000 application performs a Channel Power measurement as in the Spectrum application with settings according to the cdma2000 standard. The bandwidth and the associated channel power are displayed in the Result Summary.

SCPI command:

CONF:CDP:MEAS POW, see CONFigure:CDPower[:BTS]:MEASurement on page 129

Querying results: CALC:MARK:FUNC:POW:RES? CPOW, see CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult? on page 211

CALC:MARK:FUNC:POW:RES? ACP, see CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult? on page 211

Channel Power ACLR

Channel Power ACLR performs an adjacent channel power measurement in the default setting according to cdma2000 specifications (adjacent channel leakage ratio).

The R&S FSW measures the channel power and the relative power of the adjacent channels and of the alternate channels. The results are displayed in the Result Summary.

SCPI command:

CONF:CDP:MEAS ACLR, see CONFigure:CDPower[:BTS]:MEASurement
on page 129

Querying results:

CALC:MARK:FUNC:POW:RES? ACP, see CALCulate<n>:MARKer<m>:FUNCtion:
POWer:RESult? on page 211

CALC:MARK:FUNC:POW:RES? ACP, see CALCulate<n>:MARKer<m>:FUNCtion:
POWer:RESult? on page 211

Spectrum Emission Mask

The Spectrum Emission Mask measurement determines the power of the cdma2000 signal in defined offsets from the carrier and compares the power values with a spectral mask specified by the cdma2000 specifications. The limits depend on the selected band-class.Thus, the performance of the DUT can be tested and the emissions and their distance to the limit be identified.

Note: The cdma2000 standard does not distinguish between spurious and spectral emissions.
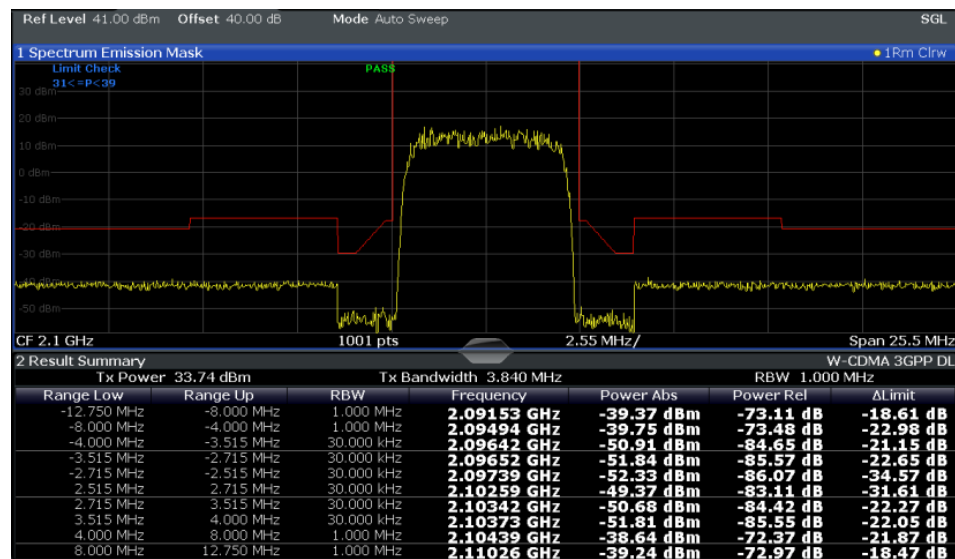
Fig. 3-13: SEM measurement results for BTS mode

SCPI command:

CONF:CDP:MEAS ESP, see CONFigure:CDPower[:BTS]:MEASurement
on page 129

Querying results:

CALC:MARK:FUNC:POW:RES? CPOW, see CALCulate<n>:MARKer<m>:FUNCtion:
POWer:RESult? on page 211

CALC:MARK:FUNC:POW:RES? ACP, see CALCulate<n>:MARKer<m>:FUNCtion:
POWer:RESult? on page 211

CALCulate<n>:LIMit<k>:FAIL on page 211

Occupied Bandwidth

The Occupied Bandwidth measurement determines 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.

SCPI command:

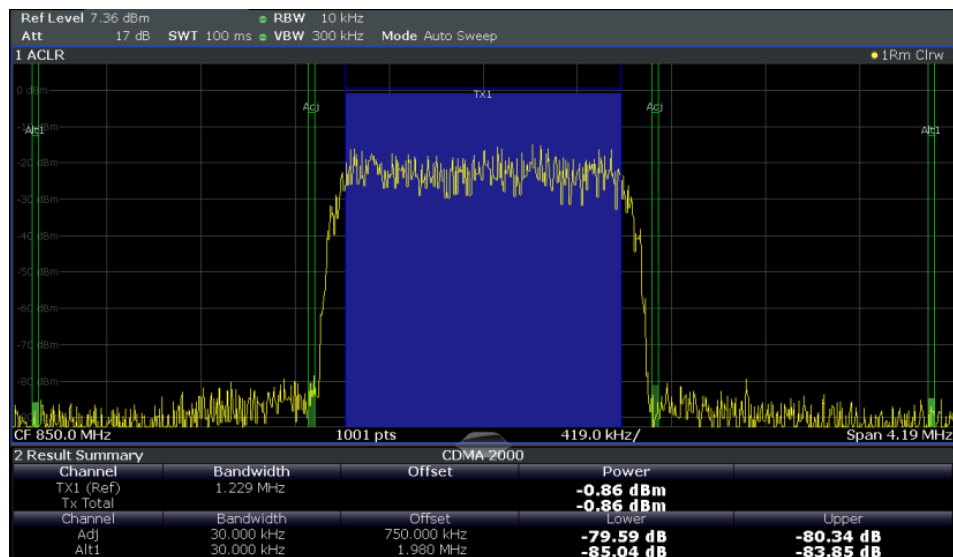`CONF:CDP:MEAS OBAN,` see `CONFigure:CDPower[:BTS]:MEASurement` on page 129

Querying results:

`CALC:MARK:FUNC:POW:RES? OBW,` see `CALCulate<n>:MARKer<m>:FUNCtion: POWer:RESult?` on page 211

`CALC:MARK:FUNC:POW:RES? ACP,` see `CALCulate<n>:MARKer<m>:FUNCtion: POWer:RESult?` on page 211

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.

Fig. 3-14: CCDF measurement results for BTS mode

SCPI command:

CONF:CDP:MEAS CCDF, see CONFigure:CDPower[:BTS]:MEASurement
on page 129

Querying results:

CALCulate<n>:MARKer<m>:Y? on page 195

CALC:MARK:FUNC:POW:RES? ACP, see CALCulate<n>:MARKer<m>:FUNCtion:
POWer:RESult? on page 211

CALC:MARK:FUNC:POW:RES? ACP, see CALCulate<n>:MARKer<m>:FUNCtion:
POWer:RESult? on page 211

CALCulate<n>:STATistics:RESult<t> on page 213

3.2.2 Evaluation Methods for RF Measurements

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

Diagram

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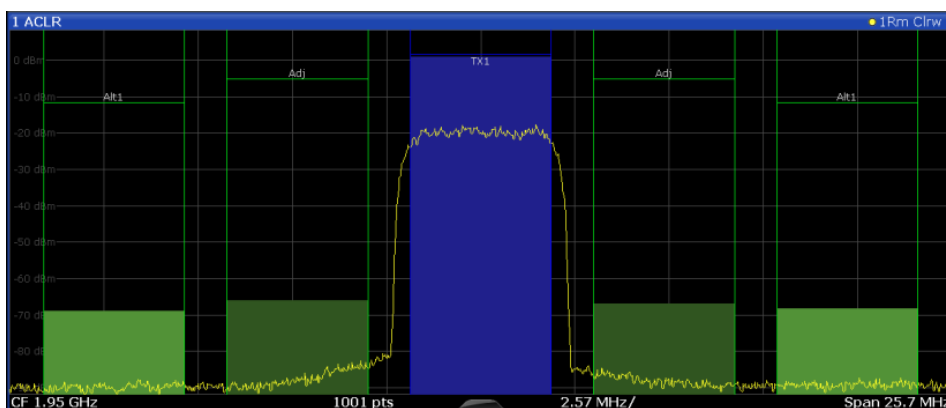
SCPI command:

LAY:ADD? '1',RIGH, DIAG, see LAYout:ADD[:WINDow]? on page 180

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.

SCPI command:

LAY:ADD? '1',RIGH, RSUM, see LAYout:ADD[:WINDow]? on page 180

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 103).

SCPI command:

LAY:ADD? '1',RIGH, MTAB, see LAYout:ADD[:WINDow]? on page 180

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

SCPI command:

LAY:ADD? '1',RIGH, PEAK, see LAYout:ADD[:WINDow]? on page 180

4 Measurement Basics

cdma2000® is based on code division multiplex access (CDMA), where all users share the same 1.25 MHz-wide channel, but use individual pseudo noise (PN) sequences for differentiation.

cdma2000® was specified by 3GPP2 (3rd Generation Partnership Project 2). The following link provides access to 3GPP2 specifications:

http://www.3gpp2.org/Public_html/specs/index.cfm

Some background knowledge on basic terms and principles used in cdma2000 tests and measurements is provided here for a better understanding of the required configuration settings.

4.1 PCGs and Sets

The user data is transmitted in individual data packages, each of which may have different transmission settings such as the power level. The data in one such package, for which the power remains constant, is called a power control group, or **PCG**. A PCG has a duration of 1.25 ms (or 1536 chips, same as slots in other standards).

The cdma2000 applications can capture up to 31360 PCGs (about 26 seconds) in a single sweep. In order to improve performance during measurement and analysis, the captured PCGs are not processed by the cdma2000 application all at once, but rather in **sets**, one at a time. One set consists of 64 PCGs. You can select how many sets are to be captured and which set is currently analyzed and displayed. The possible value range is from 1 to a maximum of 490 sets.

4.2 Channels, Codes and Symbols

In cdma2000 applications, the data is transmitted in **channels**. These channels are based on orthogonal **codes** and can have different **symbol rates**. The symbol rate depends on the used modulation type and the spreading factor of the channel.

Spreading factors

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

A channel with a lower spreading factor consists of several combined codes. That means a channel can be described by its number and its spreading factor.

The spread bits are called **chips**.

Since a PCG is a fixed time unit, knowing the symbol rate you can calculate how many symbols are transmitted for each PCG.

> For evaluations which display symbols on the x–axis, the maximum number of symbols varies according to the symbol rate of the selected code channel. With transmit diversity signals, the symbols of the signal are distrubuted on two antennas (see chapter 4.7.2, "Antenna Diversity", on page 40). Therefore the symbol number is reduced to half.

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

Table 4-1: Relationship between various code parameters for cdma2000 BTS signals

Code class	Spreading factor	No. codes / channel	Symbol rate [ksps]	Symbols per PCG (no transmit diversity)	Symbols per PCG (transmit diversity)
2	4	128	307.2	384	192
3	8	64	153.6	192	96
4	16	32	76.8	96	48
5	32	16	38.4	48	24
6	64	8	19.2	24	12
7	128	4	9.6	12	6

Table 4-2: Relationship between various code parameters for cdma2000 MS signals

Code class	Spreading factor	No. codes / channel	Symbol rate [ksps]	Symbols per PCG
1	2	128	614.4	768
2	4	64	307.2	384
3	8	32	153.6	192
4	16	16	76.8	96
5	32	8	38.4	48
6	64	4	19.2	24

Number of bits per symbol

Depending on the modulation type, a symbol consists of the following number of bits:

- **BPSK**: 1 bit (for BTS signals, only the I-component is assigned)
- **QPSK**: 2 bits (I-component followed by the Q-component)
- **8PSK**: 3 bits
- **16QAM**: 4 bits
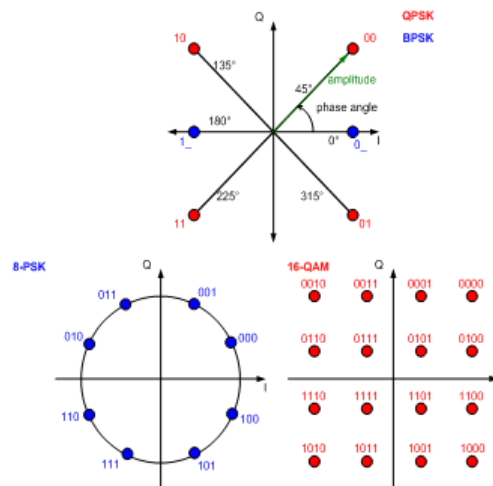
Fig. 4-1: Bits per symbol constellations for different modulation types in BTS mode

4.3 Code Display and Sort Order

In the result displays that refer to codes, the currently selected code is highlighted in the diagram. You select a code by entering a code number in the "Evaluation Range" settings.

By default, codes are displayed in ascending order of the code number (**Hadamard** order). The currently selected code number is highlighted. If the code belongs to a detected active channel, the entire channel is highlighted. (For details on active channels and channel detection see)

However, in cdma2000 signals, the codes that belong to the same channel need not lie next to each other in the code domain, they may be distributed.

Example: Example for Hadamard order

For a base spreading factor of 64, the following code order is displayed:

0.64, 1.64, 2.64, …, 63.64.
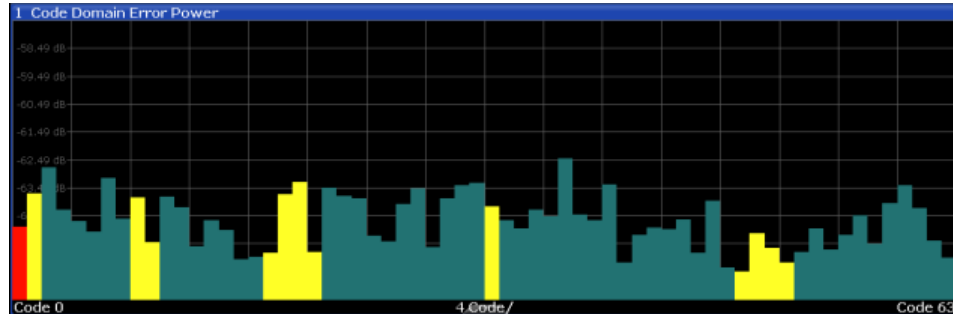
Fig. 4-2: Code Domain Error Power result display in Hadamard code sorting order

In order to compare all codes in the same channel visually, a **Bit-Reverse** sorting order is provided. In this case, all codes of a channel are displayed next to each other.

Example: Example for Bit-Reverse order

For a base spreading factor of 64, the following code order may be displayed:

0.64, 32.64, 16.64, 48.64, 8.64, 40.64, …, 15.64, 47.64,31.64, 63.64
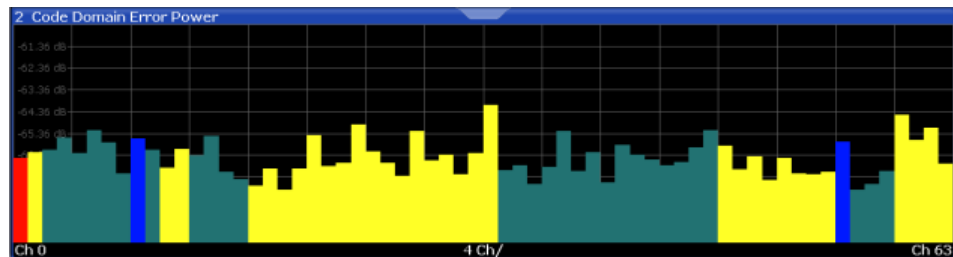
Fig. 4-3: Code Domain Error Power result display in BitReverse code sorting order

For the display in the cdma2000 applications, the scale for code-based diagrams displays 64 codes by default (32 in MS mode). However, you can change the **base spreading factor** for the display, and thus the number of displayed codes.

Alias power

Note, however, that if you select a base spreading factor that is lower than the actual spreading factor used by the channel (e.g. 64 for channels with a base spreading factor of 128), the results are distorted. This is due to the fact that a wider area of the code domain is taken into consideration, for example when calculating the power level, than the code actually occupies. The excess power calculated due to a false spreading factor is referred to as **alias power**.

4.4 Scrambling via PN Offsets and Long Codes

Short code scrambling

Base stations use a pseudo noise (PN) sequence (also referred to as short code sequence) to scramble the data during transmission. The used PN sequence is circulated in fixed time intervals. A specified **PN offset** value determines the start phase for the short code sequence.

The PN parameter is unique for each base station. Thus, the signals from different base stations can be distinguished quickly by the cdma2000 BTS application if the "PN Offset" is defined in the signal description and an external trigger is used to provide a reference for the start phase. If no offset is specified or no external trigger is available, calculation is much slower as the correct PN must be determined from all possible positions.

During short code scrambling, the channel data is split up into I and Q components.

Long code scrambling

Mobile stations also use a PN short code, but with a fixed or no offset. Additionally, a complex **long code** is used for scrambling, making the data less susceptible to interference. The long code used by a mobile station is defined by a mask and an offset. These settings are required by the cdma2000 MS application to distinguish the senders and are defined in the signal description.

The long code offset also includes the PN offset (if any) and is defined in chips. The offset corresponds to the GPS timing since 6.1.1980 00:00:00 UTC. The offset in chips is calculated as follows:

```
tSinceStartGPS  * 1.2288 MChips/s
```

where `tSinceStartGPS` is defined in seconds

The offset is applied at the next trigger pulse, which cannot occur until a setup time of 300 ms has elapsed.

A special **long code generation mode** is provided to analyze signals sent by an Agilent ESG 101 generator.

During long code scrambling, the channel data is mapped either to the I or to the Q branch of the complex input signal.

4.5 Code Mapping and Branches

Since MS signals use long code scrambling, the channel data is mapped either to the I or to the Q branch of the complex input signal. During channel detection, the branch to which the data was mapped is determined and indicated in the channel table. During analysis, each branch of the symbol constellation area (imaginary part, I, or real part, Q) can be evaluated independantly. Thus, when analyzing MS signals, you must define which branch results you want to analyze. Especially for code power measurements the

results may vary considerably. While a channel may be active on one branch, the other branch may belong to an inactive channel.

4.6 Radio Configuration

The radio configuration specifies various settings for transmission according to the cdma2000 standard including:

- allowed data rates
- modulation types
- use of special channels
- transmit diversity

The standard describes nine RCs for BTS and six for MS signals, for different transmission scenarios.

In BTS mode only, the radio configuration can be customized for two channel types: PDCH and CHAN (see chapter 4.8.1, "BTS Channel Types", on page 41). The applied RC is specified for each channel of these types in the channel tables. Predefined channel tables are provided for particular radio configurations (see chapter A.1, "Reference: Predefined Channel Tables", on page 228).

The following RCs are used in BTS mode:

Table 4-3: RCs used in BTS mode:

Channel type	Modulation	Manual operation	SCPI parameter
PDCH	QPSK	10	10
	8PSK	10	20
	16QAM	10	30
CHAN		1-2	1
		3-5	3
special channels		-	0

4.7 Transmission with Multiple Carriers and Multiple Antennas

The cdma2000 standard allows for transmission using multiple carriers as well as transmission via multiple antennas.

4.7.1 Multi-Carrier Mode

The cdma2000 applications can filter out and analyze one carrier out of a multi-carrier signal, if a special multi-carrier mode is activated in the signal description.

Two filter types used to select the required carrier from the signal are available for selection: a low-pass filter and an RRC filter.

By default, the low-pass filter is active. The low-pass filter affects the quality of the measured signal compared to a measurement without a filter. The frequency response of the low-pass filter is shown below.
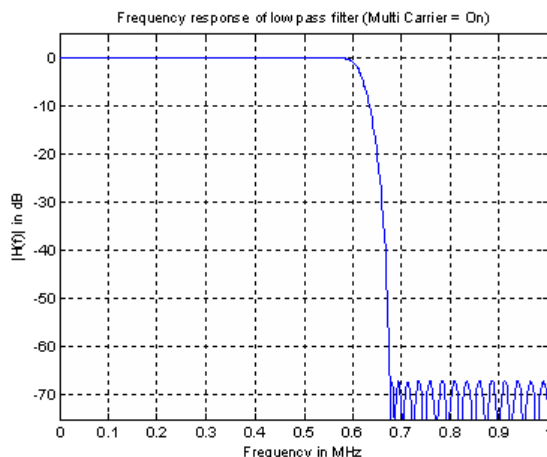
Fig. 4-4: Frequency response of the low-pass multi-carrier filter

The RRC filter comes with an integrated Hamming window. The roll-off factor of the RRC filter defines the slope of the filter curve and therefore the excess bandwidth of the filter. The cut-off frequency of the RRC filter is the frequency at which the passband of the filter begins. Both parameters can be configured.

4.7.2 Antenna Diversity

The standard allows for transmission via multiple antennas (**transmit diversity**). If transmit diversity is implemented for the input signal, the cdma2000 BTS application must know which antenna to analyze the input from. This information is provided by the signal description (**"Antenna Diversity"**). Depending on which antenna is selected for analysis, certain special channels are required for predefined channel tables (see also "Channel table definition for transmit diversity" on page 42):

Antenna	Required special channels
1	Pilot channel (F-PICH, 0.64) required and used as power reference
	Transmit diversity pilot channel (F-TDPICH, 16.128) not allowed
2	Transmit diversity pilot channel (F-TDPICH, 16.128) required and used as power reference
	Pilot channel (F-PICH, 0.64) not allowed
- (No diversity)	Pilot channel (F-PICH, 0.64) required and used as power reference
	Transmit diversity pilot channel (F-TDPICH, 16.128) required

4.8 Channel Detection and Channel Types

The cdma2000 applications provide two basic methods of detecting active channels:

- **Automatic search using pilot sequences**
  The application performs an automatic search for active (DPCH) channels throughout the entire code domain. At the specific codes at which channels can be expected, the application detects an active channel if the corresponding symbol rate and a sufficiently high power level is measured (see "Inactive Channel Threshold" on page 78).
  Any channel that does not have a predefined channel number and symbol rate is considered to be a data channel.
  In MS mode, a channel is considered to be active if a minimum signal/noise ratio is maintained within the channel.

- **Comparison with predefined channel tables**
  The input signal is compared to a predefined channel table. All channels that are included in the predefined channel table are considered to be active.
  For a list of predefined channel tables provided by the cdma2000 applications see chapter A.1, "Reference: Predefined Channel Tables", on page 228.

Quasi-inactive channels in MS mode

In MS mode, only one branch in the code domain is analyzed at a time (see also chapter 4.5, "Code Mapping and Branches", on page 38). However, even if the code on the analyzed branch is inactive, the code with the same number on the other branch may belong to an active channel. In this case, the channel is indicated as **quasi-inactive** in the current branch evaluation.

4.8.1 BTS Channel Types

The cdma2000 standard defines various BTS channel types. Some special channels are mandatory and must be contained in the signal, as they have control or synchronization functions. Thus, these channels always occupy a specific channel number and use a specific symbol rate by which they can be identified.

Special channels

The cdma2000 BTS application expects at least the Pilot Channel (F-PICH) or the Transmit Diversity Pilot CHannel (F-TDPICH) for the Code Domain Power measurements.

The following channels are detected automatically during automatic channel detection:

Table 4-4: Common cdma2000 BTS channels and their usage

Channel type	Ch.no . / SF	Modulation	Description
F-PICH	0.64	BPSK	Pilot channel
F-PCH	1.64	BPSK	Paging channel
F-TDPICH	16.128	BPSK	Transmit Diversity Pilot CHannel

Channel type	Ch.no. / SF	Modulation	Description
F-SYNC	32.64	BPSK	Synchronization channel
F-CHAN		BPSK (RC 1+2) QPSK (RC 3-5)	active data channel
INACTIVE		-	inactive channel
F-PDCCH		QPSK	Packet Data Control CHannel
F-PDCH	.32	QPSK, 8PSK, or 16-QAM	Packet Data CHannel

In addition, the following channel types can be defined in a predefined channel table for the cdma2000 BTS application.

Channel type	Ch.no. / SF	Description
F-APICH	BPSK	Auxiliary Pilot CHannel
F-ATDPICH	BPSK	Auxiliary Ttransmit Diversity Pilot CHannel
F-BCH	QPSK	Broadcast CHannel
F-CACH	QPSK	Common Assignment Channel
F-CCCH	QPSK	Common Control CHannel
F-CPCCH	QPSK	Common Power Control CHannel

Channel table definition for transmit diversity

In a measurement scenario with two antennas (transmit diversity), the following conditions apply to the channel table definition:

- **Antenna 1** is used for transmission:
  - The pilot channel **F-PICH must** be included.
  - The pilot channel of antenna 2 **F-TDPICH must not** be included.
- **Antenna 2** is used for transmission:
  - The pilot channel of antenna 2 **F-TDPICH must** be included.
  - The pilot channel **F-PICH must not** be included.
- **Both antennas** are used for transmission:
  - The pilot channel **F-PICH must** be included.
  - The pilot channel of antenna 2 **F-TDPICH must** be included.

4.8.2 MS Channel Types

The following channel types can be detected in cdma2000 MS signals by the cdma2000 MS application.

Channel type	Ch.no / SF	Mapping	Description
ACKCH	16.64	Q	Reverse Acknowledgment Channel (1xEV-DV)
CCCH	2.8	Q	Reverse Common Control Channel
CQICH	12.16	I (if FCH available) /Q	Reverse Channel Quality Indicator Channel (1xEV-DV)
DCCH	8.16	I	Reverse Dedicated Control Channel
EACH	2.8	Q	Enhanced Access Channel
FCH	4.16	Q	Reverse Fundamental Channel
PICH	0.32	I	Reverse Pilot Channel
S1CH	1.2 or 2.4	Q	Reverse Supplemental 1 Channel
S2CH	2.4 or 6.8	I	Reverse Supplemental 2 Channel

Note: Since the EACH has the same mapping, the same channel number and the same spreading factor as the CCCH, it is not possible to distinguish them during an automatic search. In this case, both the EACH and CCCH are output.

4.9 Test Setup for cdma2000 Base Station or Mobile Station Tests

Before a CDMA measurement can be performed, the R&S FSW must be set up in a test environment. This section describes the required settings of the R&S FSW if it is used as a cdma2000 base or mobile station tester. Before starting the measurements, the R&S FSW has to be configured correctly and supplied with power as described in the R&S FSW Getting Started manual, "Preparing For Use". Furthermore, the application firmware cdma2000 BTS or cdma2000 MS must be enabled. Installation and enabling of the application firmware are described in the R&S FSW Getting Started manual or in the Release Notes.

NOTICE

Risk of instrument damage during operation

An unsuitable operating site or test setup can cause damage to the instrument and to connected devices. Ensure the following operating conditions before you switch on the instrument:

- All fan openings are unobstructed and the airflow perforations are unimpeded. The minimum distance from the wall is 10 cm.
- The instrument is dry and shows no sign of condensation.
- The instrument is positioned as described in the following sections.
- The ambient temperature does not exceed the range specified in the data sheet.
- Signal levels at the input connectors are all within the specified ranges.
- Signal outputs are correctly connected and are not overloaded.

Required units and accessories

The measurements are performed with the following units and accessories:

- An R&S FSW equipped with the cdma2000 BTS or MS option.
- R&S SMU signal generator equipped with option SMU-B9/B10/B11 baseband generator and SMUK46 cdma2000 incl. 1xEVDV.
- 1 coaxial cable, 50 Ω, approximately 1 m, N connector
- 2 coaxial cables, 50 Ω, approximately 1 m, BNC connector

General Test Setup

Connect the antenna output (or TX output) of the base station/mobile station to the RF input of the R&S FSW. Use a power attenuator exhibiting suitable attenuation.
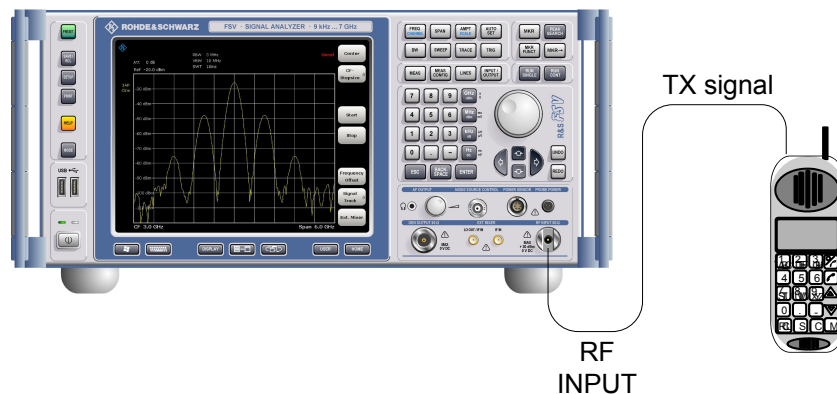
The following values for external attenuation are recommended to ensure that the RF input of the R&S FSW is protected and the sensitivity of the unit is not reduced too much:

Maximum Power	Recommended external attenuation
≥ 55 to 60 dBm	35 to 40 dB
≥ 50 to 55 dBm	30 to 35 dB

Maximum Power	Recommended external attenuation
≥ 45 to 50 dBm	25 to 30 dB
≥ 40 to 45 dBm	20 to 25 dB
≥ 35 to 40 dBm	15 to 20 dB
≥ 30 to 35 dBm	10 to 15 dB
≥ 25 to 30 dBm	0 to 10 dB
≥ 20 to 25 dBm	0 to 5 dB
≤ 20 dBm	0 dB

- For signal measurements at the output of two-port networks, connect the reference frequency of the signal source to the rear reference input (REF INPUT) of the R&S FSW.
- The R&S FSW must be operated with an external frequency reference to ensure that the error limits of the cdma2000 specification for frequency measurements on base stations/mobile stations are met. A rubidium frequency standard can be used as a reference source, for example.
- If the base station/mobile station has a trigger output, connect the trigger output of the base station/mobile station to one of the trigger inputs (TRIGGER INPUT) of the R&S FSW (see "Trigger 2/3" on page 62).

Presettings

(For details see chapter 5.2, "Code Domain Analysis", on page 48)

- Enter the external attenuation.
- Enter the reference level.
- Enter the center frequency.
- Set the trigger.
- If used, enable the external reference.
- Select the cdma2000 standard and the desired measurement.
- Set the PN offset.

4.10 CDA Measurements in MSRA Operating Mode

The cdma2000 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 cdma2000 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 cdma2000 BTS measurement.

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 cdma2000 BTS application the analysis interval is automatically determined according to the selected set, PCG or code to analyze which is defined for the evaluation range, depending on the result display. The analysis interval can not be edited directly in the cdma2000 BTS application, but is changed automatically when you change the evaluation range.

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

5 Configuration

The cdma2000 applications provide several different measurements for signals accord-ing to the cdma2000 standard. The main and default measurement is Code Domain Analysis. In addition to the code domain power measurements specified by the cdma2000 standard, the cdma2000 applications offer measurements with predefined settings in the frequency domain, e.g. RF power measurements.

Only one measurement type can be configured per channel; however, several channels for cdma2000 applications can be configured in parallel on the R&S FSW. Thus, you can configure one channel for a Code Domain Analysis, for example, and another for a 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 FSW User Manual.

Selecting the measurement type

When you activate a measurement channel in a cdma2000 application, Code Domain Analysis of the input signal is started automatically. However, the cdma2000 applications also provide other measurement types.

► To select a different measurement type, do one of the following:

- Tap the "Overview" softkey. In the "Overview", tap the "Select Measurement" button. Select the required measurement.
- Press the MEAS key on the front panel. In the "Select Measurement" dialog box, select the required measurement.

5.1 Result Display

The captured signal can be displayed using various evaluation methods. All evaluation methods available for cdma2000 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 cdma2000 menu.

Up to 16 evaluation methods can be displayed simultaneously in separate windows. The cdma2000 evaluation methods are described in chapter 3.1.2, "Evaluation Methods for Code Domain Analysis", on page 16.

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 on the front panel.

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

5.2 Code Domain Analysis

cdma2000 measurements require a special application on the R&S FSW, which you activate using the MODE key on the front panel.

When you activate a cdma2000 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 cdma2000 application, Code Domain Analysis of the input signal is started automatically with the default configuration. The "Code Domain Analyzer" menu is displayed and provides access to the most important configuration functions. This menu is also displayed when you press the MEAS CONFIG key on the front panel.

The "Span", "Bandwidth", "Lines", and "Marker Functions" menus are not available for CDA measurements.

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 cdma2000 can not only be measured by the cdma2000 applications themselves, it can also be imported to the applications, provided it has the correct format. Furthermore, the evaluated I/Q data from the cdma2000 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 FSW User Manual.

5.2.1   Default Settings for Code Domain Analysis

When you activate a cdma2000 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
- YIG filter state

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 cdma2000 application is activated, or after a Preset Channel:

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

Table 5-1: Default settings for cdma2000 channels

Parameter	Value
Common cdma2000 settings	
Digital standard	CDMA 2000 MC1 (where MC1 stands for Multi–carrier 1 and thus describes cdma2000 1X, i.e. a single carrier)
Measurement	Code Domain Analysis
Bandclass	BC 0: 800 MHz Cellular Band
Sweep	CONTINUOUS
Channel detection mode	AUTOSEARCH
Trigger settings	FREE RUN
Trigger offset	0

Parameter	Value
Threshold value	-60 dB
Number of PCGs	3
Number of Sets	1
PCG number	0
Code number	0
Code Order	Hadamard
Evaluations	Window 1: Code Domain Power Relative Window 2: Result Summary
BTS specific settings	
Symbol rate	19.2 ksps
PN offset	0 chips
Antenna Diversity	Off
MS specific settings	
Symbol rate	38.4 ksps
Long code mask	0
Long code offset	0
Evaluated Branch	I

5.2.2 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.
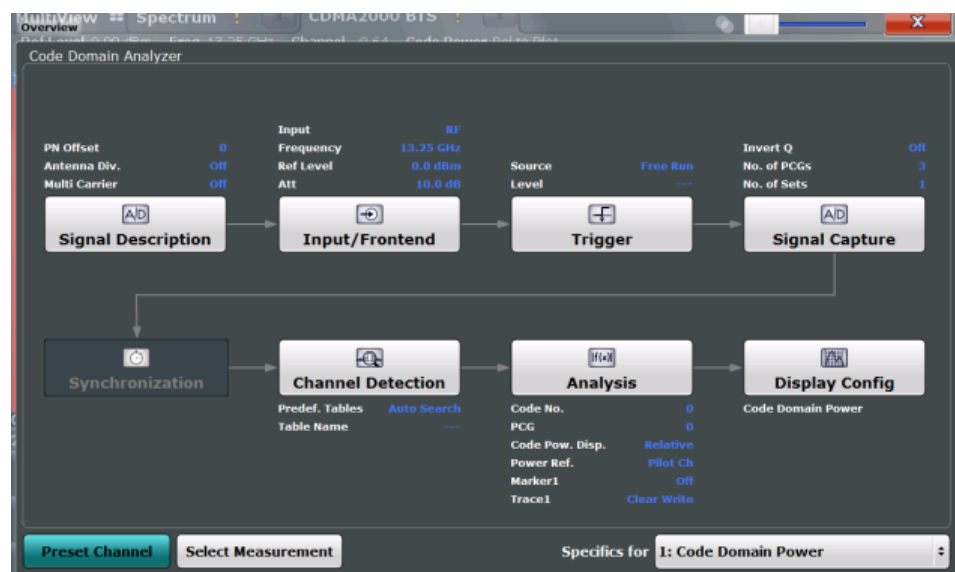
In addition to the main measurement settings, the "Overview" provides quick access to the main settings dialog boxes. Thus, you can easily configure an entire measurement channel from input over processing to output and evaluation by stepping through the dialog boxes as indicated in the "Overview".

The available settings and functions in the "Overview" vary depending on the currently selected measurement. For RF measurements see chapter 5.3, "RF Measurements", on page 89.

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

1. "Select Measurement"
   See "Selecting the measurement type" on page 47

2. "Signal Description"
   See chapter 5.2.3, "Signal Description", on page 52

3. "Input/ Frontend"
   See chapter 5.2.4, "Data Input and Output Settings", on page 57 and chapter 5.2.5, "Frontend Settings", on page 64

4. (Optionally:) "Trigger"
   See chapter 5.2.6, "Trigger Settings", on page 69

5. "Signal Capture"
   See chapter 5.2.7, "Signal Capture (Data Acquisition)", on page 74

   Note: The "Synchronization" button indicated in the Overview is not required for cdma2000 measurements.

6. "Channel Detection"
   See chapter 5.2.9, "Channel Detection", on page 76

7. "Analysis"
   See chapter 6, "Analysis", on page 95

8. "Display Configuration"
   See chapter 3.1.2, "Evaluation Methods for Code Domain Analysis", on page 16

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 on the front panel restores all measurements **in all measurement channels** on the R&S FSW to their default values!

See chapter 5.2.1, "Default Settings for Code Domain Analysis", on page 49 for details.

SCPI command:
SYSTem:PRESet:CHANnel[:EXECute] on page 129

Select Measurement
Selects a different measurement to be performed.

See "Selecting the measurement type" on page 47.

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

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

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

5.2.3 Signal Description

The signal description provides information on the expected input signal.

5.2.3.1 BTS Signal Description

These settings describe the input signal in BTS measurements.
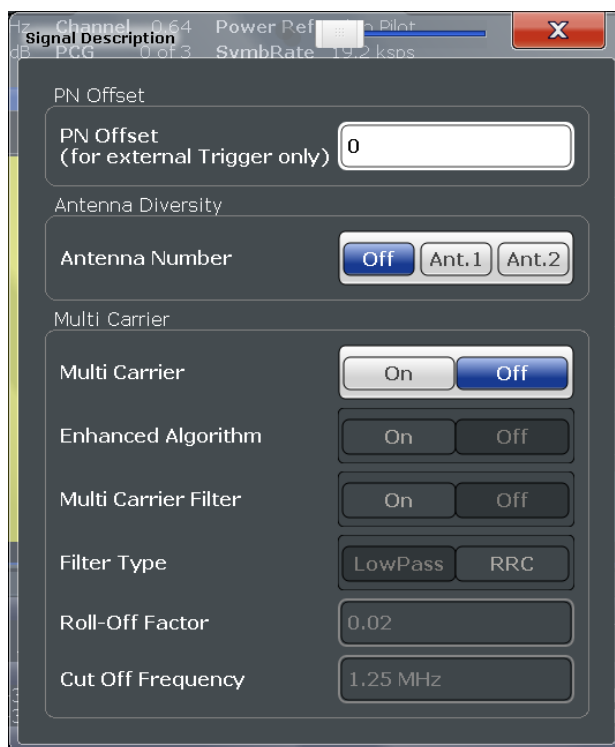
PN Offset

Specifies the Pseudo Noise (PN) offset from an external trigger. If no offset is specified or no external trigger is available, calculation is much slower as the correct PN must be determined from all possible positions.

For details see chapter 4.4, "Scrambling via PN Offsets and Long Codes", on page 38.

SCPI command:

[SENSe:]CDPower:PNOFfset on page 133

Antenna Diversity - Antenna Number

Activates or deactivates the orthogonal transmit diversity (two-antenna system) and defines the antenna for which the results are displayed.

For details on antenna diversity see also chapter 4.7.2, "Antenna Diversity", on page 40.

"Antenna 1"　　The signal of antenna 1 is fed in.

"Antenna 2"　　The signal of antenna 2 is fed in.

"Off"   The aggregate signal from both antennas is fed in.
                        The pilot channels of both antennas are required.
                        As reference for the code power (Power Reference), PICH is used.

SCPI command:
[SENSe:]CDPower:ANTenna on page 133

Multi Carrier

Activates or deactivates the multi-carrier mode. This mode improves the processing of multi-carrier signals. It allows you to measure one carrier out of a multi-carrier signal.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier[:STATe] on page 132

Enhanced Algorithm ← Multi Carrier

Activates or deactivates the enhanced algorithm that is used for signal detection on multi-carrier signals. This algorithm slightly increases the calculation time.

This setting is only available if "Enhanced Algorithm" on page 54 is activated.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier:MALGo on page 132

Multi Carrier Filter ← Multi Carrier

Activates or deactivates the usage of a filter for signal detection on multi-carrier signals.

This setting is only available if "Enhanced Algorithm" on page 54 is activated.

For details see chapter 4.7.1, "Multi-Carrier Mode", on page 39.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe] on page 131

Filter Type ← Multi Carrier

Selects the filter type if Filter Type is activated.

Two filter types are available for selection: a low-pass filter and an RRC filter.

By default, the low-pass filter is active. The low-pass filter affects the quality of the measured signal compared to a measurement without a filter.

The RRC filter comes with an integrated Hamming window. If selected, two more settings become available for configuration: the Roll-Off Factor and the Cut Off Frequency.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE on page 132

Roll-Off Factor ← Filter Type ← Multi Carrier

Defines the roll-off factor of the RRC filter which defines the slope of the filter curve and therefore the excess bandwidth of the filter. Possible values are between 0.01 and 0.99 in 0.01 steps. The default value is 0.02.

This parameter is available for the RRC filter.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE on page 132
CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF on page 131

Cut Off Frequency ← Filter Type ← Multi Carrier
Defines the frequency at which the passband of the RRC filter begins. Possible values are between 0.1 MHz and 2.4 MHz in 1 Hz steps. The default value is 1.25 MHz

This parameter is available for the RRC filter.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE on page 132
CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency on page 130

5.2.3.2 MS Signal Description
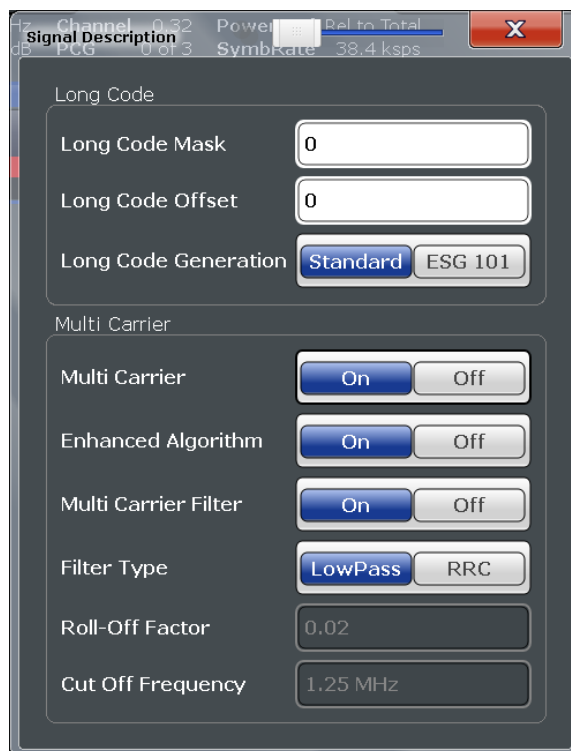
These settings describe the input signal in MS measurements.

Long Code Mask
Defines the long code mask of the mobile in hexadecimal form. The value range is from 0 to 4FFFFFFFFFF.

For the default mask value of 0 the Long Code Offset is not taken into consideration.

For more information on long codes see "Long code scrambling" on page 38.

SCPI command:

[SENSe:]CDPower:LCODe:MASK on page 134

Long Code Offset

Defines the long code offset, including the PN offset, in chips in hexadecimal format with a 52-bit resolution. This value corresponds to the GPS timing since 6.1.1980 00:00:00 UTC. This offset is applied at the next trigger pulse (which cannot occur until a setup time of 300 ms has elapsed). The default value is 0.

The setting is ignored if the Long Code Mask is set to 0.

For more information on long codes see "Long code scrambling" on page 38.

SCPI command:

[SENSe:]CDPower:LCODe:OFFSet on page 135

Long Code Generation

Selects the mode of the long code generation.

"Standard"   The cdma2000 standard long code generator is used.

"ESG 101"   The Agilent ESG option 101 long code is used; in this case, only signals from that generator can be analyzed.

SCPI command:

[SENSe:]CDPower:LCODe:MODE on page 134

Multi Carrier

Activates or deactivates the multi-carrier mode. This mode improves the processing of multi-carrier signals. It allows you to measure one carrier out of a multi-carrier signal.

SCPI command:

CONFigure:CDPower[:BTS]:MCARrier[:STATe] on page 132

Enhanced Algorithm ← Multi Carrier

Activates or deactivates the enhanced algorithm that is used for signal detection on multi-carrier signals. This algorithm slightly increases the calculation time.

This setting is only available if "Enhanced Algorithm" on page 54 is activated.

SCPI command:

CONFigure:CDPower[:BTS]:MCARrier:MALGo on page 132

Multi Carrier Filter ← Multi Carrier

Activates or deactivates the usage of a filter for signal detection on multi-carrier signals.

This setting is only available if "Enhanced Algorithm" on page 54 is activated.

For details see chapter 4.7.1, "Multi-Carrier Mode", on page 39.

SCPI command:

CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe] on page 131

Filter Type ← Multi Carrier

Selects the filter type if Filter Type is activated.

Two filter types are available for selection: a low-pass filter and an RRC filter.

By default, the low-pass filter is active. The low-pass filter affects the quality of the measured signal compared to a measurement without a filter.

The RRC filter comes with an integrated Hamming window. If selected, two more settings become available for configuration: the Roll-Off Factor and the Cut Off Frequency.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE on page 132

Roll-Off Factor ← Filter Type ← Multi Carrier

Defines the roll-off factor of the RRC filter which defines the slope of the filter curve and therefore the excess bandwidth of the filter. Possible values are between 0.01 and 0.99 in 0.01 steps. The default value is 0.02.

This parameter is available for the RRC filter.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE on page 132
CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF on page 131

Cut Off Frequency ← Filter Type ← Multi Carrier

Defines the frequency at which the passband of the RRC filter begins. Possible values are between 0.1 MHz and 2.4 MHz in 1 Hz steps. The default value is 1.25 MHz

This parameter is available for the RRC filter.

SCPI command:
CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE on page 132
CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency on page 130

5.2.4   Data Input and Output Settings

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

5.2.4.1   Input Settings

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

Input settings can be configured via the INPUT/OUTPUT key, in the "Input" dialog box.

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

Radio Frequency Input

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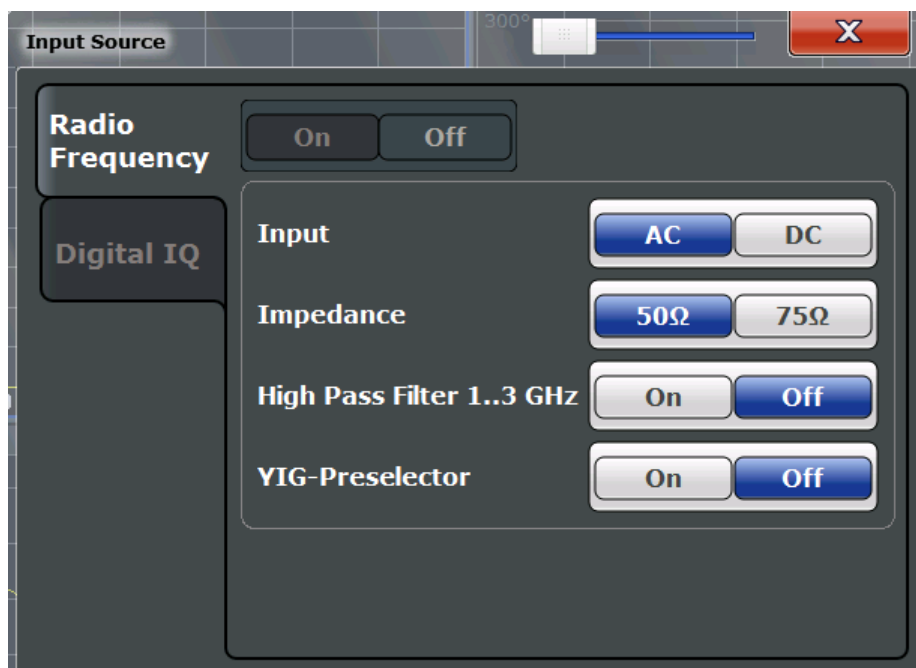
Radio Frequency State

Activates input from the RF INPUT connector.

SCPI command:

Input Coupling

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

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

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.

SCPI command:

Impedance

The reference impedance for the measured levels of the R&S FSW 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 66).

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

SCPI command:
INPut:IMPedance on page 137

High-Pass Filter 1...3 GHz

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

This function requires option R&S FSW-B13.

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

SCPI command:
INPut:FILTer:HPASs[:STATe] on page 136

YIG-Preselector

Activates or deactivates the YIG-preselector.

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

INPut:FILTer:YIG[:STATe] on page 137

Digital I/Q Input Settings

The following settings and functions are available to provide input via the Digital Baseband Interface (R&S FSW-B17) in the applications that support it.

They can be configured via the INPUT/OUTPUT key, in the "Input" dialog box.
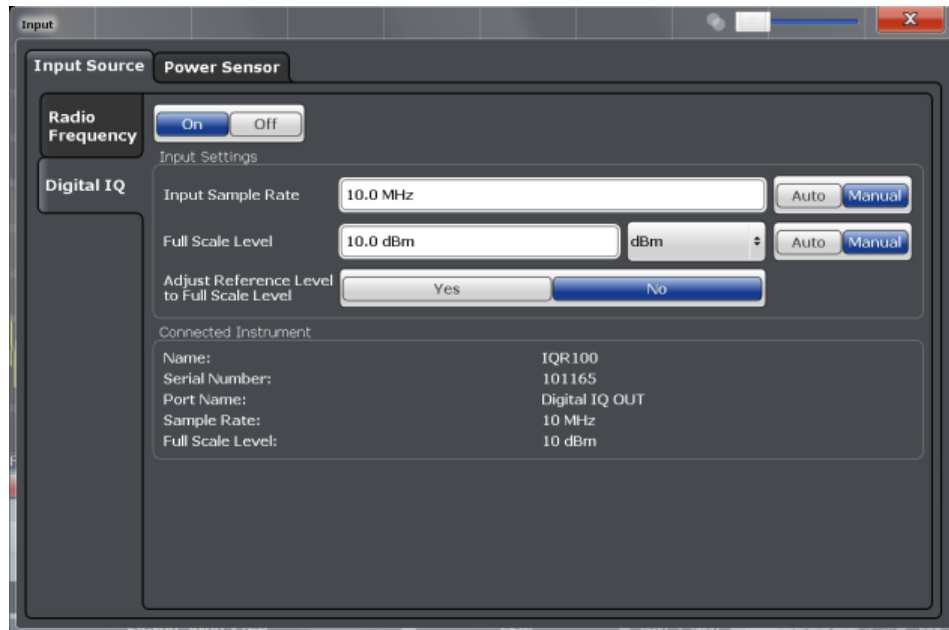
Digital I/Q Input State

Enables or disable the use of the "Digital IQ" input source for measurements. "Digital IQ" is only available if the Digital Baseband Interface (R&S FSW-B17) is installed.

SCPI command:

INPut:SELect on page 137

Input Sample Rate

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

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

The allowed range is from 100 Hz to 10 GHz.

SCPI command:

INPut:DIQ:SRATe on page 141

INPut:DIQ:SRATe:AUTO on page 141

Full Scale Level

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

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

SCPI command:
INPut:DIQ:RANGe[:UPPer] on page 141
INPut:DIQ:RANGe[:UPPer]:UNIT on page 141
INPut:DIQ:RANGe:AUTO on page 140

Adjust Reference Level to Full Scale Level
If enabled, the reference level is adjusted to the full scale level automatically if any change occurs.

SCPI command:
INPut:DIQ:RANGe:COUPling on page 140

Connected Instrument
Displays the status of the Digital Baseband Interface connection.

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

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

SCPI command:
INPut:DIQ:CDEVice on page 139

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

Note that R&S DigIConf requires a USB connection (not LAN!) from the R&S FSW to the R&S EX-IQ-BOX in addition to the Digital Baseband Interface (R&S FSW-B17) connection. R&S DigIConf version 2.20.360.86 Build 170 or higher is required.

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

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

Note: If you close the R&S DigIConf window using the "Close" icon, the window is minimized, not closed.
If you select the "File > Exit" menu item in the R&S DigIConf window, the application is closed. Note that in this case the settings are lost and the EX-IQ-BOX functionality is no longer available until you restart the application using the "DigIConf" softkey in the R&S FSW once again.

5.2.4.2 Data Output

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

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

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

Output settings can be configured via the INPUT/OUTPUT key or in the "Outputs" dialog box.
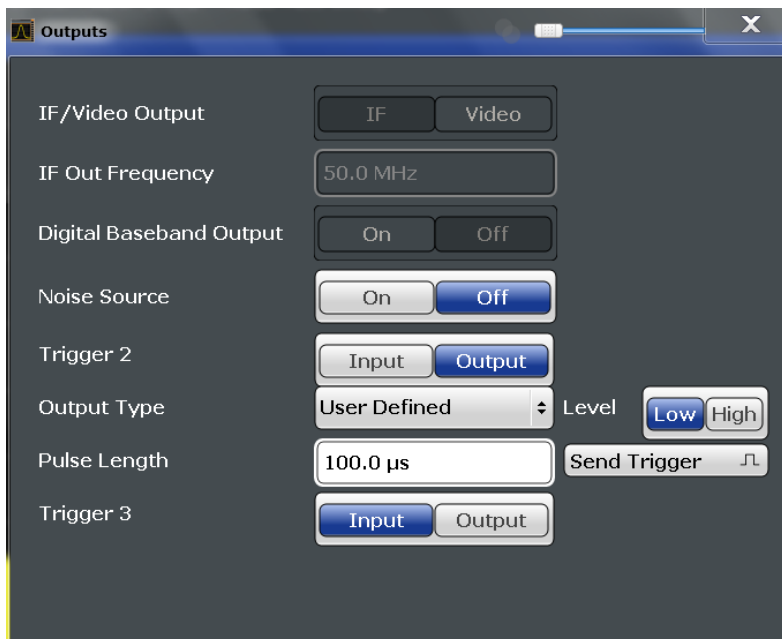
Noise Source
Switches the supply voltage for an external noise source on or off.

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

SCPI command:
DIAGnostic<n>:SERVice:NSOurce on page 144

Trigger 2/3
Defines the usage of the variable TRIGGER INPUT/OUTPUT connectors, where:

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

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

(Trigger 1 is INPUT only.)

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

"Input"	The signal at the connector is used as an external trigger source by the R&S FSW. No further trigger parameters are available for the connector.
"Output"	The R&S FSW sends a trigger signal to the output connector to be used by connected devices. Further trigger parameters are available for the connector.

SCPI command:

OUTPut:TRIGger<port>:LEVel on page 159

OUTPut:TRIGger<port>:DIRection on page 159

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

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

SCPI command:

OUTPut:TRIGger<port>:OTYPe on page 160

Level ← Output Type ← Trigger 2/3
Defines whether a constant high (1) or low (0) signal is sent to the output connector.

SCPI command:

OUTPut:TRIGger<port>:LEVel on page 159

Pulse Length ← Output Type ← Trigger 2/3
Defines the length of the pulse sent as a trigger to the output connector.

SCPI command:

OUTPut:TRIGger<port>:PULSe:LENGth on page 161

Send Trigger ← Output Type ← Trigger 2/3
Sends a user-defined trigger to the output connector immediately. Note that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, 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.

SCPI command:

OUTPut:TRIGger<port>:PULSe:IMMediate on page 160

5.2.5 Frontend Settings

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

5.2.5.1 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 the "Frequency" tab in the "Input Settings" dialog box
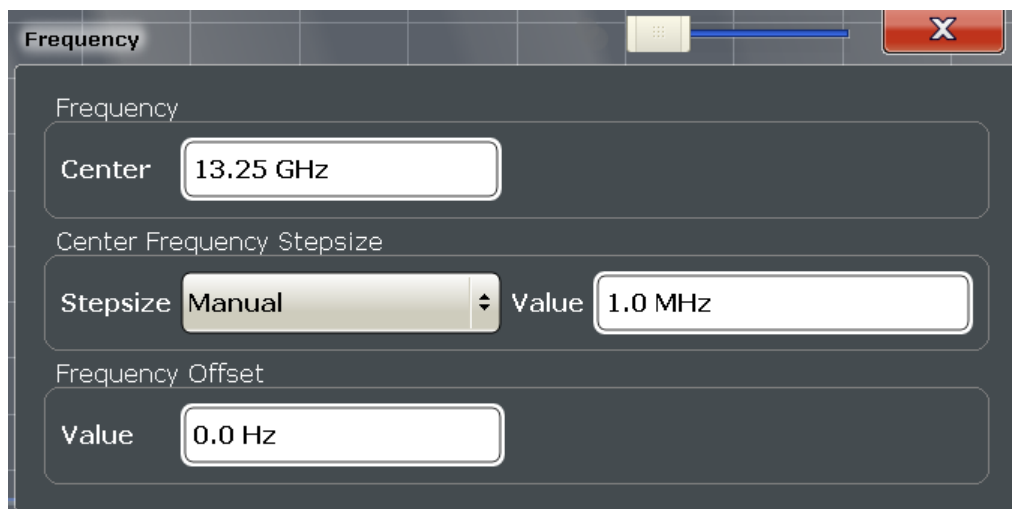
Center

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

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

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

SCPI command:
[SENSe:]FREQuency:CENTer on page 145

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 RF measurements.

"X * Span"   Sets the step size for the center frequency to a defined factor of the span. The "X-Factor" defines the percentage of the span.
Values between 1 and 100 % in steps of 1 % are allowed. The default setting is 10 %.

"= Center"   Sets the step size to the value of the center frequency. The used value is indicated in the "Value" field.

"Manual"   Defines a fixed step size for the center frequency. Enter the step size in the "Value" field.

SCPI command:
[SENSe:]FREQuency:CENTer:STEP on page 146

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

This parameter has no effect on the R&S FSW 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.

SCPI command:
[SENSe:]FREQuency:OFFSet on page 147

5.2.5.2   Amplitude Settings

Amplitude settings determine how the R&S FSW 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.
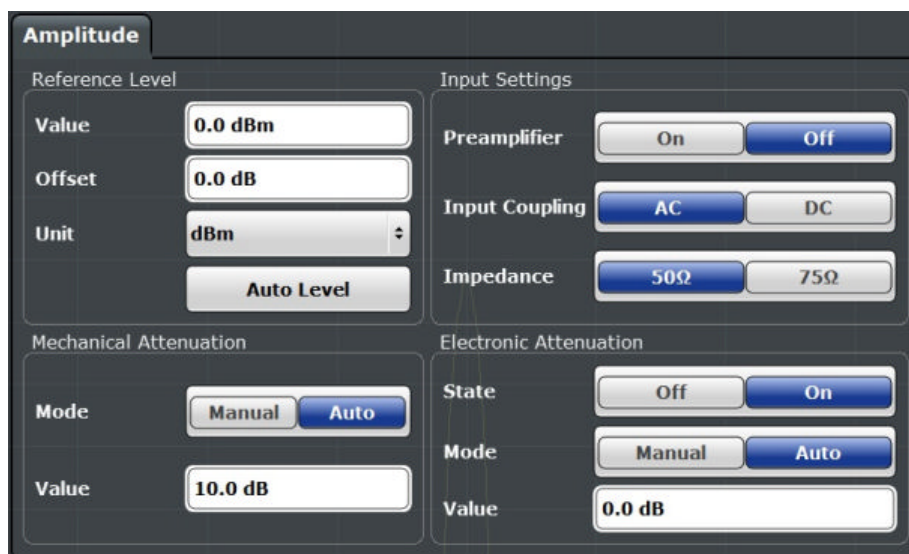
Reference Level

Defines the expected maximum reference level. Signal levels above this value may not be measured correctly, which is indicated by the "IFOVL" status display.

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 R&S FSW hardware 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).

Note that the "Reference Level" value ignores the Shifting the Display (Offset). It is important to know the actual power level the R&S FSW must handle.

SCPI command:
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel on page 149

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

Defines an arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the y-axis is changed accordingly.

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

Note, however, that the Reference Level value ignores the "Reference Level Offset". It is important to know the actual power level the R&S FSW must handle.

To determine the required offset, consider the external attenuation or gain applied to the input signal. A positive value indicates that an attenuation took place (R&S FSW increases the displayed power values) , a negative value indicates an external gain (R&S FSW decreases the displayed power values).

The setting range is ±200 dB in 0.01 dB steps.

SCPI command:
DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel:OFFSet on page 149

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 and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized.

In order to do so, a level measurement is performed to determine the optimal reference level.

You can change the measurement time for the level measurement if necessary (see "Changing the Automatic Measurement Time (Meastime Manual)" on page 88).

SCPI command:
[SENSe:]ADJust:LEVel on page 173

RF Attenuation

Defines the attenuation applied to the RF input.

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

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 (Option B25) is not available, mechanical attenuation is applied.

This function is not available for input from the **Digital Baseband Interface (R&S FSW-B17)**.

In "Manual" mode, you can set the RF attenuation in 1 dB steps (down to 0 dB, also using the rotary knob). 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.

SCPI command:

INPut:ATTenuation on page 151

INPut:ATTenuation:AUTO on page 151

Using Electronic Attenuation (Option B25)

If option R&S FSW-B25 is installed, you can also activate an electronic attenuator.

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

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

Note: Electronic attenuation is not available for stop frequencies (or center frequencies in zero span) >13.6 GHz.
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, automatic attenuation can be taken over by the mechanical attenuation, if possible.

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.

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.

SCPI command:

INPut:EATT:STATe on page 152

INPut:EATT:AUTO on page 152

INPut:EATT on page 152

Input Settings

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

The parameters "Input Coupling" and "Impedance" are identical to those in the "Input" settings, see chapter 5.2.4.1, "Input Settings", on page 57.

Preamplifier (option B24) ← Input Settings

If option R&S FSW-B24 is installed, a preamplifier can be activated for the RF input signal.

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

For R&S FSW 26 models, the input signal is amplified by 30 dB if the preamplifier is activated.

For R&S FSW 8 or 13 models, the following settings are available:

"Off"   Deactivates the preamplifier.

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

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

SCPI command:

INPut:GAIN:STATe on page 150

INPut:GAIN[:VALue] on page 150

5.2.5.3 Y-Axis Scaling

The vertical axis scaling is configurable. In Code Domain Analysis, the y-axis usually displays the measured power levels.
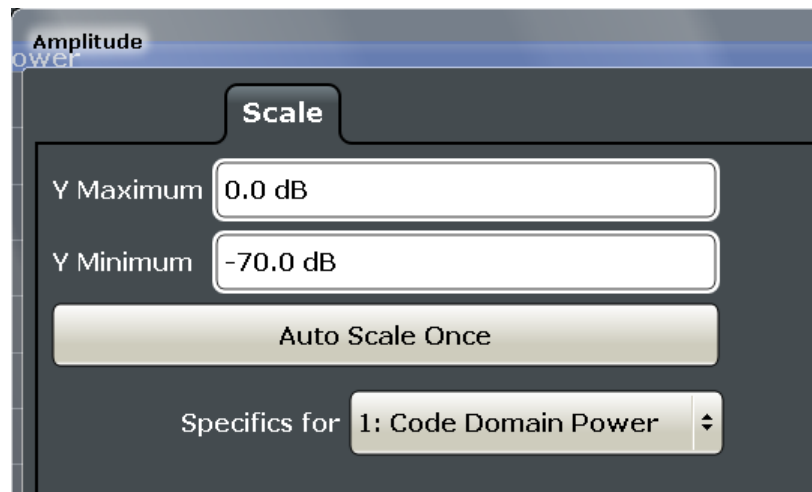
Y-Maximum, Y-Minimum
Defines the amplitude range to be displayed on the y-axis of the evaluation diagrams.

SCPI command:

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:MAXimum on page 148

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:MINimum on page 149

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.

SCPI command:

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:AUTO ONCE on page 148

5.2.6 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".
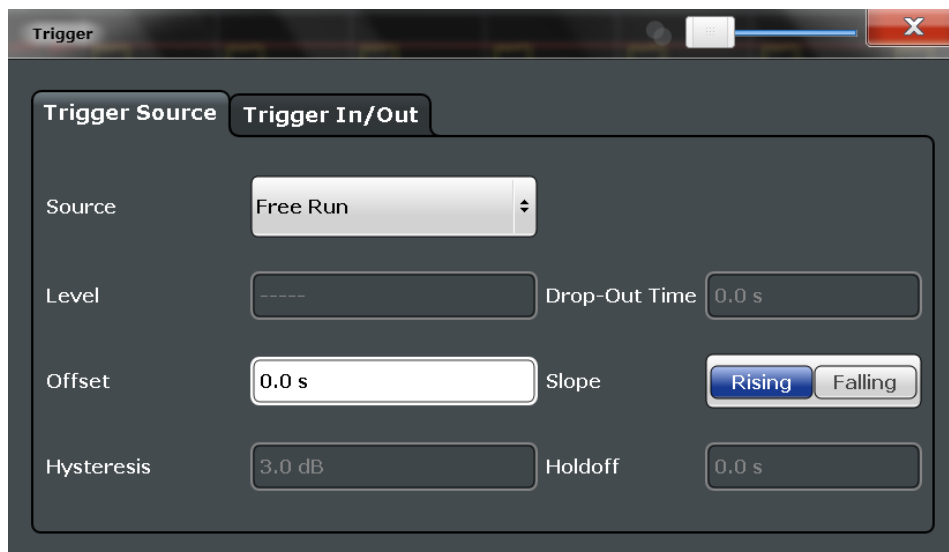
External triggers from one of the TRIGGER INPUT/OUTPUT connectors on the R&S FSW are configured in a separate tab of the dialog box.

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

Trigger Source

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.

Note: When triggering is activated, the squelch function is automatically disabled.

SCPI command:

TRIGger[:SEQuence]:SOURce on page 157

Free Run ← Trigger Source ← Trigger Source

No tirgger source is considered. Data acquisition is started manually or automatically and continues until stopped explicitely.

SCPI command:

TRIG:SOUR IMM, see TRIGger[:SEQuence]:SOURce on page 157

RF Power ← Trigger Source ← Trigger Source

Defines triggering of the measurement via signals which are outside the displayed measurement range.

For this purpose the instrument uses a level detector at the first intermediate frequency. The input signal must be in the frequency range between 500 MHz and 8 GHz. The resulting trigger level at the RF input depends on the RF attenuation and preamplification. For details on available trigger levels see the data sheet.

Note: If the input signal contains frequencies outside of this range (e.g. for fullspan measurements), the sweep may be aborted and a message indicating the allowed input frequencies is displayed in the status bar.

A "Trigger Offset", "Trigger Polarity" and "Trigger Holdoff" (to improve the trigger stability) can be defined for the RF trigger, but no "Hysteresis".

This trigger source is not available for input from the Digital Baseband Interface (R&S FSW-B17). If the trigger source "RF Power" is selected and digital I/Q input is activated, the trigger source is automatically switched to "Free Run".

SCPI command:

TRIG:SOUR RFP, see TRIGger[:SEQuence]:SOURce on page 157

IQ Power ← Trigger Source ← Trigger Source

Triggers the measurement when the magnitude of the sampled I/Q data exceeds the trigger threshold.

SCPI command:
TRIG:SOUR IQP, see TRIGger[:SEQuence]:SOURce on page 157

Digital IQ ← Trigger Source ← Trigger Source

For applications that process I/Q data, such as the I/Q Analyzer or optional applications, and only if the Digital Baseband Interface (R&S FSW-B17) is available:

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

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

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

Table 5-2: Assignment of general purpose bits to LVDS connector pins

Bit	LVDS pin
GP0	SDATA4_P - Trigger1
GP1	SDATA4_P - Trigger2
GP2	SDATA0_P - Reserve1
GP3	SDATA4_P - Reserve2
GP4	SDATA0_P - Marker1
GP5	SDATA4_P - Marker2

SCPI command:
TRIG:SOUR GP0, see TRIGger[:SEQuence]:SOURce on page 157

Trigger Level ← Trigger Source

Defines the trigger level for the specified trigger source.

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

SCPI command:
TRIGger[:SEQuence]:LEVel[:EXTernal<port>] on page 155
TRIGger[:SEQuence]:LEVel:BBPower on page 155

Drop-Out Time ← Trigger Source

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

SCPI command:
TRIGger[:SEQuence]:DTIMe on page 154

Trigger Offset ← Trigger Source

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

offset > 0:	Start of the sweep is delayed
offset < 0:	Sweep starts earlier (pre-trigger)

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

SCPI command:
TRIGger[:SEQuence]:HOLDoff[:TIME] on page 154

Hysteresis ← Trigger Source

Defines the distance in dB to the trigger level that the trigger source must exceed before a trigger event occurs. Settting 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 RF measurements.

SCPI command:
TRIGger[:SEQuence]:IFPower:HYSTeresis on page 155

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.

SCPI command:
TRIGger[:SEQuence]:IFPower:HOLDoff on page 154

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.

SCPI command:
TRIGger[:SEQuence]:SLOPe on page 157

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. The offset must be a positive value, as the application can only analyze data that is contained in the capture buffer.

SCPI command:
[SENS:]MSRA:CAPTure:OFFSet on page 223

Trigger 2/3

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

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

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

(Trigger 1 is INPUT only.)

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

"Input"   The signal at the connector is used as an external trigger source by the R&S FSW. No further trigger parameters are available for the connector.

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

SCPI command:

OUTPut:TRIGger<port>:LEVel on page 159

OUTPut:TRIGger<port>:DIRection on page 159

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

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

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

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

SCPI command:

OUTPut:TRIGger<port>:OTYPe on page 160

Level ← Output Type ← Trigger 2/3
Defines whether a constant high (1) or low (0) signal is sent to the output connector.

SCPI command:

OUTPut:TRIGger<port>:LEVel on page 159

Pulse Length ← Output Type ← Trigger 2/3
Defines the length of the pulse sent as a trigger to the output connector.

SCPI command:

OUTPut:TRIGger<port>:PULSe:LENGth on page 161

Send Trigger ← Output Type ← Trigger 2/3
Sends a user-defined trigger to the output connector immediately. Note that the trigger pulse level is always opposite to the constant signal level defined by the output "Level" setting, 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.
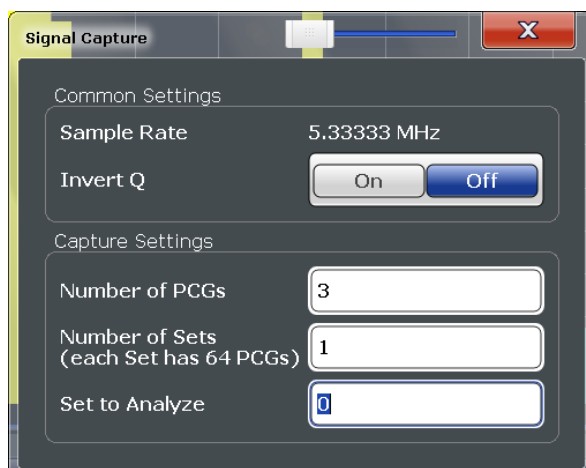
Which pulse level will be sent is indicated by a graphic on the button.

SCPI command:

OUTPut:TRIGger<port>:PULSe:IMMediate on page 160

5.2.7 Signal Capture (Data Acquisition)

You must define 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 cdma2000 BTS application in MSRA mode define the **application data** (see chapter 5.2.8, "Application Data (MSRA) ", on page 76).
>
> For details on the MSRA operating mode see the R&S FSW MSRA User Manual.

Sample Rate

The sample rate is always 5.33333 MHz (indicated for reference only).

Invert Q

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

SCPI command:

[SENSe:]CDPower:QINVert on page 162

Number of PCGs

Sets the number of PCGs you want to analyze. The input value is always in multiples of the PCGs. The maximum capture length is 64. The default value is 3.

If the "Number of Sets" on page 76 to capture is larger than 1, the number of PCGs is always 64.

For more information on PCGs and sets see chapter 4.1, "PCGs and Sets", on page 34.

SCPI command:

[SENSe:]CDPower:IQLength on page 161

Number of Sets

Defines the number of consecutive sets to be captured and stored in the instrument's IQ memory. The possible value range is from 1 to a maximum of 1500 (BTS mode) or 810 (MS mode) sets.

The default setting is 1. If you capture more than one set, the number of slots/PCGs is always 64 (cdma2000 BTS mode: 32) and is not available for modification.

SCPI command:

[SENSe:]CDPower:SET:COUNt on page 162

Set to Analyze

Selects a specific set for further analysis. The value range is between 0 and "Number of Sets" on page 76 – 1.

SCPI command:

[SENSe:]CDPower:SET on page 174

5.2.8 Application Data (MSRA)

For the cdma2000 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 "Number of Sets" on page 76).

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 cdma2000 BTS measurement (see "Capture Offset" on page 73).

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

5.2.9 Channel Detection

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

5.2.9.1 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".
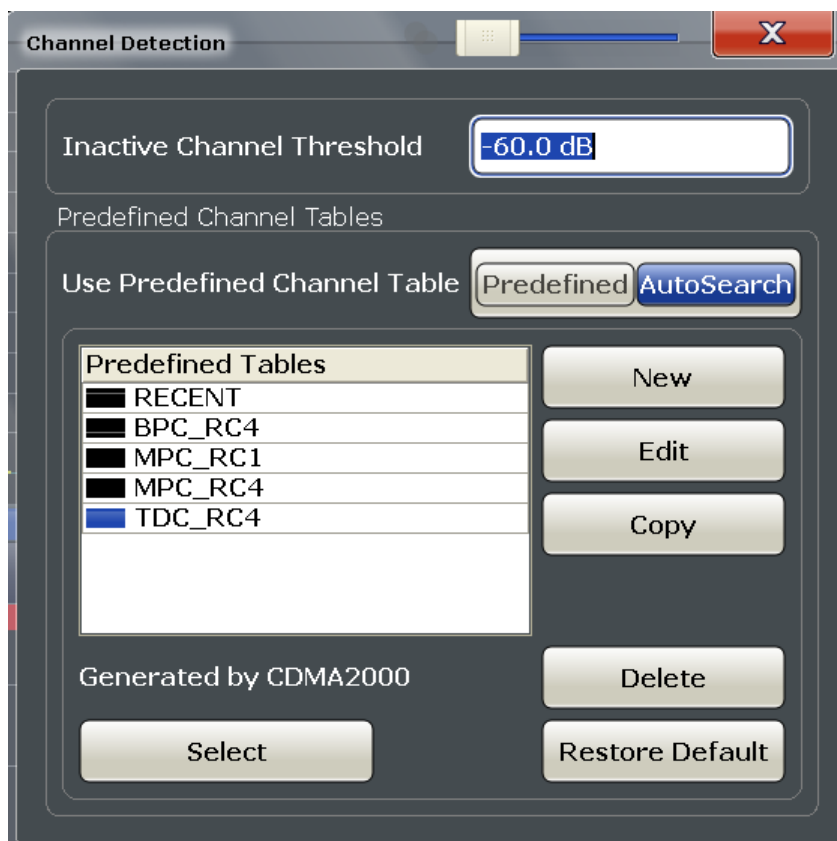
Inactive Channel Threshold
Defines the minimum power that a single channel must have compared to the total signal in order to be recognized as an active channel.

The default value is -60 dB. With this value all channels with signals such as the cdma2000 test models are detected by the Code Domain Power analysis. Decrease the Inactive Channel Threshold value, if not all channels contained in the signal are detected.

SCPI command:
[SENSe:]CDPower:ICTReshold on page 164

Using Predefined Channel Tables
Defines the channel search mode.

"Predefined"   Compares the input signal to the predefined channel table selected in the "Predefined Tables" list

"Auto"   Detects channels automatically using pilot sequences and fixed code numbers

The automatic search provides an overview of the channels contained in the currently measured signal. If channels are not detected as being active, change the Inactive Channel Threshold or select the "Predefined" channel search mode.

SCPI command:
CONFigure:CDPower[:BTS]:CTABle[:STATe] on page 166

5.2.9.2 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".

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

For details on predefined channel tables provided by the cdma2000 applications see chapter A.1, "Reference: Predefined Channel Tables", on page 228.

The following channel tables are available by default:

"RECENT"

Contains the most recently selected channel table

"BPC_RC4, MPC_RC1, MPC_RC4, TDC_RC4"

Channel tables for BTS mode; configured according to a specific radio configuration

"EACHOP, RCCCHOP, RTCHOP3, RTCHOP5"

Channel tables for MS mode; configured according to a specific radio configuration

SCPI command:
CONFigure:CDPower[:BTS]:CTABle:CATalog? on page 164

Selecting a Table
Selects the channel table currently focussed in the "Predefined Tables" list and compares it to the measured signal to detect channels.

SCPI command:
CONFigure:CDPower[:BTS]:CTABle:SELect on page 166

Creating a New Table

Creates a new channel table. For a description of channel table settings and functions see chapter 5.2.9.3, "Channel Table Settings and Functions", on page 80.

For step-by-step instructions on creating a new channel table, see "To define or edit a channel table" on page 109.

SCPI command:

CONFigure:CDPower[:BTS]:CTABle:NAME on page 169

Editing a Table

You can edit existing channel table definitions. The details of the selected channel are displayed in the "Channel Table" dialog box.

Copying a Table

Copies an existing channel table definition. The details of the selected channel are displayed in the "Channel Table" dialog box.

SCPI command:

CONFigure:CDPower[:BTS]:CTABle:COPY on page 165

Deleting a Table

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

SCPI command:

CONFigure:CDPower[:BTS]:CTABle:DELete on page 165

Restoring Default Tables

Restores the predefined channel tables delivered with the instrument.

SCPI command:

CONFigure:CDPower[:BTS]:CTABle:RESTore on page 166

5.2.9.3 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.

For details on channel table entries see chapter 5.2.9.4, "Channel Details (BTS Mode)", on page 81 or chapter 5.2.9.5, "Channel Details (MS Mode)", on page 83.

Name

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

SCPI command:

CONFigure:CDPower[:BTS]:CTABle:NAME on page 169

Comment

Optional description of the channel table.

SCPI command:

CONFigure:CDPower[:BTS]:CTABle:COMMent on page 167

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.

SCPI command:

CONFigure:CDPower[:BTS]:MEASurement on page 129

Sorting the Table

Sorts the channel table entries.

Cancelling the Configuration

Closes the "Channel Table" dialog box without saving the changes.

Saving the Table

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

5.2.9.4 Channel Details (BTS Mode)

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.

Channel Type

Type of channel according to cdma2000 standard. For a list of possible channel types see chapter 4.8.1, "BTS Channel Types", on page 41 or chapter 4.8.2, "MS Channel Types", on page 42.

SCPI command:
BTS mode: `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 167
MS mode: `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 168

Channel Number (Ch. SF)

Number of channel spreading code (0 to [spreading factor-1])

SCPI command:
BTS mode: `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 167
MS mode: `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 168

Symbol Rate

Symbol rate at which the channel is transmitted.

RC

The Radio Configuration (RC) can be customized for two channel types. For the PDCH you can set the configuration to either 10 (QPSK), 10 (8PSK) or 10 (16QAM). For CHAN channels, you can set the radio configuration to 1-2 or 3-5.

For details on radio configurations see chapter 4.6, "Radio Configuration", on page 39.

Power
Contains the measured relative code domain power. The unit is dB. The fields are filled with values after you press the "Meas" button (see "Creating a New Channel Table from the Measured Signal (Measure Table)" on page 81).

SCPI command:
BTS mode: CONFigure:CDPower[:BTS]:CTABle:DATA on page 167
MS mode: CONFigure:CDPower[:BTS]:CTABle:DATA on page 168

Status
Indicates the channel status. Codes that are not assigned are marked as inactive channels.

SCPI command:
BTS mode: CONFigure:CDPower[:BTS]:CTABle:DATA on page 167
MS mode: CONFigure:CDPower[:BTS]:CTABle:DATA on page 168

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

5.2.9.5 Channel Details (MS Mode)

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.

Channel Type

Type of channel according to cdma2000 standard. For a list of possible channel types see chapter 4.8.1, "BTS Channel Types", on page 41 or chapter 4.8.2, "MS Channel Types", on page 42.

SCPI command:
BTS mode: `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 167
MS mode: `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 168

Channel Number (Ch. SF)

Number of channel spreading code (0 to [spreading factor-1])

SCPI command:
BTS mode: `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 167
MS mode: `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 168

Symbol Rate

Symbol rate at which the channel is transmitted.

Mapping

Branch onto which the channel is mapped (I or Q). The setting is not editable, since the standard specifies the channel assignment for each channel.

For more information see chapter 4.5, "Code Mapping and Branches", on page 38.

SCPI command:

[SENSe:]CDPower:MAPPing on page 174

Power

Contains the measured relative code domain power. The unit is dB. The fields are filled with values after you press the "Meas" button (see "Creating a New Channel Table from the Measured Signal (Measure Table)" on page 81).

SCPI command:

BTS mode: CONFigure:CDPower[:BTS]:CTABle:DATA on page 167

MS mode: CONFigure:CDPower[:BTS]:CTABle:DATA on page 168

Status

Indicates the channel status. Codes that are not assigned are marked as inactive channels.

SCPI command:
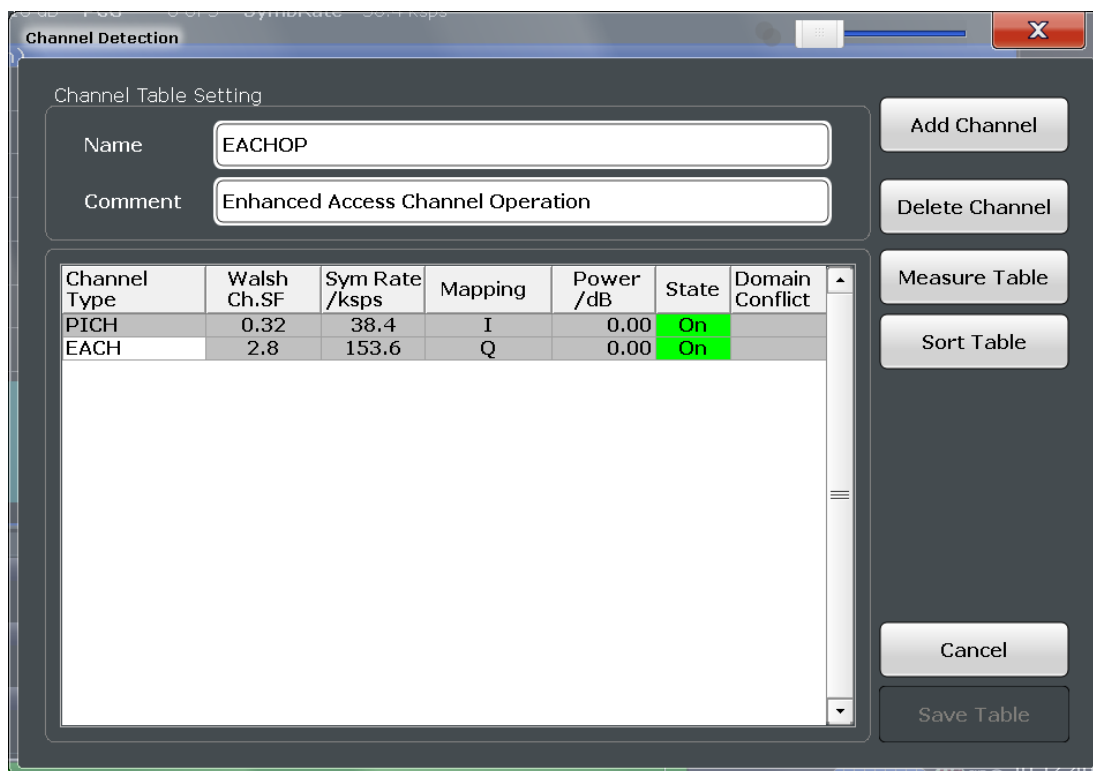
BTS mode: CONFigure:CDPower[:BTS]:CTABle:DATA on page 167

MS mode: CONFigure:CDPower[:BTS]:CTABle:DATA on page 168

Domain Conflict

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

5.2.10 Sweep Settings

The sweep settings define how the data is measured.

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.

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

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

SCPI command:

[SENSe:]SWEep:COUNt on page 170

[SENSe:]AVERage<n>:COUNt on page 170

Continuous Sweep/RUN CONT

After triggering, starts the sweep and repeats it continuously until stopped. This is the default setting.

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

Note: Sequencer. If the Sequencer is active, the "Continuous Sweep" softkey only controls the sweep mode for the currently selected channel; however, the sweep mode only 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 on the front panel controls the Sequencer, not individual sweeps. RUN CONT starts the Sequencer in continuous mode.

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

SCPI command:
INITiate:CONTinuous on page 189

Single Sweep/ RUN SINGLE

After triggering, starts the number of sweeps set in "Sweep Count". The measurement stops after the defined number of sweeps has been performed.

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

Note: Sequencer. If the Sequencer is active, the "Single Sweep" softkey only controls the sweep mode for the currently selected channel; however, the sweep mode only has an effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in single sweep mode is swept only once by the Sequencer.
Furthermore, the RUN SINGLE key on the front panel controls the Sequencer, not individual sweeps. RUN SINGLE starts the Sequencer in single mode.

If the Sequencer is off, only the evaluation for the currently displayed measurement channel is updated.

SCPI command:
INITiate[:IMMediate] on page 190

Continue Single Sweep

After triggering, repeats the number of sweeps set in "Sweep Count", without deleting the trace of the last measurement.

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

SCPI command:
INITiate:CONMeas on page 189

5.2.11 Automatic Settings

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

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, cdma2000 applications cannot perform data acquisition in MSRA operating mode.

Adjusting all Determinable Settings Automatically (Auto All)
Activates all automatic adjustment functions for the current measurement settings.

This includes:

*   "Setting the Reference Level Automatically (Auto Level)" on page 67
*   "Auto Scale All" on page 88

SCPI command:
[SENSe:]ADJust:ALL on page 171

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 and the preamplifier are adjusted so the signal-to-noise ratio is optimized, while signal compression, clipping and overload conditions are minimized.

In order to do so, a level measurement is performed to determine the optimal reference level.

You can change the measurement time for the level measurement if necessary (see "Changing the Automatic Measurement Time (Meastime Manual)" on page 88).

SCPI command:
[SENSe:]ADJust:LEVel on page 173

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.

Resetting the Automatic Measurement Time (Meastime Auto)

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

SCPI command:

[SENSe:]ADJust:CONFigure:DURation:MODE on page 172

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.

SCPI command:

[SENSe:]ADJust:CONFigure:DURation:MODE on page 172

[SENSe:]ADJust:CONFigure:DURation on page 171

Upper Level Hysteresis

When the reference level is adjusted automatically using the Setting the Reference Level Automatically (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.

SCPI command:

[SENSe:]ADJust:CONFiguration:HYSTeresis:UPPer on page 173

Lower Level Hysteresis

When the reference level is adjusted automatically using the Setting the Reference Level Automatically (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.

SCPI command:

[SENSe:]ADJust:CONFiguration:HYSTeresis:LOWer on page 172

5.2.12 Zoom Functions

The zoom functions are only available from the toolbar.

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.

SCPI command:

DISPlay[:WINDow<n>]:ZOOM:STATe on page 187

DISPlay[:WINDow<n>]:ZOOM:AREA on page 186

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.

SCPI command:

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe on page 188

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:AREA on page 187

Restore Original Display

Restores the original display and closes all zoom windows.

SCPI command:

DISPlay[:WINDow<n>]:ZOOM:STATe on page 187 (single zoom)

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe on page 188 (for each multiple zoom window)

Deactivating Zoom (Selection mode)

Deactivates zoom mode; tapping the screen no longer invokes a zoom, but selects an object.

SCPI command:

DISPlay[:WINDow<n>]:ZOOM:STATe on page 187 (single zoom)

DISPlay[:WINDow<n>]:ZOOM:MULTiple<zoom>:STATe on page 188 (for each multiple zoom window)

5.3 RF Measurements

cdma2000 measurements require a special application on the R&S FSW, which you activate using the MODE key on the front panel.

When you activate a cdma2000 application, Code Domain Analysis of the input signal is started automatically. However, the cdma2000 applications also provide various RF measurement types.

Selecting the measurement type

► To seler konnte sich ect an RF measurement type, do one of the following:

- Tap the "Overview" softkey. In the "Overview", tap the "Select Measurement" button. Select the required measurement.
- Press the MEAS key on the front panel. In the "Select Measurement" dialog box, select the required measurement.

Some parameters are set automatically according to the cdma2000 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 "Measurements" in the R&S FSW User Manual.

The measurement-specific settings for the following measurements are available via the "Overview".

5.3.1 Signal Channel Power Measurements

The Power measurement determines the cdma2000 signal channel power.

To do so, the RF signal power of a single channel is analyzed with 1.2288 MHz bandwidth over a single trace. The displayed results are based on the root mean square. The bandwidth and the associated channel power are displayed in the Result Summary.

In order to determine the signal channel power, the cdma2000 application performs a Channel Power measurement as in the Spectrum application with the following settings:

Table 5-3: Predefined settings for cdma2000 Output Channel Power measurements

Setting	Default Value
ACLR Standard	cdma2000 MC1
Number of adjacent channels	0
Frequency Span	2 MHz

For further details about the Power measurement refer to "Channel Power and Adjacent-Channel Power (ACLR) Measurements" in the R&S FSW User Manual.

5.3.2 Channel Power (ACLR) Measurements

The Adjacent Channel Power measurement analyzes the power of the TX channel and the power of adjacent and alternate channels on the left and right side of the TX channel. The number of TX channels and adjacent channels can be modified as well as the band class. The bandwidth and power of the TX channel and the bandwidth, spacing and power of the adjacent and alternate channels are displayed in the Result Summary.

Channel Power ACLR measurements are performed as in the Spectrum application with the following predefined settings according to cdma2000 specifications (adjacent channel leakage ratio).

Table 5-4: Predefined settings for cdma2000 ACLR Channel Power measurements

Setting	Default value
Bandclass	0: 800 MHz Cellular
Number of adjacent channels	2

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

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

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

The main measurement menus for the RF measurements are identical to the Spectrum application. However, for ACLR and SEM measurements in cdma2000 applications, an additional softkey is available to select the required bandclass.

Bandclass

The bandclass defines the frequency band used for ACLR and SEM measurements. It also determines the corresponding limits and ACLR channel settings according to the cdma2000 standard.

For an overview of supported bandclasses and their usage see chapter A.3, "Reference: Supported Bandclasses", on page 234.

SCPI command:
CONFigure:CDPower[:BTS]:BCLass|BANDclass on page 178

5.3.3 Spectrum Emission Mask

The Spectrum Emission Mask measurement shows the quality of the measured signal by comparing the power values in the frequency range near the carrier against a spectral mask that is defined by the cdma2000 specifications. The limits depend on the selected

bandclass. In this way, the performance of the DUT can be tested and the emissions and their distance to the limit be identified.

Note that the cdma2000 standard does not distinguish between spurious and spectral emissions.

The Result Summary contains a peak list with the values for the largest spectral emissions including their frequency and power.

The cdma2000 applications perform the SEM measurement as in the Spectrum application with the following settings:

Table 5-5: Predefined settings for cdma2000 SEM measurements

Bandclass	0: 800 MHz Cellular
Span	-4 MHz to +1.98 MHz
Number of ranges	5
Fast SEM	ON
Sweep time	100 ms
Number of power classes	3
Power reference type	Channel power

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

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 for the RF measurements are identical to the Spectrum application. However, for ACLR and SEM measurements, an additional softkey is available to select the required bandclass.

Bandclass

The bandclass defines the frequency band used for ACLR and SEM measurements. It also determines the corresponding limits and ACLR channel settings according to the cdma2000 standard.

For an overview of supported bandclasses and their usage see chapter A.3, "Reference: Supported Bandclasses", on page 234.

SCPI command:
CONFigure:CDPower[:BTS]:BCLass|BANDclass on page 178

5.3.4 Occupied Bandwidth

The Occupied Bandwidth measurement is performed as in the Spectrum application with default settings.

Table 5-6: Predefined settings for cdma2000 OBW measurements

Setting	Default value
% Power Bandwidth	99 %
Channel bandwidth	1.2288 MHz

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.

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

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

● Reference level and reference level offset

● RBW, VBW

● Sweep time

● Span

5.3.5 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 zero span, and the distribution of the signal amplitudes is evaluated.

The measurement is useful to determine errors of linear amplifiers. The crest factor is defined as the ratio of the peak power and the mean power. The Result Summary displays the number of included samples, the mean and peak power and the crest factor.

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

Table 5-7: Predefined settings for cdma2000 CCDF measurements

CCDF	Active on trace 1
Analysis bandwidth	10 MHz
Number of samples	62500
VBW	5 MHz

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

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

● Reference level and reference level offset

● Analysis bandwidth

● Number of samples

6 Analysis

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

The remote commands required to perform these tasks are described in chapter 10.9, "General Analysis", on page 213.

Analyzing RF Measurements

General result analysis settings concerning the trace, markers, lines etc. for RF measurements are identical to the analysis functions in the Spectrum application except for some special marker functions and spectrograms, which are not available in cdma2000 applications.

For details see the "General Measurement Analysis and Display" chapter in the R&S FSW User Manual.

6.1 Code Domain Analysis Settings

Some evaluations provide further settings for the results. The settings for CDA measurements are described here.
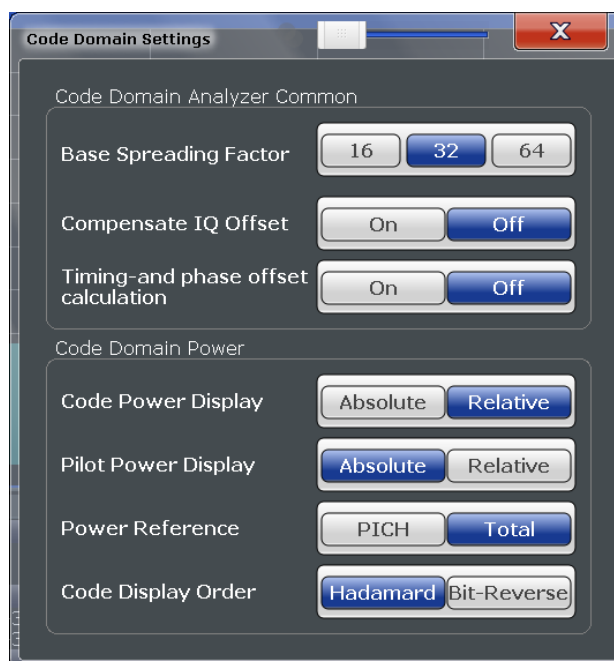
Base Spreading Factor

Changes the base spreading factor, which also changes the scale for code-based result displays. If you set the base spreading factor too low (e.g. to 64 for channels with a base spreading factor of 128 = code class 7), an alias power is displayed in the Code Domain Power and Code Domain Error Power diagrams.

For more information see chapter 4.3, "Code Display and Sort Order", on page 36.

SCPI command:

[SENSe:]CDPower:SFACtor on page 177

Compensate IQ Offset

If enabled, the I/Q offset is eliminated from the measured signal.

SCPI command:

[SENSe:]CDPower:NORMalize on page 175

Timing and phase offset calculation

Activates or deactivates the timing and phase offset calculation of the channels to the pilot channel. If deactivated, or if more than 50 active channels are in the signal, the calculation does not take place and dashes are displayed instead of values as results.

SCPI command:

[SENSe:]CDPower:TPMeas on page 177

Code Power Display

For "Code Domain Power" evaluation:

Defines whether the absolute power or the power relative to the chosen reference (in BTS mode: relative to total power) is displayed.

SCPI command:

[SENSe:]CDPower:PDISplay on page 176

Pilot Power Display (MS mode only)

For "Code Domain Power" evaluation in MS mode only:

Defines whether the absolute power or the power relative to the chosen reference is displayed for the pilot channel.

SCPI command:

[SENSe:]CDPower:PPReference on page 176

Power Reference

For "Code Domain Power" evaluation in MS mode only:

Defines the reference for relative power display.

"Total"   Relative to the total signal power

"PICH"   Relative to the power of the PICH

SCPI command:

[SENSe:]CDPower:PREFerence on page 176

Code Display Order

Defines the sorting of the channels for the Code Domain Power and Code Domain Error result displays.

For further details on the code order refer to chapter 4.3, "Code Display and Sort Order", on page 36 and chapter A.2, "Reference: Code Tables", on page 231.

"Hadamard"   By default, the codes are sorted in Hadamard order, i.e. in ascending order.
                  The power of each code is displayed; there is no visible distinction between channels. If a channel covers several codes, the display shows the individual power of each code.

"Bit-Reverse"   Bundles the channels with concentrated codes, i.e. all codes of a channel are next to one another. Thus you can see the total power of a concentrated channel.

SCPI command:

[SENSe:]CDPower:ORDer on page 175

6.2 Evaluation Range

The evaluation range defines which channel (Code Number), PCG or set is analyzed in the result display.

For cdma2000 MS measurements, the branch to be analyzed can also be defined.
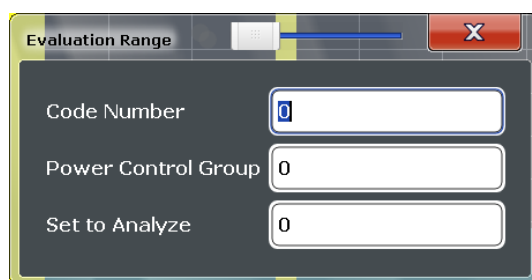
Code Number

Selects a code for the following evaluations (see also chapter 3.1.2, "Evaluation Methods for Code Domain Analysis", on page 16):

● Bitstream
● Code Domain Power

- Code Domain Error Power
- Peak Code Domain Error
- Power vs PCG
- Power vs Symbol
- Result Summary
- Symbol Constellation
- Symbol EVM

The specified code is selected and marked in red.

For details on how specific codes are displayed see chapter 4.3, "Code Display and Sort Order", on page 36.

SCPI command:

[SENSe:]CDPower:CODE on page 173

Power Control Group

Selects a PCG for the following evaluations:

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

SCPI command:

[SENSe:]CDPower:SLOT on page 174

Set to Analyze

Selects a specific set for further analysis. The value range is between 0 and "Number of Sets" on page 76 – 1.

SCPI command:

[SENSe:]CDPower:SET on page 174

Branch (MS mode only)

Switches between the evaluation of the I and the Q branch in MS measurements.
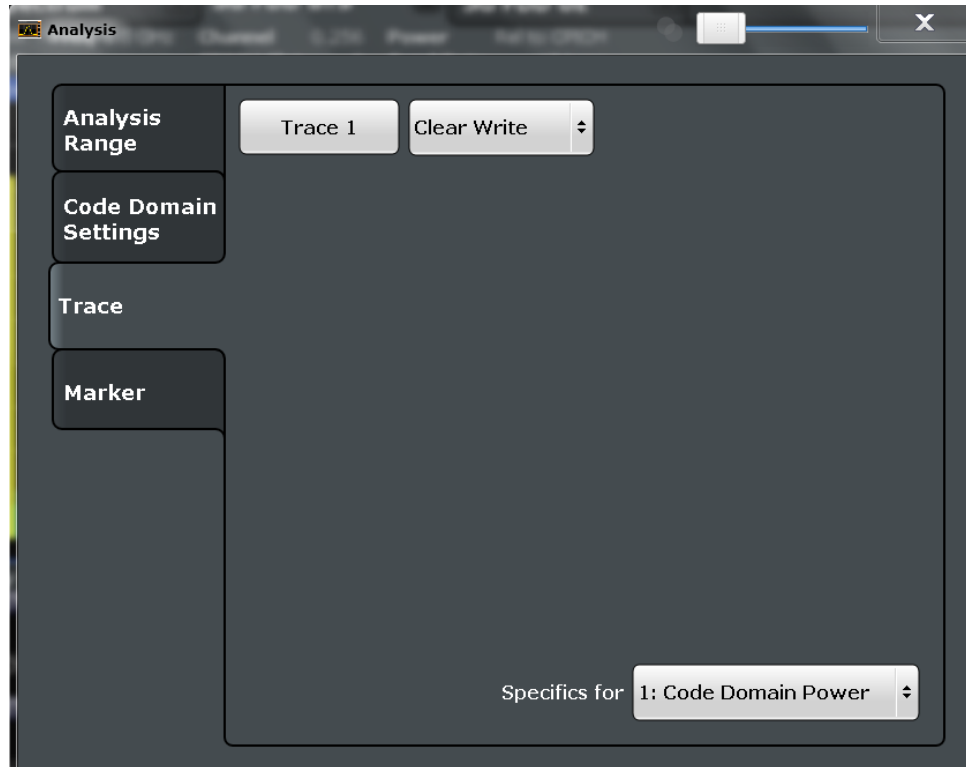
This affects the following evaluations:

- Code Domain Power
- Code Domain Error Power
- Peak Code Domain Error
- Power vs PCG
- Result Summary

SCPI command:

[SENSe:]CDPower:MAPPing on page 174

6.3 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 sweep. This is the default setting.
The "Detector" is automatically set to "Auto Peak".

"Max Hold"   The maximum value is determined over several sweeps and displayed. The R&S FSW saves the sweep result in the trace memory only if the new value is greater than the previous one.
The "Detector" is automatically set to "Positive Peak".

"Min Hold"   The minimum value is determined from several measurements and displayed. The R&S FSW saves the sweep result in the trace memory only if the new value is lower than the previous one.
The "Detector" is automatically set to "Negative Peak".

"Average"   The average is formed over several sweeps.
                 The Sweep/Average Count determines the number of averaging pro-
                 cedures.
                 The "Detector" is automatically set to "Sample".

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

"Blank"   Removes the selected trace from the display.

SCPI command:
DISPlay[:WINDow<n>]:TRACe<t>:MODE on page 213

6.4 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.

6.4.1 Individual Marker Settings

In CDA evaluations, up to 4 markers can be activated in each diagram at any time.
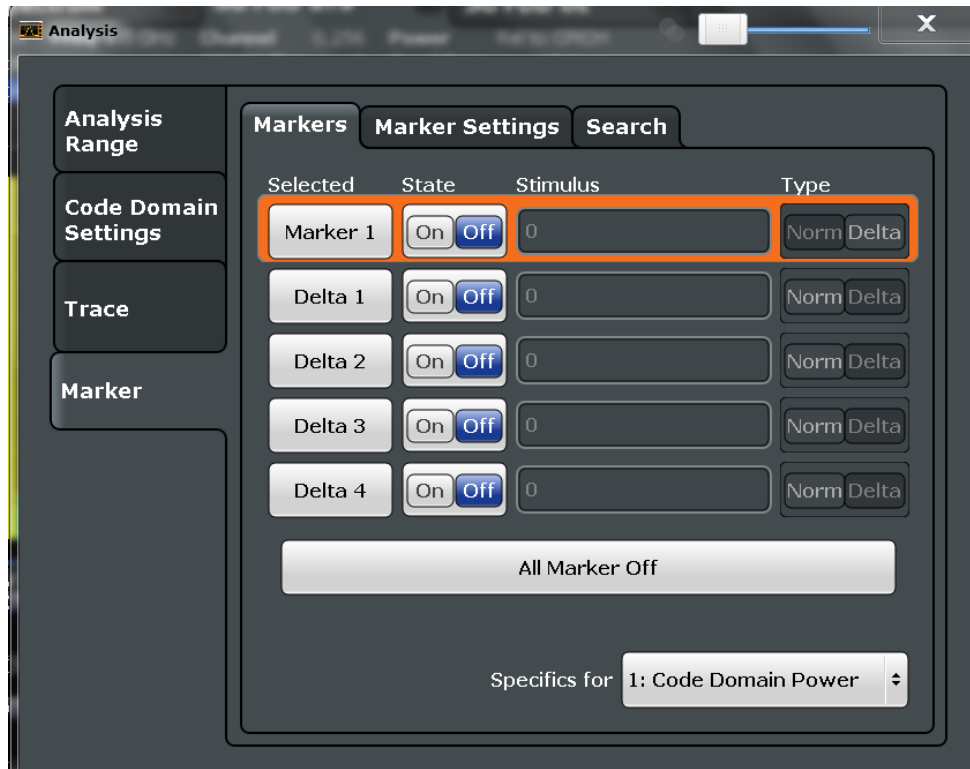
Select Marker
Opens a dialog box to select and activate or deactivate one or more markers quickly.

SCPI command:
Marker selected via suffix <m> in remote commands.

Selected Marker

Marker name. The marker which is currently selected for editing is highlighted orange.

SCPI command:
Marker selected via suffix <m> in remote commands.

Marker State

Activates or deactivates the marker in the diagram.

SCPI command:
CALCulate<n>:MARKer<m>[:STATe] on page 215
CALCulate<n>:DELTamarker<m>[:STATe] on page 216

Stimulus

Defines the position of the marker on the x-axis (channel, slot, symbol, depending on evaluation).

SCPI command:
CALCulate<n>:DELTamarker<m>:X on page 216
CALCulate<n>:MARKer<m>:X on page 215

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).

SCPI command:
CALCulate<n>:MARKer<m>[:STATe] on page 215

CALCulate<n>:DELTamarker<m>[:STATe] on page 216

All Markers Off
Deactivates all markers in one step.

SCPI command:
CALCulate<n>:MARKer<m>:AOFF on page 215

6.4.2 General Marker Settings

General marker settings are defined in the "Marker Config" tab of the "Marker" dialog box.
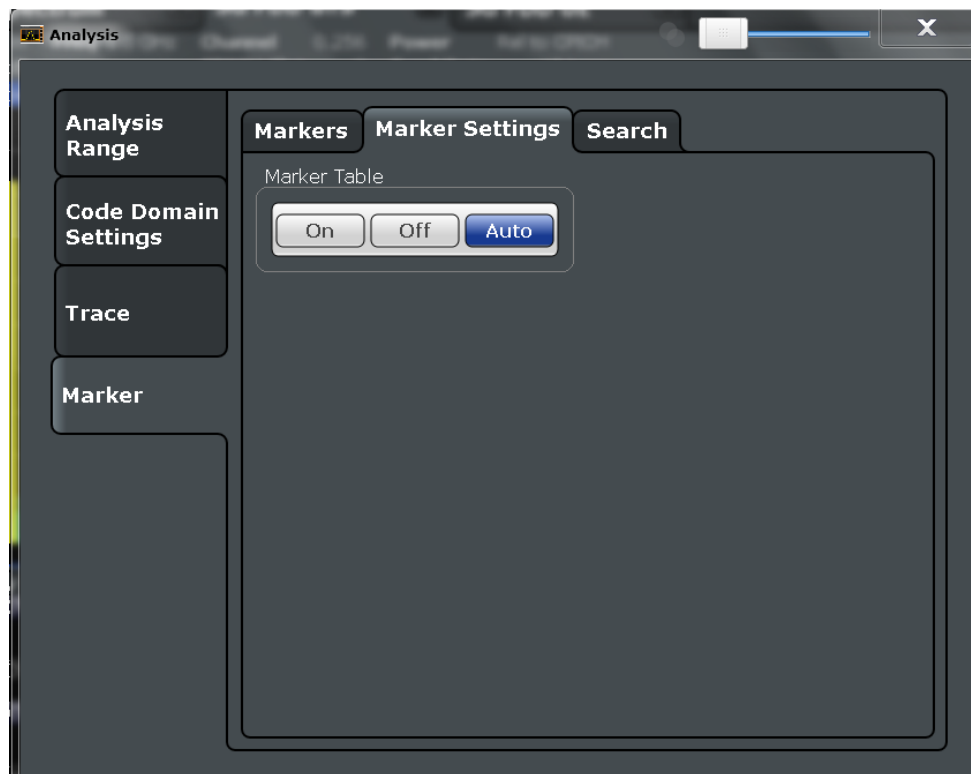
Marker Table Display
Defines how the marker information is displayed.

"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.

SCPI command:
DISPlay:MTABle on page 217

6.4.3 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.
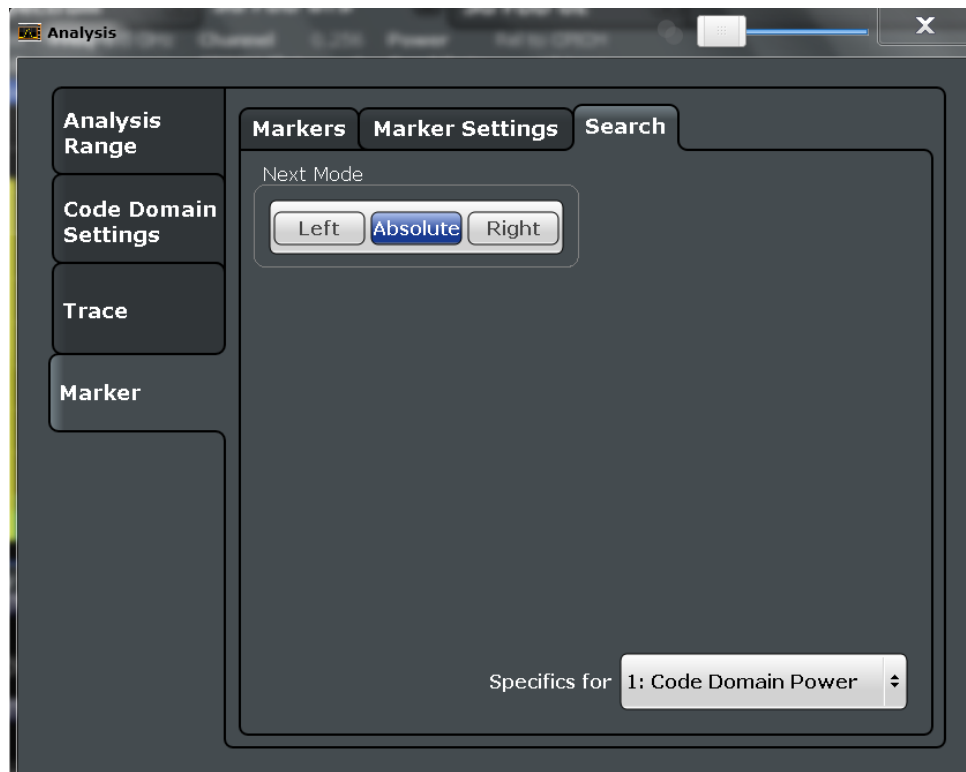
Search Mode for Next Peak
Selects the search mode for the next peak search.

"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.

SCPI command:

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT on page 220

CALCulate<n>:MARKer<m>:MAXimum:LEFT on page 219

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 220

CALCulate<n>:MARKer<m>:MAXimum:NEXT on page 219

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt on page 221

CALCulate<n>:MARKer<m>:MAXimum:RIGHt on page 219

CALCulate<n>:DELTamarker<m>:MINimum:LEFT on page 221

CALCulate<n>:MARKer<m>:MINimum:LEFT on page 220

CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 221

CALCulate<n>:MARKer<m>:MINimum:NEXT on page 220

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt on page 221

CALCulate<n>:MARKer<m>:MINimum:RIGHt on page 220

6.4.4 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.

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.

SCPI command:

CALCulate<n>:MARKer<m>:MAXimum:NEXT on page 219

CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 220

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.

SCPI command:

CALCulate<n>:MARKer<m>:MINimum:NEXT on page 220

CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 221

Peak Search

Sets the selected marker/delta marker to the maximum of the trace. If no marker is active, marker 1 is activated.

SCPI command:

CALCulate<n>:MARKer<m>:MAXimum[:PEAK] on page 219

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK] on page 221

Search Minimum

Sets the selected marker/delta marker to the minimum of the trace. If no marker is active, marker 1 is activated.

SCPI command:

CALCulate<n>:MARKer<m>:MINimum[:PEAK] on page 220

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK] on page 222

Marker To PICH

Sets the marker to the PICH channel.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:PICH on page 218

Marker To TDPICH

Sets the marker to the TDPICH channel.

SCPI command:

CALCulate<n>:MARKer<m>:FUNCtion:TDPIch on page 219

7 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 center frequency.
- Perform an automatic reference level adjustment.
- In BTS mode, when using an external trigger, check whether an external trigger signal is being sent to the R&S FSW. and check the "PN offset ".
- In MS mode, check the "Long Code Mask" and "Long Code Offset".
- Make sure "Invert Q" is off.

7.1 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 application-specific error messages for cdma2000 measurements 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, or signal description values are set incorrectly, or the input signal is invalid.
Sync OK	This message is displayed if synchronization is possible.

8 How to Perform Measurements in cdma2000 Applications

The following step-by-step instructions describe how to perform measurements with the cdma2000 applications.

To perform Code Domain Analysis

1. Press the MODE key on the front panel and select the "cdma2000 BTS" application for base station tests, or "cdma2000 MS" for mobile station tests.
   Code Domain Analysis of the input signal is performed by default.

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

3. Select the "Signal Description" button and configure the expected input signal.

4. Select the "Input/Frontend" button and then the "Frequency" tab to define the input signal's center frequency.

5. Optionally, select the "Trigger" button and define a trigger for data acquisition, for example an external trigger to start capturing data only when a useful signal is transmitted.

6. Select the "Signal Capture" button and define the acquisition parameters for the input signal.
   In MSRA mode, define the application data instead, see "To select the application data for MSRA measurements" on page 110.

7. Select the "Channel Detection" button and define how the individual channels are detected within the input signal. If necessary, define a channel table as described in "To define or edit a channel table" on page 109.

8. 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.

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

10. Select the "Analysis" button in the "Overview" to configure how the data is evaluated in the individual result displays.

    ● Select the set, PCG/slot or code to be evaluated.
    ● Configure specific settings for the selected evaluation method(s).
    ● Optionally, configure the trace to display the average over a series of sweeps. If necessary, increase the "Sweep/Average Count" in the "Sweep Config" dialog box.
    ● Configure markers and delta markers to determine deviations and offsets within the results, e.g. when comparing errors or peaks.

11. Start a new sweep with the defined settings.

In MSRA mode you may want to stop the continuous measurement mode by the Sequencer and perform a single data acquisition:

a) Select the Sequencer icon (⬛) from the toolbar.
b) Set the Sequencer state to "OFF".
c) Press the RUN SINGLE key.

To define or edit a channel table

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

1. From the main "Code Domain Analyzer" menu, select the "Channel Detection" softkey 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) Tap the existing channel table in the "Predefined Tables" list.
   b) Select the "Edit" button next to the "Predefined Tables" list.

3. In the "Channel Table" dialog box, define a name and, optionally, a comment that describes the channel table. The comment is displayed when you set the focus on the table in the "Predefined Tables" list.

4. Define the channels to be detected using one of the following methods:
   Select the "Measure Table" button to create a table that consists of the channels detected in the currently measured signal.
   Or:

   a) Select the "Add Channel" button to insert a row for a new channel below the currently selected row in the channel table.
   b) Define the channel specifications required for detection:

      ● Channel type
      ● Channel number and spreading factor used by the channel
      ● Symbol rate
      ● Which RC is used **(BTS mode only)**
      ● Which mapping is applied **(MS mode only)**
      ● The channel's code domain power (relative to the total signal power)
      ● The channel's state (active or inactive)

5. Select the "Save Table" button to store the channel table.

   The table is stored and the dialog box is closed. The new channel table is included in the "Predefined Tables" list in the "Channel Detection" dialog box.

6. To activate the use of the new channel table:

   a) Select the table in the "Predefined Tables" list.
   b) Tap the "Select" button.
      A checkmark is displayed next to the selected table.
   c) Toggle the "Use Predefined Channel Table" setting to "Predefined".

    d) Toggle the "Compare Meas Signal with Predefined Table" setting to "On".

    e) Start a new measurement.

To perform an RF measurement

1. Press the MODE key on the front panel and select the "cdma2000 BTS" application for base station tests, or "cdma2000 MS" 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 on the front panel.

   b) In the "Select Measurement" dialog box, select the required measurement.

   The selected measurement is activated with the default settings for cdma2000 immediately.

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

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

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

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

   ● Configure a trace to display the average over a series of sweeps; if necessary, increase the "Sweep Count" in the "Sweep" settings.

   ● Configure markers and delta markers to determine deviations and offsets within the evaluated signal.

   ● Use special marker functions to calculate noise or a peak list.

   ● Configure a limit check to detect excessive deviations.

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

   a) In the "Traces" tab of the "Analysis" dialog box, switch to the "Trace Export" tab.

   b) Select "Export Trace to ASCII File".

   c) Define a file name and storage location and select "OK".

To select the application data for MSRA measurements

In multi-standard radio analysis you can analyze the data captured by the MSRA Master in the cdma2000 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 cdma2000 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 and the "Number of Sets". You must determine the number of sets according to the following formula:
   <No of sets> = <measurement time in seconds> / 80 ms (time per set)
   Enter the next larger integer value.

4. Define the starting point of the application data as the "Capture offset". The offset is calculated according to the following formula:
   <capture offset> = <starting point for application> - <starting point in capture buffer>

5. The analysis interval is automatically determined according to the selected channel, slot or frame to analyze (defined for the evaluation range), depending on the result display. Note that the frame/slot/channel is analyzed *within the application data*. If the analysis interval does not yet show the required area of the capture buffer, move through the frames/slots/channels in the evaluation range or correct the application data range.

6. If the Sequencer is off, select the "Refresh" softkey in the "Sweep" menu to update the result displays for the changed application data.

9 Measurement Examples

The following measurement examples demonstrate the basic Code Domain Analysis functions for the cdma2000 standard. These examples assume a basic test setup as described in chapter 4.9, "Test Setup for cdma2000 Base Station or Mobile Station Tests", on page 43.

The following measurement examples are basic cdma2000 base station tests using a setup with a signal generator, e.g. an R&S SMU. They are meant to demonstrate how operating and measurement errors can be avoided using correct settings. The measurements are performed on a cdma2000 signal with an R&S FSW equipped with the cdma2000 BTS application.

Measurement examples for mobile station tests

The measurements can be performed for mobile station tests in a similar way with the cdma2000 MS application. In this case, use the following settings:

* "DIGITAL STD > LINK DIRECTION > UP/REVERSE"
* "FREQ" = *833.49GHz*

The measurements are performed using the following devices and accessories:

* The R&S FSW with Application Firmware R&S FSW-K82: cdma2000 Base Station Test
* The Vector Signal Generator R&S SMU with option R&S SMU-B46: digital standard cdma2000 (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

The following measurements are described:

9.1 Meas 1: Measuring the Signal Channel Power

In the Power measurement, the total channel power of the cdma2000 signal is displayed. The measurement also displays spurious emissions like harmonics or intermodulation products that occur close to the carrier.

Test setup

► Connect the RF output of the R&S SMU to the RF input of the R&S FSW (coaxial cable with N connectors).

Settings on the R&S SMU

1. PRESET

2. "FREQ" = *878.49 MHz*

3. "LEVEL"= *0 dBm*

4. "DIGITAL STD" = "cdma2000"

5. "DIGITAL STD > Set Default"

6. "DIGITAL STD > LINK DIRECTION > DOWN/FORWARD"

7. "DIGITAL STD > cdma2000 > STATE"= "ON"

Settings on the R&S FSW

1. PRESET

2. "MODE > cdma2000 BTS"

3. "AMPT > Reference level"= *0 dBm*

4. "FREQ > Center frequency" = *878.49 MHz*

5. "MEAS > POWER"

    The spectrum of the signal and the corresponding power levels within the 1.2288
    MHz channel bandwidth are displayed.

9.2 Meas 2: Measuring the Spectrum Emission Mask

The cdma2000 specification calls for a measurement that monitors compliance with a
spectral mask over a range of at least ±4.0 MHz around the cdma2000 carrier. To assess
the power emissions within the specified range, the signal power is measured with a
30kHz filter. The resulting trace is compared with a limit line as defined in the cdma2000
standard. The limit lines are automatically selected as a function of the used band class.

Test setup

► Connect the RF output of the R&S SMU to the RF input of the R&S FSW (coaxial
   cable with N connectors).

Settings on the R&S SMU

1. PRESET

2. "FREQ" = *878.49 MHz*

3. "LEVEL"= *0 dBm*

4. "DIGITAL STD" = "cdma2000"

5. "DIGITAL STD > Set Default"

6. "DIGITAL STD > LINK DIRECTION > DOWN/FORWARD"

7. "DIGITAL STD > cdma2000 > STATE"= "ON"

Settings on the R&S FSW

1. PRESET

2. "MODE > cdma2000 BTS"

3. "AMPT > Reference level"= *0 dBm*

4. "FREQ > Center frequency" = *878.49 MHz*

5. "MEAS > Spectrum Emission Mask"

    The spectrum of the signal is displayed, including the limit line defined in the standard. To understand where and about how much the measurement has failed, the "List Evaluation" shows the frequencies where spurious emissions occur.

9.3 Meas 3: Measuring the Relative Code Domain Power and Frequency Error

A Code Domain Power measurement analyzes the signal over a single Power Control Group (PCG). It also determines the power of all codes and channels.

The following examples show a Code Domain Power measurement on a test model with 9 channels. In this measurement, changing some parameters one after the other should demonstrate the resulting effects: values adapted to the measurement signal are changed to non-adapted values.

Test setup

1. Connect the RF output of the R&S SMU to the input of the R&S FSW.

2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).

Settings on the R&S SMU

1. PRESET

2. "FREQ" = *878.49 MHz*

3. "LEVEL"= *0 dBm*

4. "DIGITAL STD" = "cdma2000"

5. "DIGITAL STD > Set Default"

6. "DIGITAL STD > LINK DIRECTION > DOWN/FORWARD"

7. "DIGITAL STD > cdma2000 > STATE"= "ON"

Settings on the R&S FSW

1. PRESET

2. "MODE > cdma2000 BTS"

3. "AMPT > Reference level"= *10 dBm*

4. "FREQ > Center frequency" = *878.49 MHz*

   The following results are displayed: the first window shows the power of the code domain of the signal. The x-axis represents the individual channels (or codes), while the y-axis shows the power of each channel.
   In the second window, the Result Summary is displayed. It shows the numeric results of the code domain power measurement, including the frequency error.

Synchronization of the reference frequencies

The frequency error can be reduced by synchronizing the transmitter and the receiver to the same reference frequency.

► "SETUP > Reference > External Reference ..."

   Again, the first window shows the Code Domain Power measurement and the second window contains the Result Summary. After the reference frequencies of the devices have been synchronized, the frequency error should be smaller than 10 Hz.

Behavior with deviating center frequency setting

A measurement can only be valid if the center frequency of the DUT and the analyzer are balanced.

1. On the signal generator, change the center frequency in steps of 0.1 kHz and observe the analyzer display.
   Up to a frequency error of approximately 1.0 kHz, a Code Domain Power measurement on the R&S FSW is still possible. A frequency error within this range causes no apparent difference in the accuracy of the Code Domain Power measurement.
   In case of a frequency error of more than 1.0 kHz, the probability of incorrect synchronization increases. This is indicated by the "SYNC FAILED" error message.
   If the frequency error exceeds approximately 1.5 kHz, a Code Domain Power measurement cannot be performed. This is also indicated by the "SYNC FAILED" error message.

2. Reset the center frequency of the signal generator to *878.49 MHz*.

The center frequency of the DUT should not deviate by more than 1.0 kHz from that of the R&S FSW.

9.4 Meas 4: Measuring the Triggered Relative Code Domain Power

If the code domain power measurement is performed without external triggering, a section of the test signal is recorded at an arbitrary point of time and the firmware attempts to detect the start of a PCG. To detect this start, all possibilities of the PN sequence location have to be tested in Free Run trigger mode. This requires computing time. This computing time can be reduced by using an external (frame) trigger and entering the correct PN offset. If the search range for the start of the power control group and the PN offset are known then fewer possibilities have to be tested. This increases the measurement speed.

Test setup

1. Connect the RF output of the R&S SMU to the input of the R&S FSW.

2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).

3. Connect the external trigger input on the front panel of the R&S FSW (TRIGGER INPUT) to the external trigger output on the front panel of the R&S SMU (TRIGOUT1 of PAR DATA).

Settings on the R&S SMU

1. PRESET

2. "FREQ" = *878.49 MHz*

3. "LEVEL"= *0 dBm*

4. "DIGITAL STD" = "cdma2000"

5. "DIGITAL STD > Set Default"

6. "DIGITAL STD > LINK DIRECTION > DOWN/FORWARD"

7. "DIGITAL STD > cdma2000 > STATE"= "ON"

Settings on the R&S FSW

1. PRESET

2. "MODE > cdma2000 BTS"

3. "AMPT > Reference level"= *10 dBm*

4. "FREQ > Center frequency" = *878.49 MHz*

5. "TRIG > External Trigger 1"

   The following results are displayed: the first window shows the power of the code domain of the signal. Compared to the measurement without an external trigger (see chapter 9.3, "Meas 3: Measuring the Relative Code Domain Power and Frequency Error", on page 114), the repetition rate of the measurement increases.

In the second window, the Result Summary is displayed. It shows the numeric results of the code domain power measurement, including the frequency error. The "Trigger to Frame" shows the offset between the trigger event and and the start of the PCG.

9.4.1 Adjusting the Trigger Offset

The delay between the trigger event and the start of the PCG can be compensated for by adjusting the trigger offset.

1. "TRIG > External Trigger 1"

2. "TRIG > Trigger Offset" = *100 µs*

    The following results are displayed: the first window shows the power of the code domain of the signal.
    In the second window, the Result Summary is displayed. The "Trigger to Frame" offset between the trigger event and and the start of the PCG has been eliminated.

9.4.2 Behaviour With the Wrong PN Offset

The last adjustment is setting the PN (Pseudo Noise) offset correctly. The measurement is only valid if the PN offset on the analyzer is the same as that of the transmit signal.

► "Signal Description > PN Offset"= *200*.

    In the Result Summary, the "Trigger to Frame" result is not correct. Also, the error message `SYNC FAILED` indicates that the synchronization has failed.

Correct the "PN Offset".

► "Signal Description > PN Offset"= *0*.

    Now the PN offset on the R&S FSW is the same as that of the signal. In the Result Summary the "Trigger to Frame" value is now correct.

9.5 Meas 5: Measuring the Composite EVM

The Error Vector Magnitude (EVM) describes the quality of the measured signal compared to an ideal reference signal generated by the R&S FSW. In the I-Q plane, the error vector represents the ratio of the measured signal to the ideal signal on symbol level. The error vector is equal to the square root of the ratio of the measured signal to the reference signal. The result is given in %.

In the Composite EVM measurement the error is averaged over all channels (by means of the root mean square) for a given PCG. The measurement covers the entire signal during the entire observation time. In the graphical display the results are shown in a diagram, in which the x-axis represents the examined PCGs and the y-axis shows the EVM values.

Test setup

1. Connect the RF output of the R&S SMU to the input of the R&S FSW.

2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).

3. Connect the external trigger input on the front panel of the R&S FSW (TRIGGER INPUT) to the external trigger output on the front panel of the R&S SMU (TRIGOUT1 of PAR DATA).

Settings on the R&S SMU

1. PRESET

2. "FREQ" = *878.49 MHz*

3. "LEVEL"= *0 dBm*

4. "DIGITAL STD" = "cdma2000"

5. "DIGITAL STD > Set Default"

6. "DIGITAL STD > LINK DIRECTION > DOWN/FORWARD"

7. "DIGITAL STD > cdma2000 > STATE"= "ON"

Settings on the R&S FSW

1. PRESET

2. "MODE > cdma2000 BTS"

3. "AMPT > Reference level"= *10 dBm*

4. "FREQ > Center frequency" = *878.49 MHz*

5. "TRIG > External Trigger 1"

6. "MEAS CONFIG > Display Config > Composite EVM" (Window 2)

7. "AMPT > Scale Config > Auto Scale Once"

The following results are displayed: the first window shows the diagram of the Composite EVM measurement result. In the second window, the Result Summary is displayed. It shows the numeric results of the Code Domain Power measurement, including the values for the Composite EVM.

9.6 Meas 6: Measuring the Peak Code Domain Error and the RHO Factor

The Code Domain Error Power describes the quality of the measured signal compared to an ideal reference signal generated by the R&S FSW. In the I-Q plane, the error vector represents the difference of the measured signal and the ideal signal. The Code Domain

Error is the difference in power on symbol level of the measured and the reference signal projected to the class of of the base spreading factor. The unit of the result is dB.

In the Peak Code Domain Error (PCDE) measurement, the maximum error value over all channels is determined and displayed for a given PCG. The measurement covers the entire signal during the entire observation time. In the graphical display the results are shown in a diagram, in which the x-axis represents the PCGs and the y-axis shows the PCDE values.

A measurement of the RHO factor is shown in the second part of the example. RHO is the normalized, correlated power between the measured and the ideal reference signal. The maximum value of RHO is 1. In that case the measured signal and the reference signal are identical. When measuring RHO, it is required that only the pilot channel is active.

Test setup

1. Connect the RF output of the R&S SMU to the input of the R&S FSW.

2. Connect the reference input (REF INPUT) on the rear panel of the R&S FSW to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).

3. Connect the external trigger input on the front panel of the R&S FSW (TRIGGER INPUT) to the external trigger output on the front panel of the R&S SMU (TRIGOUT1 of PAR DATA).

Settings on the R&S SMU

1. PRESET

2. "FREQ" = *878.49 MHz*

3. "LEVEL" = *0 dBm*

4. "DIGITAL STD" = "cdma2000"

5. "DIGITAL STD > Set Default"

6. "DIGITAL STD > LINK DIRECTION > DOWN/FORWARD"

7. "DIGITAL STD > cdma2000 > STATE" = "ON"

Settings on the R&S FSW

1. PRESET

2. "MODE > cdma2000 BTS"

3. "AMPT > Reference level"= *0 dBm*

4. "FREQ > Center frequency" = *878.49 MHz*

5. "TRIG > External Trigger 1"

6. "MEAS CONFIG > Display Config > Peak Code Domain Error" (Window 1)

7. "AMPT > Scale Config > Auto Scale Once"

    The following results are displayed: the first window shows the diagram of the Peak Code Domain Error. In the second window, the Result Summary is displayed.

Displaying RHO

Make sure that all channels except the pilot channel (code 0.64) are OFF, so that only the pilot channel is available in the measurement.

No specific measurement is required to get the value for RHO. The R&S FSW always calculates this value automatically regardless of the code domain measurement performed. Besides the results of the code domain measurements, the numeric result of the RHO measurement is shown in the Result Summary, by default in the second window.

10 Remote Commands for cdma2000 Measurements

The following commands are required to perform measurements in cdma2000 applications in a remote environment. It assumes that the R&S FSW has already been set up for remote operation in a network as described in the base unit manual.

Common Suffixes

In cdma2000 applications, the following common suffixes are used in remote commands (and not described for each command individually):

Suffix	Value range	Description
<n>	1..16	Window
<t>	1 (CDA) 6 (RF)	Trace
<m>	1..4 (CDA) 1..16 (RF)	Marker
<ch>	1..18 (TX channel) 1..11 (ALT channel)	Channel in RF measurements
<k>	1..8 (Limit line) 1 | 2 (Display line)	Line in RF measurements

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

In particular, this includes:

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

After a short introduction to remote commands, the tasks specific to cdma2000 applications are described here:

10.1 Introduction

Commands are program messages that a controller (e.g. a PC) sends to the instrument or software. They operate its functions ('setting commands' or 'events') and request information ('query commands'). Some commands can only be used in one way, others work in two ways (setting and query). If not indicated otherwise, the commands can be used for settings and queries.

The syntax of a SCPI command consists of a header and, in most cases, one or more parameters. To use a command as a query, you have to append a question mark after the last header element, even if the command contains a parameter.

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

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

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 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`.

10.1.2 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.

10.1.3 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.

10.1.4 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`.

10.1.5 SCPI Parameters

Many commands feature one or more parameters.

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

Example:

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

Parameters may have different forms of values.

10.1.5.1 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.

10.1.5.2 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

10.1.5.3 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 10.1.1, "Long and Short Form", on page 122.

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`

10.1.5.4 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'`

10.1.5.5 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 Activating the Measurement Channel

cdma2000 measurements require a special application on the R&S FSW. The measurement is started immediately with the default settings.

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 table 10-1.

<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 table 10-1).

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.

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 table 10-1.

<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 table 10-1).

Example: `INST:CRE:REPL 'Spectrum2',IQ,'IQAnalyzer'`

Replaces the channel named 'Spectrum2' by a new measurement channel of type 'IQ Analyzer' named 'IQAnalyzer'.

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 spectrum channel with the name 'Spectrum4'.

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>,   For each channel, the command returns the channel type and
<ChannelName>   channel name (see table 10-1).

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','SANALYZER','Spectrum'`

Usage: Query only

Table 10-1: Available measurement channel types and default channel names

Application	<ChannelType> Parameter	Default Channel Name*)
Spectrum	SANALYZER	Spectrum
I/Q Analyzer	IQ	IQ Analyzer
Pulse (R&S FSW-K6)	PULSE	Pulse
Analog Demodulation (R&S FSW-K7)	ADEM	Analog Demod
Multi-Carrier Group Delay (R&S FSW-K17)	MCGD	MC Group Delay
Noise (R&S FSW-K30)	NOISE	Noise
Phase Noise (R&S FSW-K40)	PNOISE	Phase Noise
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.		

Application	<ChannelType> Parameter	Default Channel Name*)
VSA (R&S FSW-K70)	DDEM	VSA
3GPP FDD BTS (R&S FSW-K72)	BWCD	3G FDD BTS
3GPP FDD UE (R&S FSW-K73)	MWCD	3G FDD UE
cdma2000 BTS (R&S FSW-K82)	BC2K	CDMA2000 BTS
cdma2000 MS (R&S FSW-K83)	MC2K	CDMA2000 MS
1xEV-DO BTS (R&S FSW-K84)	BDO	1xEV-DO BTS
1xEV-DO MS (R&S FSW-K85)	MDO	1xEV-DO MS
WLAN (R&S FSW-K91)	WLAN	WLAN
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'.

INSTrument[:SELect] <ChannelType>

This command activates a new measurement channel with the defined channel type, or selects an existing measurement channel with the specified name.

Parameters:

<ChannelType>   **BC2K**
                   cdma2000 BTS option, R&S FSW–K82
                   MC2K
                   cdma2000 MS option, R&S FSW–K83

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:PRES:CHAN:EXEC`
	Restores the factory default settings to the "Spectrum2" channel.
Usage:	Event
Manual control:	See "Preset Channel" on page 51

10.3 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 Displays", on page 13.

CONFigure:CDPower[:BTS]:MEASurement <Measurement>

This command selects the RF measurement type (with predefined settings according to the cdma2000 standard).

Parameters:

<Measurement>   ACLR | CCDF | CDPower | ESPectrum | OBWidth | POWer

ACLR
Adjacent-Channel Power measurement

CCDF
measurement of the complementary cumulative distribution function (signal statistics)

CDPower
Code Domain Analyzer measurement.

ESPectrum
check of signal power (Spectrum Emission Mask)

OBWidth
measurement of the occupied bandwidth

POWer
Signal Channel Power measurement
(with predefined settings according to the cdma2000 standard)

*RST: CDPower

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

Manual control: See "Power" on page 26
See "Channel Power ACLR" on page 27
See "Spectrum Emission Mask" on page 28
See "Occupied Bandwidth" on page 29
See "CCDF" on page 30
See "Creating a New Channel Table from the Measured Signal
(Measure Table)" on page 81

10.4 Configuring Code Domain Analysis

10.4.1 Signal Description

The signal description provides information on the expected input signal.

10.4.1.1 BTS Signal Description

The following commands describe the input signal in BTS measurements.

For more information see chapter 4.7, "Transmission with Multiple Carriers and Multiple Antennas", on page 39.

CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency <Frequency>

This command sets the cut-off frequency for the RRC filter.

Parameters:

<Frequency>	Range:	0.1 MHz to 2.4 MHz
	*RST:	1.25

Example:	CONF:CDP:MCAR ON
	Activates multi-carrier mode
	CONF:CDP:MCAR:FILT ON
	Activates an additional filter for multi-carrier measurements
	CONF:CDP:MCAR:FILT:TYPE RRC
	Activates the RRC filter
	CONF:CDP:MCAR:FILT:COFR 1.5MHZ
	Sets the cut-off frequency to 1.5 MHz

Manual control:	See "Multi Carrier" on page 54
	See "Filter Type" on page 54
	See "Cut Off Frequency" on page 55

CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF <RollOffFactor>

This command sets the roll-off factor for the RRC filter.

Parameters:

<RollOffFactor>	Range:	0.01 to 0.99
	*RST:	0.02

Example:	CONF:CDP:MCAR ON
	Activates multi-carrier mode
	CONF:CDP:MCAR:FILT ON
	Activates an additional filter for multi-carrier measurements
	CONF:CDP:MCAR:FILT:TYPE RRC
	Activates the RRC filter
	CONF:CDP:MCAR:FILT:ROFF 0.05
	Sets the roll-off factor to 0.05

Manual control:	See "Multi Carrier" on page 54
	See "Filter Type" on page 54
	See "Roll-Off Factor" on page 54

CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe] <State>

This command activates or deactivates the usage of a filter for multi-carrier measurements.

Parameters:

<State>	ON	OFF	
	*RST:	OFF

Example:	CONF:CDP:MCAR ON
	Activates multi-carrier mode
	CONF:CDP:MCAR:FILT OFF
	Activates an additional filter for multi-carrier measurements

Manual control: See "Multi Carrier" on page 54
                         See "Multi Carrier Filter" on page 54

CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE <Type>

This command sets the filter type to be used in multi-carrier mode.

You can set the parameters for the RRC filter with the CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency and CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF commands.

Parameters:

<Type>   LPASs | RCC

                   *RST: LPAS

Example: CONF:CDP:MCAR ON

Activates multi-carrier mode

CONF:CDP:MCAR:FILT ON

Activates an additional filter for multi-carrier measurements

CONF:CDP:MCAR:FILT:TYPE RRC

Activates the RRC filter

Manual control: See "Multi Carrier" on page 54
                         See "Filter Type" on page 54
                         See "Roll-Off Factor" on page 54
                         See "Cut Off Frequency" on page 55

CONFigure:CDPower[:BTS]:MCARrier:MALGo <State>

This command activates or deactivates the enhanced algorithm for the filters in multi-carrier mode.

Parameters:

<State>   ON | OFF

                   *RST: ON

Example: CONF:CDP:MCAR ON

Activates multi-carrier mode

CONF:CDP:MCAR:FILT ON

Activates an additional filter for multi-carrier measurements

CONF:CDP:MCAR:MALG OFF

Deactivates the enhanced algorithm

Manual control: See "Multi Carrier" on page 54
                         See "Enhanced Algorithm" on page 54

CONFigure:CDPower[:BTS]:MCARrier[:STATe] <State>

This command activates or deactivates the multi-carrier mode.

Parameters:

<State>	ON | OFF
	*RST: OFF

Example:	CONF:CDP:MCAR ON
	Activates the multi-carrier settings.

Manual control:	See "Multi Carrier" on page 54

[SENSe:]CDPower:ANTenna <AntennaState>

This command deactivates the orthogonal transmit diversity (two-antenna system) or defines the antenna for which the result display is evaluated.

For details on antenna diversity see also chapter 4.7.2, "Antenna Diversity", on page 40.

Parameters:

<AntennaState>	OFF | 1 | 2
	OFF
	The aggregate signal from both antennas is fed in.
	1
	The signal of antenna 1 is fed in.
	2
	The signal of antenna 2 is fed in.
	*RST: OFF
	For further details refer to "Antenna Diversity - Antenna Number" on page 53.

Example:	CDP:ANT 2
	Selects antenna 2.

Manual control:	See "Antenna Diversity - Antenna Number" on page 53

[SENSe:]CDPower:PNOFfset <Offset>

This command sets the PN offset of the base station in multiples of 64 chips.

Parameters:

<Offset>	Range: 0 to 511
	*RST: 0

Example:	CDP:PNOF 45
	Sets PN offset.

Manual control:	See "PN Offset" on page 53

10.4.1.2 MS Signal Description

The following commands describe the input signal in MS measurements.

For more information see "Long code scrambling" on page 38.

Useful commands for describing MS signals described elsewhere:

- CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency on page 130
- CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF on page 131
- CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE on page 132
- CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe] on page 131
- CONFigure:CDPower[:BTS]:MCARrier:MALGo on page 132
- CONFigure:CDPower[:BTS]:MCARrier[:STATe] on page 132

Remote commands exclusive to describing MS signals:

[SENSe:]CDPower:LCODe:MASK <Mask>

Defines the long code mask of the mobile in hexadecimal form.

Note: For the default mask value of 0 the long code offset (see) is not taken into consideration.

Parameters:

<Mask>	Range:	#H0 to #H4FFFFFFFFFF
	*RST:	#H0

Example:	INST:SEL MC2K
	'Activate cdma2000 MS; by default, "CDP relative" is displayed in screen A and "Result Summary" in screen B.
	INIT:CONT OFF
	'Select single sweep
	TRIG:SOUR:EXT
	'Select external trigger source
	CDP:LCOD:MASK '#HF'
	'Define long code mask
	INIT;*WAI
	'Start measurement with synchronization

Manual control:	See "Long Code Mask" on page 55

[SENSe:]CDPower:LCODe:MODE <Mode>

This command selects the mode of the long code generation.

Parameters:

<Mode>	**STANdard**
	The cdma2000 standard long code generator is used.
	ESG101
	The Agilent ESG option 101 long code is used; in this case, only signals from that generator can be analysed.
	*RST: STANdard

Manual control: See "Long Code Generation" on page 56

[SENSe:]CDPower:LCODe:OFFSet <CodeOffset>

Defines the long code offset, including the PN offset. This offset is applied at the next trigger pulse (which cannot occur until a setup time of 300 ms has elapsed).

This command is ignored if [SENSe:]CDPower:LCODe:MODE is set to 0.

Parameters:

<CodeOffset>   **Offset in chips in hexadecimal format with a 52-bit resolution. The chips offset is calculated as follows: tSinceStartGPS * 1.2288 MChips/s, where tSinceStartGPS is defined in seconds.**
This value corresponds to the GPS timing since 6.1.1980 00:00:00 UTC.

*RST: #H0

Example: The hexadecimal offset of 258000 h chips is set for the first even second clock trigger:
INST:SEL MC2K
'Activate cdma2000 MS; by default, "CDP relative" is displayed in screen A and "Result Summary" in screen B.
INIT:CONT OFF
'Select single sweep
TRIG:SOUR:EXT
'Select external trigger source
CDP:LCOD:MASK '#H2'
'Define long code mask
CDP:LCOD:OFFS '#H258000'
'Define long code offset
INIT;*WAI
'Start measurement with synchronization

Manual control: See "Long Code Offset" on page 56

10.4.2   Configuring the Data Input and Output

The following commands are required to configure data input and output. For more information see chapter 5.2.4, "Data Input and Output Settings", on page 57.

10.4.2.1   RF Input

INPut:ATTenuation:PROTection:RESet

This command resets the attenuator and reconnects the RF input with the input mixer after an overload condition occured and the protection mechanism intervened.The error status bit (bit 3 in the STAT:QUES:POW status register) and the INPUT OVLD message in the status bar are cleared.

(For details on the status register see the R&S FSW User Manual).

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

Usage: Event

INPut:COUPling <CouplingType>

This command selects the coupling type of the RF input.

The command is unavailable for measurements with the Digital Baseband Interface (R&S FSW-B17).

Parameters:
<CouplingType>   **AC**
                      AC coupling
                      DC
                      DC coupling
                      *RST: AC

Example: INP:COUP:DC

Usage: SCPI confirmed

Manual control: See "Input Coupling" on page 58

INPut:FILTer:HPASs[:STATe] <State>

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

This function requires option R&S FSW-B13.

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

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

Usage: SCPI confirmed

Manual control: See "High-Pass Filter 1...3 GHz" on page 59

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-Preselec-tor" on page 59.

Parameters:

<State>   ON | OFF

                         *RST: ON

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

Manual control: See "YIG-Preselector" on page 59

INPut:IMPedance <Impedance>

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

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

The command is not available for measurements with the Digital Baseband Interface (R&S FSW-B17).

Parameters:

<Impedance>   50 | 75

                         *RST: 50 Ω

Example: INP:IMP 75

Usage: SCPI confirmed

Manual control: See "Impedance" on page 58

INPut:SELect <Source>

This command selects the signal source for measurements, i.e. it defines which connec-tor is used to input data to the R&S FSW. If no additional options are installed, only RF input is supported.

Parameters:

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

DIQ
Digital IQ data (only available with optional Digital Baseband Inter-
face R&S FSW-B17)
For details on I/Q input see the R&S FSW I/Q Analyzer User Man-
ual.

*RST:　　　RF

Manual control:　　　See "Radio Frequency State" on page 58
See "Digital I/Q Input State" on page 60

10.4.2.2　Remote Commands for the Digital Baseband Interface (R&S FSW-B17)

The following commands are required to control the Digital Baseband Interface (R&S
FSW-B17) in a remote environment.They are only available if this option is installed.

Information on the `STATus:QUEStionable:DIQ` register can be found in "STA-
Tus:QUEStionable:DIQ Register" on page 142.

Configuring Digital I/O Input and Output

Useful commands for digital I/O data described elsewhere:

- `TRIG:SEQ:LEV:BBP`TRIGger[:SEQuence]:LEVel:BBPower on page 155

Remote commands for the R&S DigIConf software

Remote commands for the R&S DigIConf software always begin with `SOURce:EBOX`.
Such commands are passed on from the R&S FSW to the R&S DigIConf automatically
which then configures the R&S EX-IQ-BOX via the USB connection.

All remote commands available for configuration via the R&S DigIConf software are
described in the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software
Operating Manual".

Example 1:

`SOURce:EBOX:*RST`

`SOURce:EBOX:*IDN?`

Result:

"Rohde&Schwarz,DigIConf,02.05.436 Build 47"

Example 2:

`SOURce:EBOX:USER:CLOCk:REFerence:FREQuency 5MHZ`

Defines the frequency value of the reference clock.

Remote commands exclusive to digital I/Q data input and output

INPut:DIQ:CDEVice

This command queries the current configuration and the status of the digital I/Q input from the optional Digital Baseband Interface (R&S FSW-B17).

For details see the section "Interface Status Information" for the Digital Baseband Interface (R&S FSW-B17) in the R&S FSW I/Q Analyzer User Manual.

Return values:

<ConnState>	Defines whether a device is connected or not.
	0
	No device is connected.
	1
	A device is connected.
<DeviceName>	Device ID of the connected device
<SerialNumber>	Serial number of the connected device
<PortName>	Port name used by the connected device
<SampleRate>	Maximum or currently used sample rate of the connected device in Hz (depends on the used connection protocol version; indicated by <SampleRateType> parameter)
<MaxTransferRate>	Maximum data transfer rate of the connected device in Hz
<ConnProtState>	State of the connection protocol which is used to identify the connected device.
	Not Started
	Has to be Started
	Started
	Passed
	Failed
	Done

<PRBSTestState>	State of the PRBS test.
	Not Started
	Has to be Started
	Started
	Passed
	Failed
	Done
<SampleRateType>	**0**
	Maximum sampling rate is displayed
	1
	Current sampling rate is displayed
<FullScaleLevel>	The level (in dBm) that should correspond to an I/Q sample with the magnitude "1" (if transferred from connected device);
	If not available, `9.97e37` is returned
Example:	`INP:DIQ:CDEV?`
	Result:
	`1,SMU200A,103634,Out`
	`A,70000000,100000000,Passed,Not Started,0,0`
Manual control:	See "Connected Instrument" on page 61

INPut:DIQ:RANGe:AUTO <State>

If enabled, the digital input full scale level is automatically set to the value provided by the connected device (if available).

This command is only available if the optional Digital Baseband interface (option R&S FSW-B17) is installed.

Parameters:

<State>	ON	OFF
	*RST: OFF
Manual control:	See "Full Scale Level" on page 60

INPut:DIQ:RANGe:COUPling <State>

If enabled, the reference level for digital input is adjusted to the full scale level automatically if the full scale level changes.

This command is only available if the optional Digital Baseband Interface (R&S FSW-B17) is installed.

Parameters:

<State>	ON	OFF
	*RST: OFF
Manual control:	See "Adjust Reference Level to Full Scale Level" on page 61

INPut:DIQ:RANGe[:UPPer] <Level>

Defines or queries the "Full Scale Level", i.e. the level that corresponds to an I/Q sample with the magnitude "1".

This command is only available if the optional Digital Baseband Interface (R&S FSW-B17) is installed.

Parameters:

<Level>	<numeric value>
	Range: 1 µV to 7.071 V
	*RST: 1 V

Manual control: See "Full Scale Level" on page 60

INPut:DIQ:RANGe[:UPPer]:UNIT <Unit>

Defines the unit of the full scale level (see "Full Scale Level" on page 60). The availability of units depends on the measurement application you are using.

This command is only available if the optional Digital Baseband Interface (R&S FSW-B17) is installed.

Parameters:

<Level>	VOLT	DBM	DBPW	WATT	DBMV	DBUV	DBUA	AMPere
	*RST: Volt

Manual control: See "Full Scale Level" on page 60

INPut:DIQ:SRATe <SampleRate>

This command specifies or queries the sample rate of the input signal from the Digital Baseband Interface (R&S FSW-B17, see "Input Sample Rate" on page 60).

Parameters:

<SampleRate>	Range: 1 Hz to 10 GHz
	*RST: 32 MHz

Example: INP:DIQ:SRAT 200 MHz

Manual control: See "Input Sample Rate" on page 60

INPut:DIQ:SRATe:AUTO <State>

If enabled, the sample rate of the digital I/Q input signal is set automatically by the connected device.

This command is only available if the optional Digital Baseband Interface (R&S FSW-B17) is installed.

Parameters:

<State>	ON	OFF
	*RST: OFF

Manual control: See "Input Sample Rate" on page 60

STATus:QUEStionable:DIQ Register

This register contains information about the state of the digital I/Q input and output. This register is available with option Digital Baseband Interface (R&S FSW-B17)Digital Baseband Interface (R&S FSW-B17).

The status of the STATus:QUEStionable:DIQ register is indicated in bit 14 of the STATus:QUEStionable register.

You can read out the state of the register with STATus:QUEStionable:DIQ:CONDition? on page 143 and STATus:QUEStionable:DIQ[:EVENt]? on page 144.

Bit No.	Meaning
0	**Digital I/Q Input Device connected** This bit is set if a device is recognized and connected to the Digital Baseband Interface of the analyzer.
1	**Digital I/Q Input Connection Protocol in progress** This bit is set while the connection between analyzer and digital baseband data signal source (e.g. R&S SMU, R&S Ex-I/Q-Box) is established.
2	**Digital I/Q Input Connection Protocol error** This bit is set if an error occurred during establishing of the connect between analyzer and digital I/Q data signal source (e.g. R&S SMU, R&S Ex-I/Q-Box) is established.
3-5	not used
6	**Digital I/Q Input FIFO Overload** This bit is set if the input transfer rate is too high.
7	not used
8	**Digital I/Q Output Device connected** This bit is set if a device is recognized and connected to the Digital I/Q Output.
9	**Digital I/Q Output Connection Protocol in progress** This bit is set while the connection between analyzer and digital I/Q data signal source (e.g. R&S SMU, R&S Ex-I/Q-Box) is established.
10	**Digital I/Q Output Connection Protocol error** This bit is set if an error occurred while the connection between analyzer and digital I/Q data signal source (e.g. R&S SMU, R&S Ex-I/Q-Box) is established.
11-14	not used
15	This bit is always set to 0.

STATus:QUEStionable:DIQ:CONDition? <ChannelName>

This command reads out the CONDition section of the STATus:QUEStionable:DIQ:CONDition status register.

The command does not delete the contents of the EVENt section.

Query parameters:

<ChannelName>   String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Example: STAT:QUES:DIQ:COND?

Usage: Query only

STATus:QUEStionable:DIQ:ENABle <SumBit>,<ChannelName>

This command controls the ENABle part of a register.

The ENABle part allows true conditions in the EVENt part of the status register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit transitions to true, a positive transition will occur in the summary bit reported to the next higher level.

Parameters:

<ChannelName>   String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Setting parameters:

<SumBit>   Range: 0 to 65535

Usage: SCPI confirmed

STATus:QUEStionable:DIQ:NTRansition <SumBit>,<ChannelName>

This command controls the Negative TRansition part of a register.

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

Parameters:

<ChannelName>   String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Setting parameters:

<SumBit>   Range: 0 to 65535

STATus:QUEStionable:DIQ:PTRansition <SumBit>,<ChannelName>

This command controls the Positive TRansition part of a register.

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

Parameters:

<ChannelName>   String containing the name of the channel.
                       The parameter is optional. If you omit it, the command works for the currently active channel.

Setting parameters:

<SumBit>   Range: 0 to 65535

STATus:QUEStionable:DIQ[:EVENt]? <ChannelName>

This command queries the contents of the "EVENt" section of the STATus:QUEStionable:DIQ register for IQ measurements.

Readout deletes the contents of the "EVENt" section.

Query parameters:

<ChannelName>   String containing the name of the channel.
                       The parameter is optional. If you omit it, the command works for the currently active channel.

Example: STAT:QUES:DIQ?

Usage: Query only

10.4.2.3   Configuring the Outputs

Configuring trigger input/output is described in chapter 10.4.4.3, "Configuring the Trigger Output", on page 159.

DIAGnostic<n>:SERVice:NSOurce <State>

This command turns the 28 V supply of the BNC connector labeled NOISE SOURCE CONTROL on the front panel on and off.

Parameters:

<State>   ON | OFF

                       *RST: OFF

Example: DIAG:SERV:NSO ON

Manual control: See "Noise Source" on page 62

OUTPut:DIQ <State>

This command turns continuous output of I/Q data to the Digital Baseband Interface (R&S FSW-B17) on and off.

Using the digital input and digital output simultaneously is not possible.

Parameters:

<State>   ON | OFF

                           *RST: OFF

Example: OUTP:DIQ ON

10.4.3 Frontend Configuration

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

For more information see chapter 5.2.5, "Frontend Settings", on page 64.

10.4.3.1 Frequency

[SENSe:]FREQuency:CENTer <Frequency>

This command defines the center frequency.

Parameters:

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

                          UP
                          Increases the center frequency by the step defined using the
                          [SENSe:]FREQuency:CENTer:STEP command.

                          DOWN
                          Decreases the center frequency by the step defined using the
                          [SENSe:]FREQuency:CENTer:STEP command.

                          *RST: fmax/2
                          Default unit: Hz

Example:	FREQ:CENT 100 MHz
	FREQ:CENT:STEP 10 MHz
	FREQ:CENT UP
	Sets the center frequency to 110 MHz.
Usage:	SCPI confirmed
Manual control:	See "Center" on page 64

[SENSe:]FREQuency:CENTer:STEP <StepSize>

This command defines the center frequency step size.

You can increase or decrease the center frequency quickly in fixed steps using the SENS:FREQ UP AND SENS:FREQ DOWN commands, see [SENSe:]FREQuency:CENTer on page 145.

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 control:	See "Center Frequency Stepsize" on page 64

[SENSe:]FREQuency:CENTer:STEP:AUTO <State>

This command couples or decouples the center frequency step size to the span.

Parameters:

<State>	ON | OFF
	*RST: ON
Example:	FREQ:CENT:STEP:AUTO ON
	Activates the coupling of the step size to the span.

[SENSe:]FREQuency:CENTer:STEP:LINK <CouplingType>

This command couples and decouples the center frequency step size to the span or the resolution bandwidth.

Parameters:

<CouplingType>   **SPAN**
                      Couples the step size to the span. Available for measurements in
                      the frequency domain.

                      RBW
                      Couples the step size to the resolution bandwidth. Available for
                      measurements in the time domain.

                      OFF
                      Decouples the step size.

                      *RST: SPAN

Example: FREQ:CENT:STEP:LINK SPAN

[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <Factor>

This command defines a step size factor if the center frequency step size is coupled to
the span or the resolution bandwidth.

Parameters:

<Factor>   1 to 100 PCT
                      *RST: 10

Example: FREQ:CENT:STEP:LINK:FACT 20PCT

[SENSe:]FREQuency:OFFSet <Offset>

This command defines a frequency offset.

If this value is not 0 Hz, the application assumes that the input signal was frequency
shifted outside the application. All results of type "frequency" will be corrected for this
shift numerically by the application.

See also "Frequency Offset" on page 65.

Parameters:

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

Example: FREQ:OFFS 1GHZ

Usage: SCPI confirmed

Manual control: See "Frequency Offset" on page 65

10.4.3.2 Amplitude and Scaling Settings

Useful commands for amplitude settings described elsewhere:

- INPut:COUPling on page 136
- INPut:IMPedance on page 137
- [SENSe:]ADJust:LEVel on page 173

Remote commands exclusive to amplitude settings:

CALCulate<n>:UNIT:POWer <Unit>

This command selects the unit of the y-axis.

The unit applies to all measurement windows.

Parameters:

<Unit>	DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere
	*RST: dBm
Example:	CALC:UNIT:POW DBM
	Sets the power unit to dBm.

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:AUTO ONCE

Automatic scaling of the y-axis is performed once, then switched off again.

Usage:	SCPI confirmed
Manual control:	See "Auto Scale Once" on page 69

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:MAXimum <Value>

This command defines the maximum value of the y-axis for the selected result display.

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 control:	See "Y-Maximum, Y-Minimum" on page 69

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:MINimum <Value>

This command defines the minimum value of the y-axis for the selected result display.

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 control: See "Y-Maximum, Y-Minimum" on page 69

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:PDIVision <Value>

This remote command determines the grid spacing on the Y-axis for all diagrams, where possible.

Parameters:

<Value>   numeric value; the unit depends on the result display

                                    Defines the range per division (total range = 10*<Value>)

                                    *RST: depends on the result display

Example: `DISP:TRAC:Y:PDIV 10`
                                    Sets the grid spacing to 10 units (e.g. dB) per division
                                    (For example 10 dB in the Code Domain Power result display.)

DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:RLEVel <ReferenceLevel>

This command defines the reference level.

With a reference level offset ≠ 0, the value range of the reference level is modified by the offset.

Parameters:

<ReferenceLevel>   The unit is variable.

                                    Range: see datasheet
                                      *RST: 0 dBm

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

Usage: SCPI confirmed

Manual control: See "Reference Level" on page 66

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

This command defines a reference level offset.

Parameters:

<Offset>	Range:	-200 dB to 200 dB
	*RST:	0dB

Example: DISP:TRAC:Y:RLEV:OFFS –10dB

Manual control: See "Reference Level" on page 66
See "Shifting the Display (Offset)" on page 66

INPut:GAIN:STATe <State>

This command turns the preamplifier on and off.

The command requires option R&S FSW-B24.

This function is not available for input from the Digital Baseband Interface (R&S FSW-B17).

Parameters:

<State>	ON	OFF
	*RST: OFF

Example: INP:GAIN:STAT ON
Switches on 30 dB preamplification.

Usage: SCPI confirmed

Manual control: See "Input Settings" on page 68
See "Preamplifier (option B24)" on page 68

INPut:GAIN[:VALue] <Gain>

This command selects the preamplification level if the preamplifier is activated (INP:GAIN:STAT ON, see INPut:GAIN:STATe on page 150).

The command requires option R&S FSW-B24.

Parameters:

<Gain>	15 dB	30 dB
	The availability of preamplification levels depends on the R&S FSW model.
	• R&S FSW8: 15dB and 30 dB
	• R&S FSW13: 15dB and 30 dB
	• R&S FSW26: 30 dB
	All other values are rounded to the nearest of these two.
	*RST: OFF

Example: INP:GAIN:VAL 30
Switches on 30 dB preamplification.

Usage: SCPI confirmed

Manual control: See "Input Settings" on page 68
See "Preamplifier (option B24)" on page 68

10.4.3.3　Configuring the Attenuation

INPut:ATTenuation <Attenuation>

This command defines the total attenuation for RF input.

If an electronic attenuator is available and active, the command defines a mechanical attenuation (see `INPut:EATT:STATe` on page 152).

If you set the attenuation manually, it is no longer coupled to the reference level, but the reference level is coupled to the attenuation. Thus, if the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

This function is not available if the Digital Baseband Interface (R&S FSW-B17) is active.

Parameters:

<Attenuation>	Range:	see data sheet
	Increment:	1 dB
	*RST:	10 dB (AUTO is set to ON)

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

Usage:	SCPI confirmed

Manual control:	See "RF Attenuation" on page 67
	See "Attenuation Mode / Value" on page 67

INPut:ATTenuation:AUTO <State>

This command couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the R&S FSW determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

This function is not available if the Digital Baseband Interface (R&S FSW-B17) is active.

Parameters:

<State>	ON	OFF
	*RST:	ON

Example:	`INP:ATT:AUTO ON`
	Couples the attenuation to the reference level.

Usage:	SCPI confirmed

Manual control:	See "RF Attenuation" on page 67
	See "Attenuation Mode / Value" on page 67

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 152).

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 is available with option R&S FSW-B25, but not if R&S FSW-B17 is active.

Parameters:

<Attenuation>	attenuation in dB
	Range: see data sheet
	Increment: 1 dB
	*RST: 0 dB (OFF)
Example:	INP:EATT:AUTO OFF
	INP:EATT 10 dB
Manual control:	See "Using Electronic Attenuation (Option B25)" on page 68

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 is available with option R&S FSW-B25, but not if R&S FSW-B17 is active.

Parameters:

<State>	ON	OFF
	*RST: ON
Example:	INP:EATT:AUTO OFF
Manual control:	See "Using Electronic Attenuation (Option B25)" on page 68

INPut:EATT:STATe <State>

This command turns the electronic attenuator on and off.

This command is only available with option R&S FSW-B25, but not if R&S FSW-B17 is active.

Parameters:

<State>	ON	OFF
	*RST: OFF
Example:	INP:EATT:STAT ON
	Switches the electronic attenuator into the signal path.
Manual control:	See "Using Electronic Attenuation (Option B25)" on page 68

10.4.4 Configuring Triggered Measurements

The following commands configure a triggered measurement in a remote environment. The tasks for manual operation are described in chapter 5.2.6, "Trigger Settings", on page 69.

*OPC should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned.

10.4.4.1 Determining the Required Trigger Parameters

Useful commands for determining trigger parameters described elsewhere:

- [SENSe:]FREQuency:CENTer on page 145

Remote commands exclusive to determining trigger parameters:

[SENSe:]BANDwidth|BWIDth[:RESolution] <Bandwidth>

This command defines the resolution bandwidth.

The command also decouples the resolution bandwidth from the span.

For statistics measurements, this command defines the **demodulation** bandwidth.

Parameters:

<Bandwidth>	refer to data sheet
	*RST: RBW: AUTO is set to ON; DBW: 3MHz
Example:	BAND 1 MHz
	Sets the resolution bandwidth to 1 MHz
Usage:	SCPI confirmed

[SENSe:]SWEep:TIME <Time>

This command defines the sweep (or: data capture) time.

Parameters:

<Time>	refer to data sheet
	*RST: (AUTO is set to ON)
Example:	SWE:TIME 10s
Usage:	SCPI confirmed

10.4.4.2 Configuring the Triggering Conditions

TRIGger[:SEQuence]:DTIMe <DropoutTime>

Defines the time the input signal must stay below the trigger level before a trigger is detected again.

Parameters:

<DropoutTime>	Dropout time of the trigger.

	Range:	0 s to 10.0 s
	*RST:	0 s

Manual control:	See "Trigger Source" on page 71
	See "Drop-Out Time" on page 72

TRIGger[:SEQuence]:HOLDoff[:TIME] <Offset>

Defines the time offset between the trigger event and the start of the sweep (data capturing).

Parameters:

<Offset>	*RST:	0 s

Example:	`TRIG:HOLD 500us`
Manual control:	See "Trigger Source" on page 71
	See "Trigger Offset" on page 72

TRIGger[:SEQuence]:IFPower:HOLDoff <Period>

This command defines the holding time before the next trigger event.

Note that this command is available for **any trigger source**, not just IF Power.

Note: If you perform gated measurements in combination with the IF Power trigger, the R&S FSW ignores the holding time for frequency sweep, FFT sweep, zero span and I/Q data measurements.

Parameters:

<Period>	*RST:	150 ns

Example:	`TRIG:SOUR IFP`
	Sets the IF power trigger source.
	`TRIG:IFP:HOLD 200 ns`
	Sets the holding time to 200 ns.

Manual control:	See "Trigger Source" on page 71
	See "Trigger Holdoff" on page 73

TRIGger[:SEQuence]:IFPower:HYSTeresis <Hysteresis>

This command defines the trigger hysteresis.

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 control:	See "Trigger Source" on page 71
	See "Hysteresis" on page 73

TRIGger[:SEQuence]:LEVel:BBPower <Level>

This command sets the level of the baseband power trigger.

This command is available with the **Digital Baseband Interface (R&S FSW-B17)**.

Parameters:

<Level>	Range:	-50 dBm to +20 dBm
	*RST:	-20 DBM

Example:	`TRIG:LEV:BB -30DBM`

Manual control:	See "Trigger Source" on page 71
	See "Trigger Level" on page 72

TRIGger[:SEQuence]:LEVel[:EXTernal<port>] <TriggerLevel>

This command defines the level the external signal must exceed to cause a trigger event.

Note that the variable INPUT/OUTPUT connectors (ports 2+3) must be set for use as input using the `OUTPut:TRIGger<port>:DIRection` command.

Suffix:

<port>	1 | 2 | 3
	Selects the trigger port.
	1 = trigger port 1 (TRIGGER INPUT connector on front panel)
	2 = trigger port 2 (TRIGGER INPUT/OUTPUT connector on front panel)
	3 = trigger port 3 (TRIGGER3 INPUT/OUTPUT connector on rear panel)

Parameters:

<TriggerLevel>	Range:	0.5 V to 3.5 V
	*RST:	1.4 V

Example:　　TRIG:LEV 2V

Manual control:　　See "Trigger Source" on page 71

TRIGger[:SEQuence]:LEVel:IFPower <TriggerLevel>

This command defines the power level at the third intermediate frequency that must be exceeded to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed.

Parameters:

<TriggerLevel>	Range:	-50 dBm to 20 dBm
	*RST:	-20 dBm

Example:　　TRIG:LEV:IFP -30DBM

TRIGger[:SEQuence]:LEVel:IQPower <TriggerLevel>

This command defines the magnitude the I/Q data must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed.

Parameters:

<TriggerLevel>	Range:	-130 dBm to 30 dBm
	*RST:	-20 dBm

Example:　　TRIG:LEV:IQP -30DBM

TRIGger[:SEQuence]:LEVel:RFPower <TriggerLevel>

This command defines the power level the RF input must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed.

The input signal must be between 500 MHz and 8 GHz.

Parameters:

<TriggerLevel>	Range:	-50 dBm to -10 dBm
	*RST:	-20 dBm

Example:　　　　　　TRIG:LEV:RFP -30dBm

TRIGger[:SEQuence]:LEVel:VIDeo <Level>

This command defines the level the video signal must exceed to cause a trigger event.
Note that any RF attenuation or preamplification is considered when the trigger level is
analyzed.

Parameters:

<Level>　　　　　　　Range:　　　0 PCT to 100 PCT
　　　　　　　　　　　*RST:　　　　50 PCT

Example:　　　　　　TRIG:LEV:VID 50PCT

TRIGger[:SEQuence]:SLOPe <Type>

For all trigger sources except time 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 control:　　　See "Trigger Source" on page 71
　　　　　　　　　　　See "Slope" on page 73

TRIGger[:SEQuence]:SOURce <Source>

This command selects the trigger source.

Parameters:

<Source>

IMMediate
Free Run

EXTern
Trigger signal from the TRIGGER INPUT connector.

EXT2
Trigger signal from the TRIGGER INPUT/OUTPUT connector.
Note: Connector must be configured for "Input".

EXT3
Trigger signal from the TRIGGER 3 INPUT/ OUTPUT connector.
Note: Connector must be configured for "Input".

IFPower
Second intermediate frequency

IQPower
Magnitude of sampled I/Q data
For applications that process I/Q data, such as the I/Q Analyzer
or optional applications

TIME
Time interval

BBPower
Baseband power (for digital input via the Digital Baseband Inter-
face R&S FSW-B17)

GP0 | GP1 | GP2 | GP3 | GP4 | GP5
For applications that process I/Q data, such as the I/Q Analyzer
or optional applications, and only if the Digital Baseband Interface
(R&S FSW-B17) is available.
Defines triggering of the measurement directly via the LVDS con-
nector. The parameter specifies which general purpose bit (0 to 5)
will provide the trigger data.
The assignment of the general purpose bits used by the Digital IQ
trigger to the LVDS connector pins is provided in "Digital IQ"
on page 72.
*RST: IMMediate

Example: TRIG:SOUR EXT
Selects the external trigger input as source of the trigger signal

Manual control: See "Trigger Source" on page 71
See "Trigger Source" on page 71
See "Free Run" on page 71
See "RF Power" on page 71
See "IQ Power" on page 72
See "Digital IQ" on page 72

TRIGger[:SEQuence]:TIME:RINTerval <Interval>

This command defines the repetition interval for the time trigger.

Parameters:

<Interval>   2.0 ms to 5000

                           Range: 2 ms to 5000 s
                           *RST: 1.0 s

Example: TRIG:SOUR TIME
                           Selects the time trigger input for triggering.
                           TRIG:TIME:RINT 50
                           The sweep starts every 50 s.

10.4.4.3 Configuring the Trigger Output

The following commands are required to send the trigger signal to one of the variable
TRIGGER INPUT/OUTPUT connectors. The tasks for manual operation are described
in "Trigger 2/3" on page 62.

OUTPut:TRIGger<port>:DIRection <Direction>

This command selects the trigger direction.

Suffix:

<port>   2 | 3
                          Selects the trigger port to which the output is sent.
                          2 = trigger port 2 (front)
                          3 = trigger port 3 (rear)

Parameters:

<Direction>   **INPut**
                          Port works as an input.

                          OUTPut
                          Port works as an output.

                          *RST: INPut

Manual control: See "Trigger 2/3" on page 62

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>	2 | 3
	Selects the trigger port to which the output is sent.
	2 = trigger port 2 (front)
	3 = trigger port 3 (rear)

Parameters:

<Level>	**HIGH**
	TTL signal.
	LOW
	0 V
	*RST: LOW

Manual control:	See "Trigger 2/3" on page 62
	See "Output Type" on page 63
	See "Level" on page 63

OUTPut:TRIGger<port>:OTYPe <OutputType>

This command selects the type of signal generated at the trigger output.

Suffix:

<port>	2 | 3
	Selects the trigger port to which the output is sent.
	2 = trigger port 2 (front)
	3 = trigger port 3 (rear)

Parameters:

<OutputType>	**DEVice**
	Sends a trigger signal when the R&S FSW has triggered internally.
	TARMed
	Sends a trigger signal when the trigger is armed and ready for an external trigger event.
	UDEFined
	Sends a user defined trigger signal. For more information see
	OUTPut:TRIGger<port>:LEVel.
	*RST: DEVice

Manual control:	See "Trigger 2/3" on page 62
	See "Output Type" on page 63

OUTPut:TRIGger<port>:PULSe:IMMediate

This command generates a pulse at the trigger output.

Suffix:

<port>	2 | 3
	Selects the trigger port to which the output is sent.
	2 = trigger port 2 (front)
	3 = trigger port 3 (rear)

Usage:	Event
Manual control:	See "Trigger 2/3" on page 62
	See "Output Type" on page 63
	See "Send Trigger" on page 63

OUTPut:TRIGger<port>:PULSe:LENGth <Length>

This command defines the length of the pulse generated at the trigger output.

Suffix:

<port>	2 | 3
	Selects the trigger port to which the output is sent.
	2 = trigger port 2 (front)
	3 = trigger port 3 (rear)

Parameters:

<Length>	Pulse length in seconds.

Manual control:	See "Trigger 2/3" on page 62
	See "Output Type" on page 63
	See "Pulse Length" on page 63

10.4.5 Signal Capturing

The following commands configure how much and how data is captured from the input signal.

ℹ **MSRA operating mode**

In MSRA operating mode, only the MSRA Master channel actually captures data from the input signal. The data acquisition commands for the cdma2000 application in MSRA mode define the **application data** (see chapter 10.10, "Configuring the Application Data Range (MSRA mode only)", on page 222).

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

[SENSe:]CDPower:IQLength <CaptureLength>

This command sets the capture length in multiples of the power control group.

Parameters:

<CaptureLength>	Range:	2 to 64
	*RST:	3

Example:	SENS:CDP:IQLength 3

Manual control:	See "Number of PCGs" on page 75

[SENSe:]CDPower:QINVert <State>

This command inverts the Q component of the signal.

Parameters:
ON | OFF   *RST: OFF

Example: CDP:QINV ON
                       Activates inversion of Q component.

Manual control: See "Invert Q" on page 75

[SENSe:]CDPower:SET:COUNt <NumberSets>

This command sets the number of sets to be captured and stored in the instrument's memory. Refer to "Number of Sets" on page 76 for more information.

Parameters:
<NumberSets>   Range: 1 to 1500 (BTS mode) or 810 (MS mode)
                       *RST: 1

Example: CDP:SET:COUN 10
                       Sets the number of sets to be captured to 10.

Manual control: See "Number of Sets" on page 76

10.4.6 Channel Detection

The channel detection settings determine which channels are found in the input signal. The commands for working with channel tables are described here.

When the channel type is required as a parameter by a remote command or provided as a result for a remote query, the following abbreviations and assignments to a numeric value are used:

Table 10-2: BTS channel types and their assignment to a numeric parameter value

Parameter	Channel type
0	PICH
1	SYNC
2	PCH
3	TDPICH
4	APICH
5	ATDPICH
6	BCH
7	CPCCH
8	CACH
9	CCCH

Parameter	Channel type
10	CHAN
11	INACTIVE
12	PDCCH
13	PDCH

Table 10-3: Allowed RC values depending on channel type for BTS measurements

RC	Channel type	Modulation
0	all special channels (not CHAN, PDCH)	
1 | 2 | 3 | 4 | 5	CHAN	
10	PDCH	QPSK
20	PDCH	8PSK
30	PDCH	16QAM

Table 10-4: MS channel types and their assignment to a numeric parameter value

Parameter	Channel type
0	PICH
1	EACH
2	CCCH
3	DCCH
4	ACKCH
5	CQICH
6	FCH
7	S1CH
8	S2CH
9	INACTIVE

10.4.6.1 General Channel Detection

The following commands configure how channels are detected in general.

Useful commands for general channel detection described elsewhere:

● CONFigure:CDPower[:BTS]:CTABle[:STATe] on page 166

● CONFigure:CDPower[:BTS]:CTABle:SELect on page 166

Remote commands exclusive to general channel detection:

[SENSe:]CDPower:ICTReshold <ThresholdLevel>

This command defines the minimum power that a single channel must have compared to the total signal in order to be regarded as an active channel. Channels below the specified threshold are regarded as "inactive".

Parameters:

<ThresholdLevel>   Range: -100 dB to 0 dB
                      *RST: -60 dB

Example: CDP:ICTR -50
                      Sets the Inactice Channel Threshold to -50 dB.

Manual control: See "Inactive Channel Threshold" on page 78

10.4.6.2 Managing Channel Tables

CONFigure:CDPower[:BTS]:CTABle:CATalog?

This command reads out the names of all channel tables stored on the instrument. The first two result values are global values for all channel tables, the subsequent values are listed for each individual table.

Return values:

<TotalSize>   Sum of file sizes of all channel table files (in bytes)

<FreeMem>   Available memory left on hard disk (in bytes)

<FileName>   File name of individual channel table file

<FileSize>   File size of individual channel table file (in bytes)

Example: CONF:CDP:CTAB:CAT?
                      Sample result (description see table below):
                      52853,2634403840,3GB_1_16.XML,
                      3469,3GB_1_32.XML,5853,3GB_1_64.XML,
                      10712,3GB_2.XML,1428,3GB_3_16.XML,
                      3430,3GB_3_32.XML,5868,3GB_4.XML,
                      678,3GB_5_2.XML,2554,3GB_5_4.XML,
                      4101,3GB_5_8.XML,7202,3GB_6.XML,
                      7209,MYTABLE.XML,349

Usage: Query only

Manual control: See "Predefined Tables" on page 79

Table 10-5: Description of query results in example:

Value	Description
52853	Total size of all channel table files: 52583 bytes
2634403840	Free memory on hard disk: 2.6 Gbytes
3GB_1_16.XML	Channel table 1: `3GB_1_16.XML`
3469	File size for channel table 1: 3469 bytes
3GB_1_32.XML	Channel table 2: `3GB_1_32.XML`
5853	File size for channel table 2: 5853 bytes
3GB_1_64.XML	Channel table 3: `3GB_1_64.XML`
10712	File size for channel table 3: 10712 bytes
...	Channel table x: ...

CONFigure:CDPower[:BTS]:CTABle:COPY <FileName>

This command copies one channel table into another one. The channel table to be copied is selected with command `CONFigure:CDPower[:BTS]:CTABle:NAME` on page 169.

Parameters:
<FileName>   string with a maximum of 8 characters

name of the new channel table

Example: `CONF:CDP:CTAB:NAME 'NEW_TAB'`
Defines the channel table name to be copied.
`CONF:CDP:CTAB:COPY 'CTAB_2'`
Copies channel table 'NEW_TAB' to 'CTAB_2'.

Usage: Event

Manual control: See "Copying a Table" on page 80

CONFigure:CDPower[:BTS]:CTABle:DELete

This command deletes the selected channel table. The channel table to be deleted is selected with the command `CONFigure:CDPower[:BTS]:CTABle:NAME` on page 169.

Example: `CONF:CDP:CTAB:NAME 'NEW_TAB'`
Defines the channel table name to be deleted.
`CONF:CDP:CTAB:DEL`
Deletes the table.

Manual control: See "Deleting a Table" on page 80

CONFigure:CDPower[:BTS]:CTABle:RESTore

This command restores the predefined channel tables to their factory-set values. In this way, you can undo unintentional overwriting.

| **Example:** | CONF:CDP:CTAB:REST |
| | Restores the channel table. |

| **Usage:** | Event |

| **Manual control:** | See "Restoring Default Tables" on page 80 |

CONFigure:CDPower[:BTS]:CTABle:SELect <FileName>

This command selects a predefined channel table file for comparison during channel detection.

Before using this command, the channel table must be switched on first with the command CONFigure:CDPower[:BTS]:CTABle[:STATe] on page 166.

Parameters:

| <FileName> | *RST: | RECENT |

Example:	CONF:CDP:CTAB ON
	Switches the channel table on.
	CONF:CDP:CTAB:SEL 'CTAB_1'
	Selects the predefined channel table 'CTAB_1'.

| **Manual control:** | See "Selecting a Table" on page 79 |

CONFigure:CDPower[:BTS]:CTABle[:STATe] <State>

This command switches the channel table on or off.

When switched on, the measured channel table is stored under the name "RECENT" and is selected for use. After the "RECENT" channel table is switched on, another channel table can be selected with the command CONFigure:CDPower[:BTS]:CTABle: SELect on page 166.

Parameters:

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

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

| **Manual control:** | See "Using Predefined Channel Tables" on page 78 |

10.4.6.3 Configuring Channel Tables

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

CONFigure:CDPower[:BTS]:CTABle:COMMent <Comment>

This command defines a comment for the selected channel table:

Prior to this command, the name of the channel table has to be defined with command `CONFigure:CDPower[:BTS]:CTABle:NAME` on page 169.

Parameters:
<Comment>

Example:	`CONF:CDP:CTAB:NAME 'NEW_TAB'`
	Defines the channel table name.
	`CONF:CDP:CTAB:COMM 'Comment for table 1'`
	Defines a comment for the table.
	`CONF:CDP:CTAB:DATA`
	`8,0,0,0,0,0,1,0.00,8,1,0,0,0,0,1,0.00,7,1,0,`
	`256,8,0,1,0.00`
	Defines the table values.
Manual control:	See "Comment" on page 81

CONFigure:CDPower[:BTS]:CTABle:DATA <ChannelType>, <CodeClass>, <CodeNumber>, <Modulation>, <Reserved1>, <Reserved2>, <Status>, <CDPRelative>

This command defines a channel table. The following description applies to cdma2000 BTS mode only.

For MS mode, see `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 168.

Before using this command, you must set the name of the channel table using the `CONFigure:CDPower[:BTS]:CTABle:NAME` command.

For a detailed description of the parameters refer to chapter 5.2.9.5, "Channel Details (MS Mode)", on page 83chapter 5.2.9.5, "Channel Details (MS Mode)", on page 83.

Parameters:

<ChannelType>	Numeric channel type according to table 10-2
<CodeClass>	2..7
	Code class depending on spreading factor; see table 4-1
<CodeNumber>	0…spreading factor-1
	Channel number (without SF)

\<Modulation\>	Modulation type including mapping
	Modulation types QPSK/8-PSK/16-QAM have complex values
	0
	BPSK-I
	1
	BPSK-Q
	2
	QPSK
	3
	8-PSK
	4
	16-QAM
\<Reserved1\>	Always 0 (reserved)
\<Reserved2\>	Always 0 (reserved)
\<Status\>	0: inactive, 1: active
	Can be used in a setting command to disable a channel temporarily
\<CDPRelative\>	Power value in dB.
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 is created.
	`CONF:CDP:CTAB:DATA`
	`0,6,0,0,0,0,1,0.0,10,5,3,4,0,0,1,0.0`
	Defines a table with the following channels: PICH 0.64 and data channel with RC4/Walsh code 3.32.
Mode:	BTS mode only
Manual control:	See "Channel Type" on page 82
	See "Channel Number (Ch. SF)" on page 82
	See "Power" on page 83
	See "Status" on page 83

CONFigure:CDPower[:BTS]:CTABle:DATA \<ChannelType\>, \<CodeClass\>,
    \<CodeNumber\>, \<Mapping\>, \<Reserved1\>, \<Reserved2\>, \<Status\>,
    \<CDPRelative\>

This command defines a channel table. The following description applies to MS mode only. For BTS mode, see `CONFigure:CDPower[:BTS]:CTABle:DATA` on page 167.

Before using this command, you must set the name of the channel table using the `CONFigure:CDPower[:BTS]:CTABle:NAME` command.

For a detailed description of the parameters refer to chapter 5.2.9.5, "Channel Details (MS Mode)", on page 83.

Parameters:

\<ChannelType\>	Numeric channel type according to table 10-4

<CodeClass>	2 to 4
	Code class depending on spreading factor; see table 4-2
<CodeNumber>	0…spreading factor-1
	Channel number (without SF)
<Mapping>	**0**
	I branch
	1
	Q branch
<Reserved1>, <Reserved2>	Always 0 (reserved for future use)
<Status>	0: inactive, 1: active
	Can be used in a setting command to disable a channel temporarily
<CDPRelative>	Power value in dB.
Example:	`"INST:SEL M2K"`
	'Activate cdma2000 MS mode
	`"CONF:CDP:CTAB:NAME 'NEW_TAB'"`
	'Select table to edit
	`"CONF:CDP:CTAB:DATA 0,4,0,0,65535,0,1,0,`
	`1,4,0,0,43690,0,1,0,`
	`2,2,2,1,65535,0,1,0"`
Mode:	MS mode only
Manual control:	See "Channel Type" on page 82
	See "Channel Number (Ch. SF)" on page 82
	See "Power" on page 83
	See "Status" on page 83

CONFigure:CDPower[:BTS]:CTABle:NAME <Name>

This command creates a new channel table file or selects an existing channel table in order to copy or delete it.

Parameters:

<Name>	string with a maximum of 8 characters
	name of the channel table
	*RST: RECENT
Example:	`CONF:CDP:CTAB:NAME 'NEW_TAB'`
Manual control:	See "Creating a New Table" on page 80
	See "Name" on page 81

10.4.7　Sweep Settings

[SENSe:]AVERage<n>:COUNt <AverageCount>

This command defines the number of sweeps that the R&S FSW uses to average traces.

In case of continuous sweeps, the R&S FSW calculates the moving average over the average count.

In case of single sweep measurements, the R&S FSW stops the measurement and calculates the average after the average count has been reached.

The average count is valid for all measurement traces in a particular measurement window.

Parameters:

<AverageCount>　　　If you set a average count of 0 or 1, the R&S FSW performs one single sweep in single sweep mode.
In continuous sweep mode, if the average count is set to 0, a moving average over 10 sweeps is performed.

　　　　　　　　　　Range:　　　0 to 200000
　　　　　　　　　　*RST:　　　　0

Usage:　　　　　　SCPI confirmed

Manual control:　　See "Sweep/Average Count" on page 85

[SENSe:]SWEep:COUNt <SweepCount>

This command defines the number of sweeps the R&S FSW uses to average traces.

In case of continuous sweeps, the R&S FSW calculates the moving average over the average count.

In case of single sweep measurements, the R&S FSW stops the measurement and calculates the average after the average count has been reached.

Parameters:

<SweepCount>　　　　If you set a sweep count of 0 or 1, the R&S FSW performs one single sweep in single sweep mode.
In continuous sweep mode, if the sweep count is set to 0, a moving average over 10 sweeps is performed.

　　　　　　　　　　Range:　　　0 to 200000
　　　　　　　　　　*RST:　　　　0

Example:　　　　　SWE:COUN 64
Sets the number of sweeps to 64.
INIT:CONT OFF
Switches to single sweep mode.
INIT;*WAI
Starts a sweep and waits for its end.

Usage:	SCPI confirmed
Manual control:	See "Sweep/Average Count" on page 85

10.4.8 Automatic Settings

MSRA operating mode

In MSRA operating mode, the following automatic commands are not available, as they require a new data acquisition. However, cdma2000 applications cannot perform data acquisition in MSRA operating mode.

Useful commands for adjusting settings automatically described elsewhere:

- `DISPlay[:WINDow<n>]:TRACe:Y[:SCALe]:AUTO ONCE` on page 148

Remote commands exclusive to adjusting settings automatically:

[SENSe:]ADJust:ALL

This command initiates a measurement to determine and set the ideal settings for the current task automatically (only once for the current measurement).

This includes:

- Reference level
- Scaling

Example:	`ADJ:ALL`
Usage:	Event
Manual control:	See "Adjusting all Determinable Settings Automatically (Auto All)" on page 87

[SENSe:]ADJust:CONFigure:DURation <Duration>

In order to determine the ideal reference level, the R&S FSW performs a measurement on the current input data. This command defines the length of the measurement if `[SENSe:]ADJust:CONFigure:DURation:MODE` is set to `MANual`.

Parameters:

<Duration>	Numeric value in seconds
	Range: 0.001 to 16000.0
	*RST: 0.001
	Default unit: s

Example:	`ADJ:CONF:DUR:MODE MAN`
	Selects manual definition of the measurement length.
	`ADJ:CONF:LEV:DUR 5ms`
	Length of the measurement is 5 ms.

Manual control:	See "Changing the Automatic Measurement Time (Meastime Manual)" on page 88

[SENSe:]ADJust:CONFigure:DURation:MODE <Mode>

In order to determine the ideal reference level, the R&S FSW performs a measurement on the current input data. This command selects the way the R&S FSW determines the length of the measurement .

Parameters:

<Mode>	**AUTO**
	The R&S FSW determines the measurement length automatically according to the current input data.
	MANual
	The R&S FSW uses the measurement length defined by `[SENSe:]ADJust:CONFigure:DURation` on page 171.
	*RST: AUTO

Manual control:	See "Resetting the Automatic Measurement Time (Meastime Auto)" on page 88
	See "Changing the Automatic Measurement Time (Meastime Manual)" on page 88

[SENSe:]ADJust:CONFiguration:HYSTeresis:LOWer <Threshold>

When the reference level is adjusted automatically using the `[SENSe:]ADJust: LEVel` on page 173 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 control: See "Lower Level Hysteresis" on page 88

[SENSe:]ADJust:CONFiguration:HYSTeresis:UPPer <Threshold>

When the reference level is adjusted automatically using the `[SENSe:]ADJust:LEVel` on page 173 command, the internal attenuators and the preamplifier are also adjusted. In order to avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines an upper threshold the signal must exceed (compared to the last measurement) before the reference level is adapted automatically.

Parameters:

<Threshold>	Range:	0 dB to 200 dB
	*RST:	+1 dB
	Default unit: dB	

Example: `SENS:ADJ:CONF:HYST:UPP 2`

Example: For an input signal level of currently 20 dBm, the reference level will only be adjusted when the signal level rises above 22 dBm.

Manual control: See "Upper Level Hysteresis" on page 88

[SENSe:]ADJust:LEVel

This command initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S FSW or limiting the dynamic range by an S/N ratio that is too small.

Example: `ADJ:LEV`

Usage: Event

Manual control: See "Reference Level" on page 66
                          See "Setting the Reference Level Automatically (Auto Level)" on page 67

10.4.9 Evaluation Range

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

[SENSe:]CDPower:CODE <CodeNo>

This command selects the code number.

For further details refer to "Code Number" on page 97.

Parameters:

<CodeNo>	<numeric value>

Range: 0 to base spreading factor - 1
Increment: 1
*RST: 0

Example: `CDP:CODE 8`
Selects the eighth channel.

Manual control: See "Code Number" on page 97

[SENSe:]CDPower:MAPPing <SignalComponent>

This command switches between the I and Q branch of the signal.

Parameters:
<SignalComponent>   I | Q
*RST: Q

Example: `CDP:MAPP Q`

Manual control: See "Mapping" on page 85
See "Branch (MS mode only)" on page 98

[SENSe:]CDPower:SET <SetNo>

This command selects a specific set for further analysis. The number of sets has to be defined with the `[SENSe:]CDPower:SET:COUNt` command before using this command.

Parameters:
<SetNo>   Range: 0 to SET COUNT -1
Increment: 1
*RST: 0

Example: `CDP:SET:COUN 10`
Selects the 11th set for further analysis (counting starts with 0).

Manual control: See "Set to Analyze" on page 76

[SENSe:]CDPower:SLOT <numeric value>

This command selects the slot (PCG) to be analyzed.

Parameters:
<numeric value>   Range: 0 to 63
Increment: 1
*RST: 0

Example: `CDP:SLOT 7`
Selects slot number 7 for analysis.

Manual control: See "Power Control Group" on page 98

10.4.10 Code Domain Analysis Settings

Some evaluations provide further settings for the results. The commands for Code Domain Analysis are described here.

[SENSe:]CDPower:NORMalize <State>

This command switches elimination of I/Q offset on or off.

Parameters:
<State>   ON | OFF

                     *RST: OFF

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

Manual control: See "Compensate IQ Offset" on page 96

[SENSe:]CDPower:ORDer <SortOrder>

This command sets the channel sorting for the Code Domain Power and Code Domain Error Power result displays.

Parameters:
<SortOrder>   HADamard | BITReverse

                     *RST: HADamard
                     For further details refer to chapter 4.3, "Code Display and Sort Order", on page 36.

Example: CDP:ORD HAD
                     Sets Hadamard order.
                     TRAC? TRACE2
                     Reads out the results in Hadamard order.
                     CDP:ORD BITR
                     Sets BitReverse order.
                     TRAC? TRACE2
                     Reads out the results in BitReverse order.

Manual control: See "Code Display Order" on page 97

[SENSe:]CDPower:PDISplay <Mode>

This command defines how the pilot channel power is displayed in the Result Summary. In relative mode, the reference power is the total power.

Parameters:

<Mode>	ABS | REL
	*RST: ABS

Example:	CDP:PDIS REL
	Pilot channel power is displayed in relation to the total power.

Manual control:	See "Code Power Display" on page 96

[SENSe:]CDPower:PPReference <Mode>

This command is only available for "Code Domain Power" evaluation in MS mode.

This command defines how the pilot channel power is displayed in the absolute summary. In relative mode, the reference power is the total power.

Parameters:

<Mode>	ABS | REL
	*RST: ABS

Example:	CDP:PPR REL
	Pilot channel power is displayed in relation to the total power.

Manual control:	See "Pilot Power Display (MS mode only)" on page 96

[SENSe:]CDPower:PREFerence <Power>

This command specifies the reference power for the relative power result displays (e.g. Code Domain Power, Power vs PCG).

Parameters:

<Power>	PICH | TOTal
	PICH The reference power is the power of the pilot channel. Which pilot channel is used as reference depends on the antenna diversity (for details see [SENSe:]CDPower:ANTenna on page 133 command).
	TOTal The reference power is the total power of the signal.
	*RST: PICH For further information refer to "Power Reference" on page 96.

Example:	CDP:PREF TOT
	Sets total power as reference power.

Manual control:	See "Power Reference" on page 96

[SENSe:]CDPower:SFACtor <SpreadingFactor>

This command defines the base spreading factor. If the base spreading factor of 64 is used for channels with a spreading factor of 128 (code class 7), an alias power is displayed in the Code Domain Power and Code Domain Error Power diagrams.

For more information see chapter 4.3, "Code Display and Sort Order", on page 36.

Parameters:

<SpreadingFactor>	64 | 128
	*RST: 64
Example:	CDP:SFAC 128
	Selects base spreading factor 128.
Manual control:	See "Base Spreading Factor" on page 96

[SENSe:]CDPower:TPMeas <State>

This command activates or deactivates the timing and phase offset evaluation of the channels to the pilot.

The results are queried using the TRAC:DATA? CTAB command or the CALC:MARK:FUNC:CDP[:BTS]:RES? command.

Parameters:

<State>	ON | OFF
	*RST: OFF
Example:	CDP:TPM ON
	Activates timing and phase offset.
	CDP:SLOT 2
	Selects slot 2.
	CDP:CODE 11
	Selects code number 11.
	CALC:MARK:FUNC:CDP:RES? TOFF
	Reads out timing offset of the code with number 11 in slot 2.
	CALC:MARK:FUNC:CDP:RES? POFF
	Reads out the phase offset of the code with number 11 in slot 2.
Manual control:	See "Timing and phase offset calculation " on page 96

10.5 Configuring RF Measurements

RF measurements are performed in the Spectrum application, with some predefined settings as described in chapter 3.2, "RF Measurements", on page 26.

For details on configuring these RF measurements in a remote environment, see the Remote Commands chapter of the R&S FSW User Manual.

The cdma2000 RF measurements must be activated in a cdma2000 application, see chapter 10.2, "Activating the Measurement Channel", on page 126.

The individiual measurements are activated using the `CONFigure:CDPower[:BTS]:MEASurement` on page 129 command (see chapter 10.3, "Selecting a Measurement", on page 129).

10.5.1 Special RF Configuration Commands

In addition to the common RF measurement configuration commands described for the base unit, the following special commands are available in cdma2000 applications:

CONFigure:CDPower[:BTS]:BCLass|BANDclass <Bandclass>

This command selects the bandclass for the measurement. The bandclass defines the frequency band used for ACLR and SEM measurements. It also determines the corresponding limits and ACLR channel settings according to the cdma2000 standard.

Parameters:

<Bandclass>	For an overview of available bandclasses and the corresponding parameter values see chapter A.3, "Reference: Supported Band-classes", on page 234.
	*RST: 0
Example:	`CONF:CDP:BCL 1` Selects band class 1, 1900 MHz
Manual control:	See "Bandclass" on page 91

10.5.2 Analysis for RF Measurements

General result analysis settings concerning the trace, markers, lines etc. for RF measurements are identical to the analysis functions in the Spectrum application except for some special marker functions and spectrograms, which are not available in cdma2000 applications.

For details see the "General Measurement Analysis and Display" chapter in the R&S FSW User Manual.

10.6 Configuring the Result Display

The following commands are required to configure the screen display in a remote environment. The tasks for manual operation are described in chapter 3, "Measurements and Result Displays", on page 13.

10.6.1 General Window Commands

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

Note that the suffix <n> always refers to the window *in the currently selected measurement channel* (see `INSTrument[:SELect]` on page 128).

DISPlay:FORMat <Format>

This command determines which tab is displayed.

Parameters:

<Format>   **SPLit**

Displays the MultiView tab with an overview of all active channels

SINGle

Displays the measurement channel that was previously focused.

*RST: SPL

Example: `DISP:FORM SING`

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 183).

Parameters:

<Size>   **LARGe**

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

SMALl

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

*RST: SMALl

Example: `DISP:WIND2:LARG`

DISPlay[:WINDow<n>]:SELect

This command sets the focus on the selected result display window.

This window is then the active window.

Example:	`DISP:WIND1:SEL` Sets the window 1 active.
Usage:	Setting only

DISPlay:WSELect?

This command queries the currently active window (the one that is focused) *in the currently selected measurement channel*.

Return values:

<ActiveWindow>   Index number of the currently active window.

Range: 1 to 16

Usage: Query only

10.6.2 Working with Windows in the Display

The following commands are required to change the evaluation type and rearrange the screen layout for a measurement channel as you do using the SmartGrid in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected measurement channel.

Note that the suffix <n> always refers to the window *in the currently selected measurement channel* (see `INSTrument[:SELect]` on page 128).

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

This command adds a window to the display.

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

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

Parameters:

<WindowName>   String containing the name of the existing window the new window is inserted next to.
By default, the name of a window is the same as its index. To determine the name and index of all active windows, use the `LAYout:CATalog[:WINDow]?` query.

<Direction>   LEFT | RIGHt | ABOVe | BELow

Direction the new window is added relative to the existing window.

<WindowType>   text value

Type of result display (evaluation method) you want to add.
See the table below for available parameter values.

Return values:

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

Example: `LAY:ADD? '1',LEFT,MTAB`
Result:
`'2'`
Adds a new window named '2' with a marker table to the left of window 1.

Example: `LAY:ADD? '1',BEL,'XPOW:CDP:ABSolute'`
Adds a Code Domain Power display below window 1.

Usage: Query only

Manual control: See "Bitstream" on page 16
See "Channel Table" on page 17
See "Code Domain Power / Code Domain Error Power" on page 19
See "Composite Constellation" on page 20
See "Composite EVM" on page 21
See "Peak Code Domain Error" on page 22
See "Power vs PCG" on page 23
See "Power vs Symbol" on page 23
See "Result Summary" on page 24
See "Symbol Constellation" on page 24
See "Symbol EVM" on page 25
See "Diagram" on page 31
See "Result Summary" on page 32
See "Marker Table" on page 32
See "Marker Peak List" on page 32

Table 10-6: <WindowType> parameter values for cdma2000 application

Parameter value	Window type
BITStream	Bitstream
CCONst	Composite Constellation
CDEPower	Code Domain Error Power

Parameter value	Window type
CDPower	Code Domain Power
CEVM	Composite EVM
CTABle	Channel Table
LEValuation	List evaluation (SEM, Power vs Time)
MTABle	Marker table
PCDerror	Peak Code Domain Error
PPCG	Power vs PCG
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 from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName_1>,<Index_1>..<WindowName_n>,<Index_n>

Return values:

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

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.

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 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, 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 180 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.

As opposed to the `DISPlay[:WINDow<n>]:SIZE` on page 179 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.
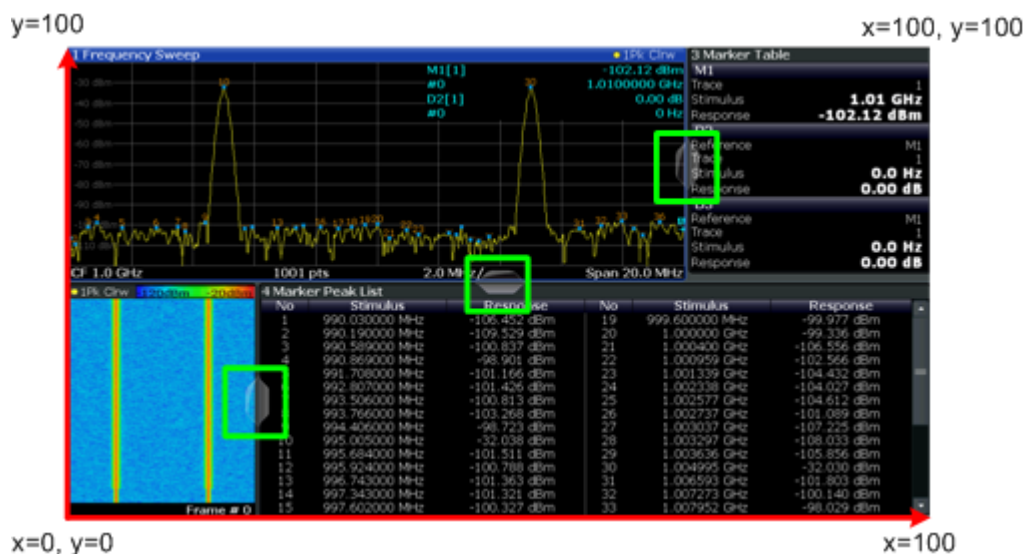
Fig. 10-1: SmartGrid coordinates for remote control of the splitters

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 com-
                     bination 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, as opposed to `LAYout:ADD[:WINDow]?`, the suffix <n> determines the existing window next to which the new window is added.

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 180 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).

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.

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>).

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 180 for a list of available window types.

10.6.3 Zooming into the Display

10.6.3.1 Using the Single Zoom

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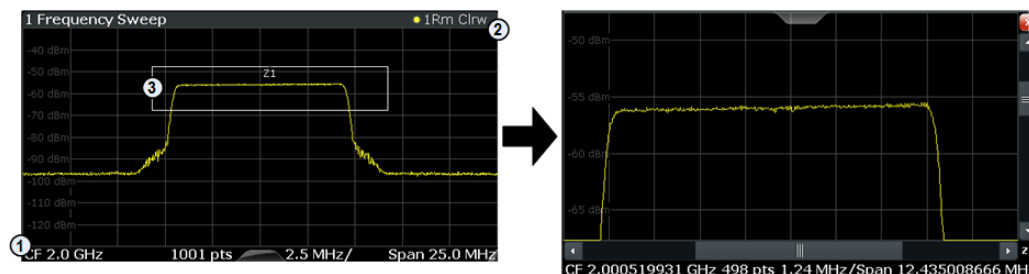
1 = origin of coordinate system (x1 = 0, y1 = 0)
2 = end point of system (x2 = 100, y2= 100)
3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

Parameters:

<x1>,<y1>,   Diagram coordinates in % of the complete diagram that define the
<x2>,<y2>   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 control: See "Single Zoom" on page 89

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 control: See "Single Zoom" on page 89
                                 See "Restore Original Display" on page 89
                                 See "Deactivating Zoom (Selection mode)" on page 89

10.6.3.2 Using the Multiple Zoom

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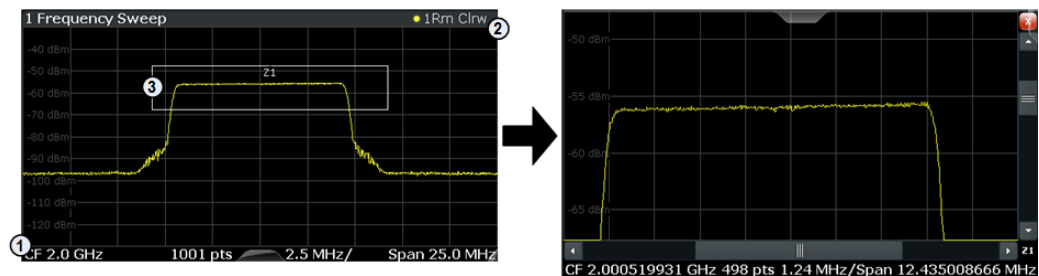
1 = origin of coordinate system (x1 = 0, y1 = 0)
2 = end point of system (x2 = 100, y2= 100)
3 = zoom area (e.g. x1 = 60, y1 = 30, x2 = 80, y2 = 75)

Suffix:

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

Parameters:

<x1>,<y1>,   Diagram coordinates in % of the complete diagram that define the
<x2>,<y2>   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 control: See "Multiple Zoom" on page 89

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

This command turns the mutliple zoom on and off.

Suffix:

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

Parameters:

<State>   ON | OFF

                *RST: OFF

Manual control: See "Multiple Zoom" on page 89
                See "Restore Original Display" on page 89
                See "Deactivating Zoom (Selection mode)" on page 89

10.7 Starting a Measurement

The measurement is started immediately when a cdma2000 application is activated, however, you can stop and start a new measurement any time.

ABORt

This command aborts a current measurement and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the `*OPC?` or `*WAI` command after `ABOR` and before the next command.

For details see the "Remote Basics" chapter in the R&S FSW User Manual.

To abort a sequence of measurements by the Sequencer, use the `INITiate: SEQuencer:ABORt` on page 190 command.

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:	SCPI confirmed

INITiate:CONMeas

This command restarts a (single) measurement that has been stopped (using `INIT:CONT OFF`) or finished in single sweep mode.

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

As opposed to `INITiate[: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.

Example:	(for Spectrum application:)
	`INIT:CONT OFF`
	Switches to single sweep mode.
	`DISP:WIND:TRAC:MODE AVER`
	Switches on trace averaging.
	`SWE:COUN 20`
	Setting the sweep counter to 20 sweeps.
	`INIT;*WAI`
	Starts the measurement and waits for the end of the 20 sweeps.
	`INIT:CONM;*WAI`
	Continues the measurement (next 20 sweeps) and waits for the end.
	Result: Averaging is performed over 40 sweeps.

Manual control:	See "Continue Single Sweep" on page 86

INITiate:CONTinuous <State>

This command controls the sweep mode.

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

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

If the sweep mode is changed for a measurement channel while the Sequencer is active (see `INITiate:SEQuencer:IMMediate` on page 191) the mode is only considered the next time the measurement in that channel is activated by the Sequencer.

Parameters:

<State>	ON | OFF
	ON
	Continuous sweep
	OFF
	Single sweep
	*RST: ON
Example:	`INIT:CONT OFF`
	Switches the sweep mode to single sweep.
	`INIT:CONT ON`
	Switches the sweep mode to continuous sweep.
Manual control:	See "Continuous Sweep/RUN CONT" on page 86

INITiate[:IMMediate]

This command starts a (single) new measurement.

With sweep count or average count > 0, this means a restart of the corresponding number of measurements. With trace mode MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

You can synchronize to the end of the measurement with *OPC, *OPC? or *WAI.

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

Example:	(For Spectrum application:)
	`INIT:CONT OFF`
	Switches to single sweep mode.
	`DISP:WIND:TRAC:MODE AVER`
	Switches on trace averaging.
	`SWE:COUN 20`
	Sets the sweep counter to 20 sweeps.
	`INIT;*WAI`
	Starts the measurement and waits for the end of the 20 sweeps.
Manual control:	See "Single Sweep/ RUN SINGLE" on page 86

INITiate: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:SEQuencer:IMMediate` on page 191.

To deactivate the Sequencer use `SYSTem:SEQuencer` on page 192.

Usage:	Event

INITiate:SEQuencer:IMMediate

This command starts a new sequence of measurements by the Sequencer. Its effect is similar to the INITiate[:IMMediate] command used for a single measurement.

Before this command can be executed, the Sequencer must be activated (see SYSTem:SEQuencer on page 192).

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.
Usage:	Event

INITiate:SEQuencer:MODE <Mode>

This command selects the way the R&S FSW application performs measurements sequentially.

Before this command can be executed, the Sequencer must be activated (see SYSTem:SEQuencer on page 192).

A detailed programming example is provided in the "Operating Modes" chapter in the R&S FSW User Manual.

Note: In order to synchronize to the end of a sequential measurement using *OPC, *OPC? or *WAI you must use SINGle Sequencer mode.

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

Parameters:

<Mode>
SINGle
Each measurement is performed once (regardless of the channel's sweep mode), considering each channels' sweep count, until all measurements in all active channels have been performed.

CONTinuous
The measurements in each active channel are performed one after the other, repeatedly (regardless of the channel's sweep mode), in the same order, until the Sequencer is stopped.

CDEFined
First, a single sequence is performed. Then, only those channels in continuous sweep mode (INIT:CONT ON) are repeated.

*RST: CONTinuous

Example: `SYST:SEQ ON`
                    Activates the Sequencer.
                    `INIT:SEQ:MODE SING`
                    Sets single Sequencer mode so each active measurement will be
                    performed once.
                    `INIT:SEQ:IMM`
                    Starts the sequential measurements.

INITiate: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.

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 MSRA channels.

Usage: Event

SYSTem:SEQuencer <State>

This command turns the Sequencer on and off. The Sequencer must be active before
any other Sequencer commands (`INIT:SEQ...`) are executed, otherwise an error will
occur.

A detailed programming example is provided in the "Operating Modes" chapter in the
R&S FSW User Manual.

Parameters:
<State>   ON | OFF

                    ON
                    The Sequencer is activated and a sequential measurement is
                    started immediately.

                    OFF
                    The Sequencer is deactivated. Any running sequential measure-
                    ments are stopped. Further Sequencer commands
                    (`INIT:SEQ...`) are not available.

                    *RST: OFF

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`

10.8 Retrieving Results

The following commands retrieve the results from a cdma2000 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 10.4.6, "Channel Detection", on page 162.

Specific commands:

10.8.1 Retrieving Calculated CDA Results

The following commands describe how to retrieve the calculated results from the CDA measurements.

CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult? <Measurement>

This command queries individual values of the measured and calculated results of the cdma2000 code domain power measurement.

Query parameters:

<Measurement>

ACTive
Number of active channels

CDPabsolute
Channel power absolute in dBm

CDPRelative
Channel power relative in dB (relative to total or PICH power, refer to `CDP:PREF` command)

CERRor
Chip rate error in ppm

CHANnel
Channel number

DMType
Domain type

EVMRms
Error vector magnitude RMS in %

EVMPeak
Error vector mag. peak in %

FERPpm
Frequency error in ppm

FERRor
Frequency error in Hz

IQIMbalance
IQ imbalance in %

IQOFfset
IQ offset in %

MACCuracy
Composite EVM in %

PCDerror
Peak code domain error in dB

POFFset
Phase offset in rad

PPICh
Pilot power in dBm

PTOTal
Total power in dBm

RHO
RHO

SFACtor
Spreading factor of channel

SLOT
PCG number

SRATe
Symbol rate in ksps

TFRame I

Trigger to frame

TOFFset
Timing offset in s

Example:	CALC:MARK:FUNC:CDP:RES? PTOT
Usage:	Query only
Manual control:	See "Code Domain Power / Code Domain Error Power" on page 19
	See "Composite Constellation" on page 20
	See "Composite EVM" on page 21
	See "Peak Code Domain Error" on page 22
	See "Power vs Symbol" on page 23
	See "Result Summary" on page 24
	See "Symbol Constellation" on page 24
	See "Symbol EVM" on page 25

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 sweeps. See also INITiate:CONTinuous on page 189.

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 control:	See "CCDF" on page 30

10.8.2 Retrieving CDA Trace Results

The following commands describe how to retrieve the trace data from the CDA measurements. 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 FSW to the controlling computer.

Note that the command has no effect for data that you send to the R&S FSW. The R&S FSW automatically recognizes the data it receives, regardless of the format.

Parameters:

<Format>   **ASCii**
                           ASCii format, separated by commas.
                           This format is almost always suitable, regardless of the actual data format. However, the data is not as compact as other formats may be.

                           REAL,32
                           32-bit IEEE 754 floating-point numbers in the "definite length block format".
                           In the Spectrum application, the format setting REAL is used for the binary transmission of trace data.

                           *RST: ASCII

Example: FORM REAL,32

Usage: SCPI confirmed

TRACe<n>[:DATA]? <ResultType>

This command reads trace data from the R&S FSW.

For details on reading trace data for other than code domain measurements refer to the TRACe:DATA command in the base unit description.

Query parameters:

<ResultType>   **TRACE1 | TRACE2 | TRACE3 | TRACE4**
                           Reads out the trace data of the corresponding trace in the specified measurement window. The results of the trace data query depend on the evaluation method in the specified window, which is selected by the LAY:ADD:WIND command. The individual results are described in chapter 10.8.3, "Measurement Results for TRACe<n>[:DATA]? TRACE<n>", on page 197.

                           CTABle
                           For the Channel Table result display, reads out the maximum values of the timing/phase offset between each assigned channel and the pilot channel (see [SENSe:]CDPower:TPMeas command).
                           To query the detailed channel information use the TRAC:DATA? TRACE1 command for a window with Channel Table evaluation.

                           LIST
                           Queries the results of the peak list evaluation for Spectrum Emission Mask measurements.
                           For each peak the following entries are given:
                           <peak frequency>, <absolute level of the peak>, <distance to the limit line>
                           For details refer to the TRACe:DATA command in the base unit description.

| **Usage:** | Query only |
| | SCPI confirmed |

10.8.3   Measurement Results for TRACe<n>[:DATA]? TRACE<n>

The results of the trace data query (TRACe<n>[:DATA]? TRACE<n>) depend on the evaluation method in the specified window, which is selected by the `LAY:ADD:WIND` command.

For each evaluation method the returned values for the trace data query are described in the following sections.

For details on the graphical results of these evaluation methods, see chapter 3, "Measurements and Result Displays", on page 13.

10.8.3.1   Bitstream

When the trace data for this evaluation is queried, the bit stream of one PCG (i.e. one value per bit for each symbol) is transferred. Each symbol contains two consecutive bits in the case of a QPSK modulated PCG and 4 consecutive bits in the case of a 16QAM modulated PCG. One value is transferred per bit (range 0, 1). The number of symbols is not constant and may vary for each sweep. Individual symbols in the bit stream may be invalid depending on the channel type and the bit rate (symbols without power). The assigned invalid bits are marked by one of the digits "6", "7" or "9".

10.8.3.2   Channel Table

Two different commands are available to retrieve the channel table results:

- `TRAC:DATA? TRACEx` commands return detailed trace information for each channel

● `TRAC:DATA? CTABle` provides the maximum values of the timing/phase offset between each assigned channel and the pilot channel

Results for TRACEx Parameters

The command returns 8 values for each channel in the following order:

<channel type>, <code class>, <code number>, <radio configuration>, <absolute level>, <relative level>, <timing offset>, <phase offset>

Value	Description	Range/Unit
<channel type>	channel type (see table 10-2 and table 10-4)	{0..13} (BTS) {0..9} (MS)
<code class>	code class of the channel (see chapter 4.2, "Channels, Codes and Symbols", on page 34)	{2...7} (BTS) {1..6} (MS)
<code number>	code number within the channel	{0..127} (BTS) {0..63}(MS)
<radio config> (BTS only)	radio configuration (see chapter 4.6, "Radio Configuration", on page 39)	
<mapping> (MS only)	channel mapping	0 = I branch 1 = Q branch
<absolute level>	absolute power level of the channel	{-∞...∞} dBm
<relative level>	relative power level of the channel, referred to either Total or Pilot power	{-∞...∞} dB
<timing offset>	referred to the pilot channel	s
<phase offset>	referred to the pilot channel	9 for: ● CDP:TPM OFF ● > 50 active channels found ● inactive channel rad

In **BTS mode**, the channels are sorted according to these rules:

1. All detected special channels

2. Data channels, in ascending order by code class and within the code class in ascending order by code number

3. Unassigned codes, with the code class of the base spreading factor

In **MS mode**, the channels are sorted according to these rules:

1. All active channels

2. All inactive or quasi-active channels, in ascending code number order, I branch first, followed by Q branch

Data channels, in ascending order by code class and within the code class in ascending order by code number

3. Unassigned codes, with the code class of the base spreading factor

Measurement Example: Retrieving the Channel Table Values (BTS mode)

The example shows the results of the query for 5 channels with the following configuration:

Chan. type	Ch.no./SF	Code class	Power
PICH	0.64	6	-7.0 dB
PCH	1.64	6	-7.3 dB
CHAN	8.32	5	-8.0 dB
CHAN	24.128	7	-9.0 dB (alias with 24.64)
SYNC	32.64	6	-13.3 dB

```
INST:SEL BC2K
//Activate cdma2000 BTS, default is CDP relative in window 1 and
//Result Summary in window 2
INIT:CONT OFF
//Select single sweep
INIT:CONT OFF
//Select single sweep
LAY:REPL:WIND '1',CTAB
//Replace CDP by Channel Table evaluation in window 1
INIT;*WAI
//Start measurement with synchronization
TRAC? TRACE1
//Read out channel table
//Result:
//0 , 6, 0, 0,        0.0, -7.0, 9, 9,
//1 , 6, 32, 0,      -6.3, -13.3, 9, 9,
//2 , 6, 1, 0,       -0.3, -7.3, 9, 9,
//10, 5, 8, 3,       -1.0, -8.0, 9, 9,
//10, 7, 24, 3,      -2.0, -9.0, 9, 9,
//11, 6, 2, 3,       -47.6, -54.6, 9, 9,
//....
//11, 6, 63, 3,      -47.7, -54.7, 9, 9
```

Measurement Example: Retrieving the Channel Table Values (MS mode)

The example shows the results of the query for 2 channels with the following configuration:

Chan. type	Ch.no./SF	Code class	Mapping	Power
PICH	0.32	5	I	-7.0 dB
CCCH	2.8	3	Q	-10:0 dB

```
INIT:CONT OFF
//Select single sweep
INIT:CONT OFF
//Select single sweep
LAY:REPL:WIND '1',CTAB
//Replace CDP by Channel Table evaluation in window 1
INIT;*WAI
//Start measurement with synchronization
TRAC? TRACE1
//Read out channel table
//Result:
//0 , 5, 0, 0,       0.0, -7.0, 9, 9,
//2 , 2, 2, 1,      -3.0, -10.0, 9, 9,
//9 , 5, 0, 1,      -46.3, -53.3, 9, 9,
//9 , 5, 1, 0,      -48.0, -55.0, 9, 9,
//9 , 5, 1, 1,      -43.2, -50.2, 9, 9,
//9 , 5, 2, 0,      -42.0, -49.0, 9, 9,
//9 , 5, 3, 0,      -47.6, -54.6, 9, 9,
//....
//9 , 5, 31, 1,     -47.7, -54.7, 9, 9
```

Results for CTABle Parameter

The command returns 12 values for each channel in the following order:

<max. time offset in s>, <code number for max. time>, <code class for max. time>, <max. phase offset in rad>, <code number for max. phase>, <code class for max. phase>, <reserved 1>, …, <reserved 6>

Value	Description	Range/ Unit
<time offset>	maximum time offset	s
<code number>	code number of the channel with maximum time offset	{0..127} (BTS) {0..63}(MS)
<code class>	code class of the channel with maximum time offset	{2...7} (BTS) {1..6} (MS)
<phase offset>	maximum phase offset	rad
<code number>	code number of the channel with maximum phase offset	{0..127} (BTS) {0..63}(MS)

Value	Description	Range/ Unit
<code class>	code class of the channel with maximum phase offset	{2...7} (BTS) {1..6} (MS)
<reserved 1...6>	reserved for future use	0

Measurement example for TRAC:DATA? CTAB

```
INIT:CONT OFF
//Select single sweep
INIT:CONT OFF
//Select single sweep
LAY:REPL:WIND '1',CTAB
//Replace CDP by Channel Table evaluation in window 1
INIT;*WAI
//Start measurement with synchronization
TRAC? CTAB
//Read out maximum timing and phase offsets
//Result: 1.20E-009,2,2,-3.01E-003,15,4,0,0,0,0,0,0
//where:
//1.20E-009,2,2,
//Max. time offset with code number and
//code class of associated channel
//-3.01E-003,15,4,
//Max. phase offset with code number
//and code class of associated channel
//0,0,0,0,0,0
//6 reserved values
```

10.8.3.3 Code Domain Error Power

The command returns four values for each channel:

<code class>, <code number>, <error power>, <power ID>

The Hadamard or BitReverse order is important for sorting the channels, but not for the number of values.

With Hadamard, the individual codes are output in ascending order.

With BitReverse, codes which belong to a particular channel are adjacent to each other.

Since an error power is output for Code Domain Error Power, consolidation of the power values is not appropriate. The number of codes that are output therefore generally corresponds to the base spreading factor.

Value	Description	Range/ Unit
<code class>	code class of the channel (see chapter 4.2, "Channels, Codes and Symbols", on page 34)	{2...7} (BTS) {1..6} (MS)
<code number>	code number within the channel	{0..127} (BTS) {0..63}(MS)
<signal level>	error power	{-∞...∞}dB
<power ID>	type of power detection: 0 - inactive channel 1 - power of own antenna 2 - alias power of own antenna 3 - alias power of other antenna 4 - alias power of own and other antenna	

To avoid alias power, set the base spreading factor correctly.

For details on these parameters see `TRACe<n>[:DATA]?` on page 196.

10.8.3.4 Code Domain Power

The command returns four values for each channel:

<code class>, <code number>, <signal level>, <power ID>

The number of displayed values depends on the spreading factor.

In Hadamard order, the different codes are output in ascending order together with their code power. The number of output codes corresponds to the base spreading factor.

In BitReverse order, codes belonging to a channel are next to one another and are therefore output in the class of the channel together with the consolidated channel power. The maximum number of output codes or channels cannot be higher than the base spreading factor, but decreases with every concentrated channel.

Value	Description	Range/ Unit
<code class>	code class of the channel (see chapter 4.2, "Channels, Codes and Symbols", on page 34)	{2...7} (BTS) {1..6} (MS)
<code number>	code number within the channel	{0..127} (BTS) {0..63}(MS)

Value	Description	Range/ Unit
<signal level>	absolute or relative power, depending on the setting (see [SENSe:]CDPower:PREFerence) Hadamard order: power values for each code BitReverse order: power values for combined channels	{-∞...∞}dB or dBm
<power ID>	type of power detection: 0 - inactive channel 1 - power of own antenna 2 - alias power of own antenna 3 - alias power of other antenna 4 - alias power of own and other antenna	

To avoid alias power, set the base spreading factor correctly.

For details on these parameters see TRACe<n>[:DATA]? on page 196.

Measurement Example: Retrieving the Code Domain Power (BTS mode)

The example shows the results of the query for 5 channels with the following configuration:

Chan. type	Ch.no./SF	Code class	Power
PICH	0.64	6	-7.0 dB
PCH	1.64	6	-7.3 dB
CHAN	8.32	5	-8.0 dB
CHAN	24.128	7	-9.0 dB (alias with 24.64)
SYNC	32.64	6	-13.3 dB

```
INST:SEL BC2K
//Activate cdma2000 BTS, default is CDP relative in window 1 and
//Result Summary in window 2
INIT:CONT OFF
//Select single sweep
CDP:ORD HAD
//Set order to Hadamard
INIT;*WAI
//Start measurement with synchronization
TRAC? TRACE1
//Read out CDP relative/Hadamard;
//Channel 8.32 is distributed to 8.64 and 40.64, in each case with half power:
//-8dB – 3dB = -11.0 dB
//Result:
//6, 0, -7.0,1,      6, 1, -7.3,1,
//6, 2,-54.6,0,      6, 3,-55.3,0,
```

```
//        ....       6, 7,-58.2,0,
//6, 8,-11.0,1,      6, 9,-53.4,0,
//        ....       6,24, -9.0,2,
//        ....       6,32,-13.3,1,
//        ....       6,40,-11.0,1,
//        ....       6,63,-54.7,0
CDP:ORD BITR
//Set order to BitReverse
TRAC? TRACE1
//Read out CDP relative/BitReverse
//Channel 8.32 can now be directly read out with its total power.
//The sort order changes in accordance with BitReverse.
//Result:
//6, 0, -7.0,1,      6,32,-13.3,1,
//6,16,-56.3,0,      6,48,-52.8,0,
//5, 8, -8.0,1,      6,24, -9.0,2,
//        ....       6, 1, -7.3,1,
//        ....       6,63,-54.7,0


INST:SEL BC2K
//Activate cdma2000 BTS, default is CDP relative in window 1 and
//Result Summary in window 2
INIT:CONT OFF
//Select single sweep
CDP:ORD HAD
//Set order to Hadamard
INIT;*WAI
//Start measurement with synchronization
TRAC? TRACE1
//Read out CDP relative/Hadamard
//Channel 8.32 is distributed to 8.64 and 40.64, in each case with half power:
// -8dB - 3dB = -11.0dB
//Result:
//6, 0, -7.0,1, 6, 1, -7.3,1,
//6, 2,-54.6,0, 6, 3,-55.3,0,
//.... 6, 7,-58.2,0,
//6, 8,-11.0,1, 6, 9,-53.4,0,
//.... 6,24, -9.0,2,
//.... 6,32,-13.3,1,
//.... 6,40,-11.0,1,
//.... 6,63,-54.7,0
CDP:ORD BITR
//Set order to BitReverse
TRAC? TRACE1
//Read out CDP relative/BitReverse
//Channel 8.32 can now be directly read out with its total power.
//The sort order changes in accordance with BitReverse.
//Result:
//6, 0, -7.0,1, 6,32,-13.3,1,
```

```
//6,16,-56.3,0, 6,48,-52.8,0,
//5, 8, -8.0,1, 6,24, -9.0,2,
//.... 6, 1, -7.3,1,
//.... 6,63,-54.7,0
```

Measurement Example: Retrieving the Code Domain Power (MS mode)

The example shows the results of the query for 2 channels with the following configuration:

Chan. type	Ch.no./SF	Code class	Mapping	Power
PICH	0.32	5	I	-7.0 dB
CCCH	2.8	3	Q	-10:0 dB

```
INST:SEL MC2K
//Activate cdma2000 MS, default is CDP relative in window 1 and
//Result Summary in window 2
//Mapping set to I
INIT:CONT OFF
//Select single sweep
CDDP:MAPP Q
//Select Q branch
CDP:ORD HAD
//Set order to Hadamard
INIT;*WAI
//Start measurement with synchronization
TRAC? TRACE1
//Read out CDP relative/Hadamard/Q
//Result:
//5, 0,-52.3,3,      5, 1,-53.3,0,
//5, 2,-16.1,1,      5, 3,-55.3,0,
//         ....      5, 9,-58.2,0,
//5,10,-16.0,1,      5,11,-53.4,0,
//         ....      5,17,-49.0,0,
//5,18,-15.8,1,      5,19,-53.3,0,
//         ....      5,25,-51.0,0,
//5,26,-16.1,1,      5,27,-54.7,0
         ....      5,31,-51.7,0
//Code 0 is quasi-inactive since PICH is set to I
//Channel 2.8 is distributed between the active codes
//2.32, 10.32, 18.32 and 26.32
//each with one quarter of the power: -10dB - 6dB = -16.0dB
CDP:ORD BITR
//Set order to BitReverse
TRAC? TRACE1
//Read out CDP relative/BitReverse/Q
//Sorting is changed according to BitReverse.
//Result:
//5, 0,-52.3,3,      5,16,-57.3,0
```

```
//5, 8,-56.3.0,       ....
//3, 2,-10.0,1,       5, 6,-55.3,0,
        ....       5,31,-51.7,0
//Code 0 is quasi-inactive since PICH is set to I
//Channel 2.8 can now be read out directly with its total power
CDP:OVER ON
//Activate Overview mode
//CDP relative on window 1 I branch
//CDP relative on window 2 Q branch
TRAC? TRACE1
//Read out CDP relative of I branch
//Result:
//5, 0, -7.0,1,       5,16,-52.3,0
//5, 8,-57.1.0,       ....
//5, 2,-49.0,3,       5,18,-49.0,3,
//5,10,-49.0,3,       5,26,-49.0,3
//5, 6,-55.3,0,       5, 6,-53.4,0,
        ....       5,31,-51.7,0
//PICH is active
//Codes of channel 2.8 are quasi-inactive
TRAC? TRACE2
//Read out CDP relative of Q branch
//Result:
//5, 0,-52.3,3,       6,16,-57.3,0
//5, 8,-56.3.0,       ....
//3, 2,-10.0,1,       6, 3,-55.3,0,
        ....       5,31,-51.7,0
```

10.8.3.5   Composite Constellation

When the trace data for this evaluation is queried, the real and the imaginary branches of each chip are transferred:

$\langle \text{Re chip}_0 \rangle$, $\langle \text{Im chip}_0 \rangle$, $\langle \text{Re chip}_1 \rangle$, $\langle \text{Im chip}_1 \rangle$, ..., $\langle \text{Re chip}_n \rangle$, $\langle \text{Im chip}_n \rangle$

The number of value pairs corresponds to the chip number of 1536 chips in a power control group.

10.8.3.6   Composite EVM (RMS)

When the trace data for this evaluation is queried, one pair of PCG and level value is transferred for each PCG:

$\langle \text{PCG number} \rangle$, $\langle \text{level value in \%} \rangle$

The number of value pairs corresponds to the number of captured PCGs.

10.8.3.7   EVM vs Chip

When the trace data for this evaluation is queried, a list of vector error values of all chips at the selected PCG is returned (=2560 values). The values are calculated as the square root of the square difference between the received signal and the reference signal for each chip, normalized to the square root of the average power at the selected PCG.

10.8.3.8   Frequency Error vs PCG

When the trace data for this evaluation is queried, one pair of PCG and error value is transferred for each PCG:

<PCG number>, <value in Hz>

10.8.3.9   Mag Error vs Chip

When the trace data for this evaluation is queried, a list of magnitude error values of all chips at the selected PCG is returned (=2560 values). The values are calculated as the magnitude difference between the received signal and the reference signal for each chip in %, and are normalized to the square root of the average power at the selected PCG.

10.8.3.10   Power vs PCG

When the trace data for this evaluation is queried, one pair of PCG and level values is transferred for each PCG:

<PCG number>, <level value in dB>

The number of value pairs corresponds to the number of captured PCGs.

10.8.3.11   Peak Code Domain Error

The command returns 2 values for each PCG in the following order:

<PCG number>, <level value in dB>

The number of value pairs corresponds to the number of captured PCGs.

10.8.3.12   Phase Discontinuity vs PCG

When the trace data for this evaluation is queried, one pair of PCG and value is transferred for each PCG:

<PCG number>, <value in deg>

10.8.3.13   Phase Error vs Chip

When the trace data for this evaluation is queried, a list of phase error values of all chips in the selected PCG is returned (=2560 values). The values are calculated as the phase

difference between the received signal and the reference signal for each chip in degrees, and are normalized to the square root of the average power at the selected PCG.

10.8.3.14   Power vs Symbol

When the trace data for this evaluation is queried. One power value per symbol is returned.

The number of values depends on the number of symbols and therefore the spreading factor. With transmit diversity activated, the number of values is reduced to half.

For details see "Number of bits per symbol" on page 36.

10.8.3.15   Result Summary

When the trace data for this evaluation is queried, the results of the result summary are output in the following order:

<PCG>, <PTOTal>, <PPICh>, <RHO>, <MACCuracy>, <PCDerror>, <ACTive>, <FER-Ror>, <FERPpm>, <TFRame>, <CERRor>, <IQOFfset>, <IQIMbalance>, <SRATe>, <CHANnel>, <SFACtor>, <TOFFset>, <POFFset>, <CDPRelative>, <CDPabsolute>, <EVMRms>, <EVMPeak>

Value	Description	Range / Unit
<PCG>	Number of the PCG	
<PTOTal>	Total power	{-∞...∞} dBm
<PPICh>	Pilot power	{-∞...∞} dBm
<RHO>	RHO	{0...1}
<MACCuracy>	Composite EVM	%
<PCDerror>	Peak Code Domain Error	dB
<ACTive>	Number of active channels	
<FERRor>	Frequency error	Hz
<FERPpm>	Frequency error	ppm
<TFRame>	Trigger to Frame	Returns a '9' if the trigger is set to Free Run
<CERRor>	Chip rate error	ppm
<IQOFfset>	IQ offset	%
<IQIMbalance>	IQ imbalance	%
<SRATe>	Symbol rate	ksps
<CHANnel>	Channel number	
<SFACtor>	Spreading factor of the channel	

Value	Description	Range / Unit
<TOFFset>	Timing offset	returns a '9' if the timing/phase offset measurement is switched off or the number of active channel exceeds 50 unit: s
<POFFset>	Phase offset	returns a '9' if the timing/phase offset measurement is switched off or the number of active channel exceeds 50 unit: rad
<CDPRelative>	Relative (to total or pilot power) channel power	$\{-\infty...\infty\}$ dBm
<CDPabsolute>	Absolute channel power	$\{-\infty...\infty\}$ dB
<EVMRms>	Error vector magnitude (RMS)	%
<EVMPeak>	Error vector magnitude peak	%

Read out the modulation type with the command: `CALCulate<n>:MARKer<m>: FUNCtion:CDPower[:BTS]:RESult?` on page 193

10.8.3.16 Symbol Constellation

When the trace data for this evaluation is queried, the real and the imaginary branches of each symbol are transferred:

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

The number of values depends on the number of symbols and therefore the spreading factor. With transmit diversity activated, the number of values is reduced to half.

For details see "Number of bits per symbol" on page 36.

10.8.3.17 Symbol EVM

When the trace data for this evaluation is queried. one EVM value per symbol is returned.

The number of values depends on the number of symbols and therefore the spreading factor. With transmit diversity activated, the number of values is reduced to half.

For details see "Number of bits per symbol" on page 36.

10.8.3.18 Symbol Magnitude Error

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

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

10.8.3.19 Symbol Phase Error

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

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

10.8.4 Exporting Trace Results

Trace results can be exported to a file.

For more commands concerning data and results storage see the R&S FSW User Manual.

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

This command exports trace data from the specified window to an ASCII file.

Trace export is only available for RF measurements.

For details on the file format see "Reference: ASCII File Export Format" in the R&S FSW User Manual.

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,'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>   **COMMa**
Uses a comma as decimal separator, e.g. *4,05*.

POINt
Uses a point as decimal separator, e.g. *4.05*.

*RST: *RST has no effect on the decimal separator. Default is POINt.

Example: FORM:DEXP:DSEP POIN
Sets the decimal point as separator.

10.8.5 Retrieving RF Results

The following commands retrieve the results of the cdma2000 RF measurements.

Useful commands for retrieving results described elsewhere:

* CALCulate<n>:MARKer<m>:Y? on page 195

Remote commands exclusive to

CALCulate<n>:LIMit<k>:FAIL

This command queries the result of a limit check.

Note that for SEM measurements, the limit line suffix <k> is irrelevant, as only one specific SEM limit line is checked for the currently relevant power class.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps. See also INITiate:CONTinuous on page 189.

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:	SCPI confirmed
Manual control:	See "Spectrum Emission Mask" on page 28

CALCulate<n>:MARKer<m>:FUNCtion:POWer:RESult? <Measurement>

This command queries the results of power measurements.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single sweeps. See also INITiate:CONTinuous on page 189.

Query parameters:

<Measurement>   **ACPower | MCACpower**

ACLR measurements (also known as adjacent channel power or multi-carrier adjacent channel measurements).

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

• power of the transmission channel
• power of lower adjacent channel
• power of upper adjacent channel
• power of lower alternate channel 1
• power of upper alternate channel 1 *(etc.)*

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

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

CN

Carrier-to-noise measurements.

Returns the C/N ratio in dB.

CN0

Carrier-to-noise measurements.

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

CPOWer

Channel power measurements.

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

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

For SEM measurements, the return value is the channel power of the reference range.

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.

OBANdwidth | OBWidth

Occupied bandwidth.

Returns the occupied bandwidth in Hz.

Manual control: See "Power" on page 26
See "Channel Power ACLR" on page 27
See "Spectrum Emission Mask" on page 28
See "Occupied Bandwidth" on page 29
See "CCDF" on page 30

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

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

Parameters:

<ResultType>   **MEAN**
                       Average (=RMS) power in dBm measured during the measure-
                       ment 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

Manual control: See "CCDF" on page 30

10.9   General Analysis

The following commands configure general result analysis settings concerning the trace
and markers for CDA measurements.

For RF measurements, see the Remote Commands - Analysis chapter in the R&S FSW
User Manual.

10.9.1   Traces

The trace settings determine how the measured data is analyzed and displayed on the
screen. In cdma2000 applications, only one trace per window can be configured for Code
Domain Analysis.

DISPlay[:WINDow<n>]:TRACe<t>:MODE <Mode>

This command selects the trace mode.

In case of max hold, min hold or average trace mode, you can set the number of single measurements with `[SENSe:]SWEep:COUNt`. Note that synchronization to the end of the measurement is possible only in single sweep mode.

Parameters:

<Mode>	**WRITe**
	Overwrite mode: the trace is overwritten by each sweep. This is the default setting.
	AVERage
	The average is formed over several sweeps. The "Sweep/Average Count" determines the number of averaging procedures.
	MAXHold
	The maximum value is determined over several sweeps and displayed. The R&S FSW saves the sweep result in the trace memory only if the new value is greater than the previous one.
	MINHold
	The minimum value is determined from several measurements and displayed. The R&S FSW saves the sweep result in the trace memory only if the new value is lower than the previous one.
	VIEW
	The current contents of the trace memory are frozen and displayed.
	BLANk
	Hides the selected trace.
	*RST: Trace 1: WRITe, Trace 2-6: BLANk
Example:	`INIT:CONT OFF`
	Switching to single sweep mode.
	`SWE:COUN 16`
	Sets the number of measurements to 16.
	`DISP:TRAC3:MODE WRIT`
	Selects clear/write mode for trace 3.
	`INIT;*WAI`
	Starts the measurement and waits for the end of the measurement.
Manual control:	See "Trace Mode" on page 99

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
	*RST: ON for TRACe1, OFF for TRACe2 to 6
Example:	`DISP:TRAC3 ON`
Usage:	SCPI confirmed

10.9.2 Markers

Markers help you analyze your measurement results by determining particular values in the diagram. In cdma2000 applications, only 4 markers per window can be configured for Code Domain Analysis.

10.9.2.1 Individual Marker Settings

CALCulate<n>:MARKer<m>:AOFF

This command turns all markers off.

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

Usage:	Event

Manual control:	See "All Markers Off" on page 103

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 control:	See "Marker State" on page 102
	See "Marker Type" on page 102

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.

                        The unit is either Hz (frequency domain) or s (time domain) or dB (statistics).

                        Range: The range depends on the current x-axis range.

Example: CALC:MARK2:X 1.7MHz

                        Positions marker 2 to frequency 1.7 MHz.

Manual control: See "Stimulus" on page 102

CALCulate<n>:DELTamarker:AOFF

This command turns all delta markers off.

Example: CALC:DELT:AOFF

                        Turns all delta markers off.

Usage: Event

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

This command turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker turns on delta marker 1.

Parameters:

<State>   ON | OFF

                        *RST: OFF

Example: CALC:DELT2 ON

                        Turns on delta marker 2.

Manual control: See "Marker State" on page 102

                        See "Marker Type" on page 102

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:X?

                        Outputs the (absolute) x-value of delta marker 1.

Manual control: See "Stimulus" on page 102

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 or the fixed reference.

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 sweeps. See also INITiate:CONTinuous on page 189.

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

10.9.2.2 General Marker Settings

DISPlay:MTABle <DisplayMode>

This command turns the marker table on and off.

Parameters:

<DisplayMode>	ON | OFF | AUTO
	ON
	Turns the marker table on.
	OFF
	Turns the marker table off.
	AUTO
	Turns the marker table on if 3 or more markers are active.
	*RST: AUTO
Example:	DISP:MTAB ON
	Activates the marker table.
Manual control:	See "Marker Table Display" on page 103

10.9.2.3 Marker Search and Positioning Settings

CALCulate<n>:MARKer<m>:FUNCtion:PICH

This command sets the marker to channel 0.64.

Example:	CALC:MARK:FUNC:PICH
	Activates marker and positions it at pilot 0.64.
	CALC:MARK:Y?
	Queries value of the relative Code Domain Power of the pilot channel.
Mode:	BTS mode only
Manual control:	See "Marker To PICH" on page 106

CALCulate<n>:MARKer<m>:FUNCtion:TDPIch

This command sets the marker to channel 16.128.

Example:	CALC:MARK:FUNC:TDPI
	Activates marker and positions it at TDPICH 16.128.
	CALC:MARK:Y?
	Queries value of the relative Code Domain Power of the transmit diversity pilot channel.

Mode:	BTS mode only

Manual control:	See "Marker To TDPICH" on page 106

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

Manual control:	See "Search Mode for Next Peak" on page 104

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

This command moves a marker to the next lower peak.

Usage:	Event

Manual control:	See "Search Mode for Next Peak" on page 104
	See "Search Next Peak" on page 105

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

Manual control:	See "Search Mode for Next Peak" on page 104

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

This command moves a marker to the highest level.

If the marker hasn't been active yet, the command first activates the marker.

Usage:	Event

Manual control:	See "Peak Search" on page 106

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

Manual control: See "Search Mode for Next Peak" on page 104

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

This command moves a marker to the next minimum value.

Usage: Event

Manual control: See "Search Mode for Next Peak" on page 104
                      See "Search Next Minimum" on page 106

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

Manual control: See "Search Mode for Next Peak" on page 104

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

This command moves a marker to the minimum level.

If the marker hasn't been active yet, the command first activates the marker.

Usage: Event

Manual control: See "Search Minimum" on page 106

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

Manual control: See "Search Mode for Next Peak" on page 104

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

This command moves a marker to the next higher value.

Usage: Event

Manual control: See "Search Mode for Next Peak" on page 104
                            See "Search Next Peak" on page 105

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

Manual control: See "Search Mode for Next Peak" on page 104

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

This command moves a delta marker to the highest level.

If the marker hasn't been active yet, the command first activates the marker.

Usage: Event

Manual control: See "Peak Search" on page 106

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

Manual control: See "Search Mode for Next Peak" on page 104

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

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

Usage: Event

Manual control: See "Search Mode for Next Peak" on page 104
                        See "Search Next Minimum" on page 106

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

Manual control: See "Search Mode for Next Peak" on page 104

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

This command moves a delta marker to the minimum level.

If the marker hasn't been active yet, the command first activates the marker.

Usage: Event

Manual control: See "Search Minimum" on page 106

10.10 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 cdma2000 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 [SENSe:]CDPower:SET:COUNt on page 162). 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 3GPP FDD BTS measurement.

The **analysis interval** used by the individual result displays cannot be edited, but is determined automatically. However, you can query the currently used analysis interval for a specific window.

Remote commands exclusive to MSRA applications

The following commands are only available for MSRA application channels:

CALCulate:MSRA:WINDow<n>:IVAL?

This command queries the analysis interval for the current window. 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

                     Default unit: us

<IntStop>   Stop value of the analysis interval

                     Default unit: us

Usage: Query only

INITiate: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.

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

[SENS:]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:

<Offset>	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 <Record length>
	*RST: 0
Manual control:	See "Trigger Source" on page 71
	See "Capture Offset" on page 73

10.11 Querying the Status Registers

The following commands query the status registers specific to the cdma2000 applications. In addition, the cdma2000 applications also use the standard status registers of the R&S FSW.

For details on the common R&S FSW status registers refer to the description of remote commands basics in the R&S FSW User Manual.

*RST does not influence the status registers.

The STATus:QUEStionable:DIQ register is described in "STATus:QUEStionable:DIQ Register" on page 142.

The STATus:QUEStionable:SYNC register contains information on the error situation in the code domain analysis of the cdma2000 applications. The bits can be queried with commands STATus:QUEStionable:SYNC:CONDition? on page 224 and STATus:QUEStionable:SYNC[:EVENt]? on page 224.

Table 10-7: Status error bits in STATus:QUEStionable:SYNC register for cdma2000 applications

Bit No	Meaning
0	This bit is not used.
1	Frame Sync failed. This bit is set when synchronization is not possible within the application. Possible reasons: • Incorrectly set frequency • Incorrectly set level • Incorrectly set PN Offset • Incorrectly set values for Swap IQ • Invalid signal at input
2 to 14	These bits are not used.
15	This bit is always 0.

STATus:QUEStionable:SYNC[:EVENt]? <ChannelName>

This command reads out the EVENt section of the status register.

The command also deletes the contents of the EVENt section.

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 <SumBit>,<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:

<SumBit>   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 <SumBit>,<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:

<SumBit>   Range: 0 to 65535

<ChannelName>   String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

STATus:QUEStionable:SYNC:PTRansition <SumBit>,<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:

<SumBit>   Range: 0 to 65535

<ChannelName>   String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

10.12 Commands for Compatibility

The following commands are provided for compatibility to other signal analyzers only. For new remote commands programs use the specified alternative commands.

CALCulate<n>:FEED <Evaluation>

This command selects the evaluation method of the measured data that is to be displayed in the specified window.

Note that this command is maintained for compatibility reasons only. Use the LAYout commands for new remote control programs (see chapter 10.6.2, "Working with Windows in the Display", on page 180).

Parameters:

<Evaluation>   Type of evaluation you want to display.
                     See the table below for available parameter values.

Example: CALC:FEED 'XPOW:CDP'
                     Selects the Code Domain Power result display.

Table 10-8: <Evaluation> parameter values

String Parameter	Text Parameter	Evaluation
'XTIM:CDP:BSTReam'	BITStream	Bitstream
'XTIM:CDP:COMP:CONStellation'	CCONst	Composite Constellation
'XPOW:CDEPower'	CDEPower	Code Domain Error Power
'XTIM:CDP:COMP:EVM'	CDEVm	Composite EVM
'XPOW:CDP:RATio'	CDPower	Code Domain Power
'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'	PSLot	Power vs Slot (BTS mode only)
'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

[SENSe:]CDPower:LEVel:ADJust

This command adjusts the reference level to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S FSW or limiting the dynamic range by an S/N ratio that is too small.

Note that this command is retained for compatibility reasons only. For new R&S FSW programs use [SENSe:]ADJust:LEVel on page 173.

[SENSe:]CDPower:PRESet

This command resets the cdma2000 channel to its predefined settings. Any RF measurement is aborted and the measurement type is reset to Code Domain Analysis.

Note that this command is retained for comaptibility reasons only. For new remote control programs use the SYSTem:PRESet:CHANnel[:EXECute] command.

Usage: Event

A Annex - Reference Data

A.1 Reference: Predefined Channel Tables

Predefined channel tables provide quick configuration for the channel search in commonly used measurement scenarios in accordance with the cdma2000 specification.

To use channels other than those in the predefined channel tables, you can copy the original tables and modify the channels in the copy.

A.1.1 BTS Channel Tables

The cdma2000 BTS Analysis application provides the following set of channel tables compliant with the cdma2000 specification:

The standard does not specify a channel number for the data channels.

Channel table	Contents
RECENT	Contains the most recently selected channel table
MPC_RC1	Base Station **M**ain **P**ath 6 **C**hannels **R**adio **C**onfiguration **1** Channel table with F-PICH/F-SYNC/F-PCH and 6 data channels.
MPC_RC4	Base Station **M**ain **P**ath 6 **C**hannels **R**adio **C**onfiguration **4** Channel table with F-PICH/F-SYNC/F-PCH and 6 data channels.
TDC_RC4	Base Station **T**ransmit **D**iversity Path 6 **C**hannels **R**adio **C**onfiguration 4 Channel table with F-PICH/F-SYNC/F-PCH and 6 data channels.
BPC_RC4	Base Station **B**oth **P**aths 6 **C**hannels **R**adio **C**onfiguration 4 Channel table with F-PICH/F-TDPICH/F-SYNC/F-PCH and 6 data channels

Table 1-1: Base station channel table for main branch in radio configuration 1 (MPC_RC1)

Channel Type	Number of Channels	Code Channel (Walsh Code.SF)	Radio Configuration
F-PICH	1	0.64	-
F-SYNC	1	32.64	-

Channel Type	Number of Channels	Code Channel (Walsh Code.SF)	Radio Configuration
F-PCH	1	1.64	-
F-CHAN	6	9.64	1
		10.64	1
		11.64	1
		15.64	1
		17.64	1
		25.64	1

Table 1-2: Base station channel table for main branch in radio configuration 4 (MPC_RC4)

Channel Type	Number of Channels	Code Channel (Walsh Code.SF)	Radio Configuration
F-PICH	1	0.64	-
F-SYNC	1	32.64	-
F-PCH	1	1.64	-
F-CHAN	6	9.128	4
		10.128	4
		11.128	4
		15.128	4
		17.128	4
		25.128	4

Table 1-3: Base station test model for aggregate signal in radio configuration 4 (TDC_RC4)

Channel Type	Number of Channels	Code Channel (Walsh Code.SF)	Radio Configuration
F-PICH	1	16.128	-
F-SYNC	1	32.64	-
F-PCH	1	1.64	-
F-CHAN	6	9.128	4
		10.128	4
		11.128	4
		15.128	4
		17.128	4
		25.128	4

Table 1-4: Base station test model for aggregate signal in radio configuration 4 (BPC_RC4)

Channel Type	Number of Channels	Code Channel (Walsh Code.SF)	Radio Configuration
F-PICH	1	0.64	-
TDPICH	1	16.128	-
F-SYNC	1	32.64	-

Channel Type	Number of Channels	Code Channel (Walsh Code.SF)	Radio Configuration
F-PCH	1	1.64	-
F-CHAN	6	9.128	4
		10.128	4
		11.128	4
		15.128	4
		17.128	4
		25.128	4

A.1.2   MS Channel Tables

The cdma2000 MS application provides the following set of channel tables compliant with the cdma2000 specification:

Channel table	Contents
RECENT	Contains the channels that were automatically created during the last measurement with the "Auto Search" option activated (for details refer to "Using Predefined Channel Tables" on page 78).
EACHOP	Channel table for **E**nhanced **A**ccess **CH**annel **OP**eration with PICH and EACH
RCCCHOP	Channel table for **R**everse **C**ommon **C**ontrol **CH**annel **OP**eration with PICH and CCCH
RTCHOP3	Channel table for **R**everse **T**raffic **CH**annel **OP**eration with the following 3 channels: • PICH • DCCH • FCH
RTCHOP5	Channel table for **R**everse **T**raffic **CH**annel **OP**eration with the following 5 channels: • PICH • DCCH • FCH • S1CH • S2CH

Table 1-5: Channel table for enhanced access channel operation

Channel type	Code channel (Walsh Code.SF)	Mapping
PICH	0.32	I
EACH	2.8	Q

Table 1-6: Channel table for reverse commom control channel operation

Channel type	Code channel (Walsh Code.SF)	Mapping
PICH	0.32	I
CCCH	2.8	Q

Table 1-7: Channel table for REVERSE TRAFFIC CHANNEL OPERATION 3

Channel type	Code channel (Walsh Code.SF)	Mapping
PICH	0.32	I
FCH	4.16	Q
S1CH	2.4	Q

Table 1-8: Channel table for REVERSE TRAFFIC CHANNEL OPERATION 5

Channel type	Code channel (Walsh Code.SF)	Mapping
PICH	0.32	I
DCCH	8.16	I
FCH	4.16	Q
S1CH	2.4	Q
S2CH	6.8	I

A.2 Reference: Code Tables

Hadamard and BitReverse Code Tables

The following tables show the code sequences with Hadamard and BitReverse orders for the Code Domain Power and Code Domain Error Power result displays.

As an example, the corresponding cells for channel 8.32 (channel number 8 for spreading factor 32) are marked to show where the different codes of this channel are located.

#	HADAMARD													BITREVERSE	#
0	000000	0 0 0 0 0 0						0 0 0 0 0 0						000000	0
1	000001	0 0 0 0 0 1						1 0 0 0 0 0						100000	32
2	000010	0 0 0 0 1 0						0 1 0 0 0 0						010000	16
3	000011	0 0 0 0 1 1						1 1 0 0 0 0						110000	48
4	000100	0 0 0 1 0 0						0 0 1 0 0 0						001000	8
5	000101	0 0 0 1 0 1						1 0 1 0 0 0						101000	40
6	000110	0 0 0 1 1 0						0 1 1 0 0 0						011000	24
7	000111	0 0 0 1 1 1						1 1 1 0 0 0						111000	56
8	001000	0 0 1 0 0 0						0 0 0 1 0 0						000100	4
9	001001	0 0 1 0 0 1						1 0 0 1 0 0						100100	36
10	001010	0 0 1 0 1 0						0 1 0 1 0 0						010100	20
11	001011	0 0 1 0 1 1						1 1 0 1 0 0						110100	52
12	001100	0 0 1 1 0 0						0 0 1 1 0 0						001100	12
13	001101	0 0 1 1 0 1						1 0 1 1 0 0						101100	44
14	001110	0 0 1 1 1 0						0 1 1 1 0 0						011100	28
15	001111	0 0 1 1 1 1						1 1 1 1 0 0						111100	60
16	010000	0 1 0 0 0 0						0 0 0 0 1 0						000010	2
17	010001	0 1 0 0 0 1						1 0 0 0 1 0						100010	34
18	010010	0 1 0 0 1 0						0 1 0 0 1 0						010010	18
19	010011	0 1 0 0 1 1						1 1 0 0 1 0						110010	50
20	010100	0 1 0 1 0 0						0 0 1 0 1 0						001010	10
21	010101	0 1 0 1 0 1						1 0 1 0 1 0						101010	42
22	010110	0 1 0 1 1 0						0 1 1 0 1 0						011010	26
23	010111	0 1 0 1 1 1						1 1 1 0 1 0						111010	58
24	011000	0 1 1 0 0 0						0 0 0 1 1 0						000110	6
25	011001	0 1 1 0 0 1						1 0 0 1 1 0						100110	38
26	011010	0 1 1 0 1 0						0 1 0 1 1 0						010110	22
27	011011	0 1 1 0 1 1						1 1 0 1 1 0						110110	54
28	011100	0 1 1 1 0 0						0 0 1 1 1 0						001110	14
29	011101	0 1 1 1 0 1						1 0 1 1 1 0						101110	46
30	011110	0 1 1 1 1 0						0 1 1 1 1 0						011110	30
31	011111	0 1 1 1 1 1						1 1 1 1 1 0						111110	62
32	100000	1 0 0 0 0 0						0 0 0 0 0 1						000001	1
33	100001	1 0 0 0 0 1						1 0 0 0 0 1						100001	33
34	100010	1 0 0 0 1 0						0 1 0 0 0 1						010001	17
35	100011	1 0 0 0 1 1						1 1 0 0 0 1						110001	49
36	100100	1 0 0 1 0 0						0 0 1 0 0 1						001001	9
37	100101	1 0 0 1 0 1						1 0 1 0 0 1						101001	41
38	100110	1 0 0 1 1 0						0 1 1 0 0 1						011001	25
39	100111	1 0 0 1 1 1						1 1 1 0 0 1						111001	57
40	101000	1 0 1 0 0 0						0 0 0 1 0 1						000101	5
41	101001	1 0 1 0 0 1						1 0 0 1 0 1						100101	37
42	101010	1 0 1 0 1 0						0 1 0 1 0 1						010101	21
43	101011	1 0 1 0 1 1						1 1 0 1 0 1						110101	53
44	101100	1 0 1 1 0 0						0 0 1 1 0 1						001101	13
45	101101	1 0 1 1 0 1						1 0 1 1 0 1						101101	45
46	101110	1 0 1 1 1 0						0 1 1 1 0 1						011101	29
47	101111	1 0 1 1 1 1						1 1 1 1 0 1						111101	61
48	110000	1 1 0 0 0 0						0 0 0 0 1 1						000011	3
49	110001	1 1 0 0 0 1						1 0 0 0 1 1						100011	35
50	110010	1 1 0 0 1 0						0 1 0 0 1 1						010011	19
51	110011	1 1 0 0 1 1						1 1 0 0 1 1						110011	51
52	110100	1 1 0 1 0 0						0 0 1 0 1 1						001011	11
53	110101	1 1 0 1 0 1						1 0 1 0 1 1						101011	43
54	110110	1 1 0 1 1 0						0 1 1 0 1 1						011011	27
55	110111	1 1 0 1 1 1						1 1 1 0 1 1						111011	59
56	111000	1 1 1 0 0 0						0 0 0 1 1 1						000111	7
57	111001	1 1 1 0 0 1						1 0 0 1 1 1						100111	39
58	111010	1 1 1 0 1 0						0 1 0 1 1 1						010111	23
59	111011	1 1 1 0 1 1						1 1 0 1 1 1						110111	55
60	111100	1 1 1 1 0 0						0 0 1 1 1 1						001111	15
61	111101	1 1 1 1 0 1						1 0 1 1 1 1						101111	47
62	111110	1 1 1 1 1 0						0 1 1 1 1 1						011111	31
63	111111	1 1 1 1 1 1						1 1 1 1 1 1						111111	63

Fig. 1-1: Codetable for base spreading factor 64

Fig. 1-2: Code table for base spreading factor 128 (part1)

Fig. 1-3: Code table for base spreading factor 128 (part 2)

A.3 Reference: Supported Bandclasses

The bandclass defines the frequency band used for ACLR and SEM measurements. It also determines the corresponding limits and ACLR channel settings according to the cdma2000 standard. The used bandclass is defined in the SEM or ACLR measurement settings (see "Bandclass" on page 91).

Table 1-9: Supported bandclasses for cdma2000 RF measurements

Bandclass	SCPI para	Description
0	0	800 MHz Cellular Band
1	1	1.9 GHz PCS Band
2	2	TACS Band

Bandclass	SCPI para	Description
3A	3	JTACS Band: >832 MHz and ≤ 834 MHz >838 MHz and ≤ 846 MHz >860 MHz and ≤ 895 MHz
3B	**21**	JTACS Band: >810 MHz and ≤ 860 MHz except: >832 MHz and ≤ 834 MHz >838 MHz and ≤ 846 MHz
3C	**22**	JTACS Band: ≤810 MHz and >895 MHz
4	4	Korean PCS Band
5	5	450 MHz NMT Band
6	6	2 GHz IMT-2000 Band
7	7	700 MHz Band
8	8	1800 MHz Band
9	9	900 MHz Band
10	10	Secondary 800 MHz
11	11	400 MHz European PAMR Band
12	12	800 MHz PAMR Band
13	13	2.5 GHz IMT-2000 Extension Band
14	14	US PCS 1.9 GHz Band
15	15	AWS Band
16	16	US 2.5 GHz Band
17	17	US 2.5 GHz Forward Link Only Band

A.4 Abbreviations

For a comprehensive glossary refer to the cdma2000 standard.

APICH	auxiliary pilot channel
ATDPCH	auxiliary transmit diversity pilot channel
BCH	broadcast channel
CACH	common assignment channel
CCCH	common control channel (2.8)

CDEP	code domain error power
CDP	code domain power
Composite EVM	in accordance with the cdma2000 specifications, determines the square root of the squared error between the real and the imaginary parts of the test signal and an ideally generated reference signal (EVM referred to the total signal) in a composite EVM measurement.
CPCCH	common power control channel
Crest factor	ratio of peak to average value of the signal
EACH	Enhanced access channel 2.8
FCH	Fundamental channel 4.16
Inactive Channel Threshold	minimum power that a single channel must have compared with the total signal to be recognized as an active channel.
MC1	multi-carrier1 (one carrier system 1X).
MC2	multi-carrier3 (three carrier system 3X).
OTD	orthogonal transmit diversity, two antennas used
PCG	power control group: name in cdma2000 system for 1536 chips or 1.25 ms interval; transmitter power is constant during a power control group
PCH	paging channel
PDCH	packet data channel
PDCCH	packet data control channel
PICH	pilot channel 0.64 (MS: 0.32)
RC	radio configuration; definition of sampling rate, permissible data rates, modulation types and use of special channels, and transmit diversity
S1CH	Supplemental 1 channel 1.2 or 2.4 (in higher layers this channel is also referred to as supplemental channel 0 – SCH0).
S2CH	Supplemental 2 channel 2.4 or 6.8 (in higher layers this channel is also referred to as supplemental channel 1 – SCH1).
SCH0	Refer to S1CH
SCH1	Refer to S2CH
Set	a group of 64 consecutive PCGs
SF	spreading factor
SYNC	synchronisation channel 32.64
TD	transmit diversity, two antennas used
TDPICH	transmit diversity pilot channel 16.128
x.y	Walsh code x.y, with code number x and spreading factor y of the channel

List of Remote Commands (CDMA2000)

Index

U

W

Y

Z