R&S®FSW-K82/-K83 CDMA2000® Measurements User Manual

1173933402
Version 28

ROHDE&SCHWARZ
Make ideas real

This manual applies to the following FSW models with firmware version 6.00 and later:

- R&S®FSW8 (1331.5003K08 / 1312.8000K08)
- R&S®FSW13 (1331.5003K13 / 1312.8000K13)
- R&S®FSW26 (1331.5003K26 / 1312.8000K26)
- R&S®FSW43 (1331.5003K43 / 1312.8000K43)
- R&S®FSW50 (1331.5003K50 / 1312.8000K50)
- R&S®FSW67 (1331.5003K67 / 1312.8000K67)
- R&S®FSW85 (1331.5003K85 / 1312.8000K85)

The following firmware options are described:

- FSW-K82 (1313.1468.02)
- FSW-K83 (1313.1474.02)

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

1173.9334.02 | Version 28 | R&S®FSW-K82/-K83

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®FSW is indicated as R&S FSW. R&S®FSW-K82 / R&S®FSW-K83 is indicated as R&S FSW-K82/-K83

Contents

1 Documentation overview....7

1.1 Getting started manual....7

1.2 User manuals and help....7

1.3 Service manual....7

1.4 Instrument security procedures....8

1.5 Printed safety instructions....8

1.6 Specifications and brochures....8

1.7 Release notes and open-source acknowledgment (OSA)....8

1.8 Application notes, application cards, white papers, etc....9

1.9 Videos....9

2 Welcome to the CDMA2000 applications....10

2.1 Starting the CDMA2000 applications....11

2.2 Understanding the display information....11

3 Measurements and result displays....14

3.1 Code domain analysis....14

3.2 RF measurements....29

4 Measurement basics....37

4.1 PCGs and sets....37

4.2 Channels, codes and symbols....37

4.3 Code display and sort order....39

4.4 Scrambling via PN offsets and long codes....41

4.5 Code mapping and branches....41

4.6 Radio configuration....42

4.7 Transmission with multiple carriers and multiple antennas....42

4.8 Channel detection and channel types....44

4.9 Test setup for CDMA2000 tests....47

4.10 CDA measurements in MSRA operating mode....48

5 I/Q data import and export....50

6 Configuration....51

6.1 Result display....51

6.2 Code domain analysis..52
6.3 RF measurements...95

7 Analysis.. 100
7.1 Code domain analysis settings... 100
7.2 Evaluation range.. 103
7.3 Traces...104
7.4 Markers.. 106

8 Optimizing and troubleshooting the measurement........................ 113
8.1 Error messages.. 113

9 How to perform measurements in CDMA2000 applications.......... 114

10 Measurement examples...118
10.1 Meas 1: measuring the signal channel power... 118
10.2 Meas 2: measuring the spectrum emission mask...119
10.3 Meas 3: measuring the relative code domain power and frequency error.......... 120
10.4 Meas 4: measuring the triggered relative code domain power......................... 122
10.5 Meas 5: measuring the composite EVM..123
10.6 Meas 6: measuring the peak code domain error and the RHO factor..................125

11 Remote commands for CDMA2000 measurements.......................127
11.1 Introduction.. 127
11.2 Common suffixes... 132
11.3 Activating the measurement channel.. 132
11.4 Selecting a measurement..137
11.5 Configuring code domain analysis.. 138
11.6 Configuring RF measurements..198
11.7 Configuring the result display.. 199
11.8 Starting a measurement.. 208
11.9 Retrieving results...212
11.10 General analysis..234
11.11 Importing and exporting I/Q data and results.. 244
11.12 Configuring the secondary application data range (MSRA mode only).............. 246
11.13 Querying the status registers.. 248
11.14 Deprecated commands..251

11.15 Programming examples for CDMA2000 BTS measurements..............................252

Annex..255

A Annex - reference data...255

A.1 Reference: predefined channel tables...255

A.2 Reference: code tables...258

A.3 Reference: supported bandclasses...261

A.4 Abbreviations...262

List of commands (CDMA2000)..264

Index..269

1 Documentation overview

This section provides an overview of the FSW user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/FSW

Further documents are available at:

www.rohde-schwarz.com/product/FSW

1.1 Getting started manual

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

A printed version is delivered with the instrument. A PDF version is available for download on the Internet.

1.2 User manuals and help

Separate user manuals are provided for the base unit and the firmware applications:

- Base unit manual
  Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.
- Firmware application manual
  Contains the description of the specific functions of a firmware application, including remote control commands. Basic information on operating the FSW is not included.

The contents of the user manuals are available as help in the FSW. The help offers quick, context-sensitive access to the complete information for the base unit and the firmware applications.

All user manuals are also available for download or for immediate display on the Internet.

1.3 Service manual

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

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

https://gloris.rohde-schwarz.com

1.4 Instrument security procedures

Deals with security issues when working with the FSW in secure areas. It is available for download on the internet.

1.5 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

1.6 Specifications and brochures

The specifications document, also known as the data sheet, contains the technical specifications of the FSW. It also lists the firmware applications and their order numbers, and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/FSW

1.7 Release notes and open-source acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation.

The firmware makes use of several valuable open source software packages. An open-source acknowledgment document provides verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/FSW

1.8 Application notes, application cards, white papers, etc.

These documents deal with special applications or background information on particular topics.

See www.rohde-schwarz.com/application/FSW

1.9 Videos

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: https://www.youtube.com/@RohdeundSchwarz

2 Welcome to the CDMA2000 applications

The CDMA2000 options are firmware applications that add functionality to the FSW to perform measurements on downlink or uplink signals according to the CDMA2000 standard.

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).

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 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 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.

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

http://www.rohde-schwarz.com/product/FSW.html.

Installation

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

2.1 Starting the CDMA2000 applications

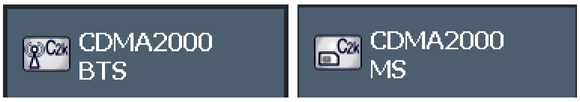
The CDMA2000 measurements require special applications on the FSW.

To activate the CDMA2000 applications

1. Press [MODE].

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

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

   The 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 6.2.1, "Configuration overview", on page 53).

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.

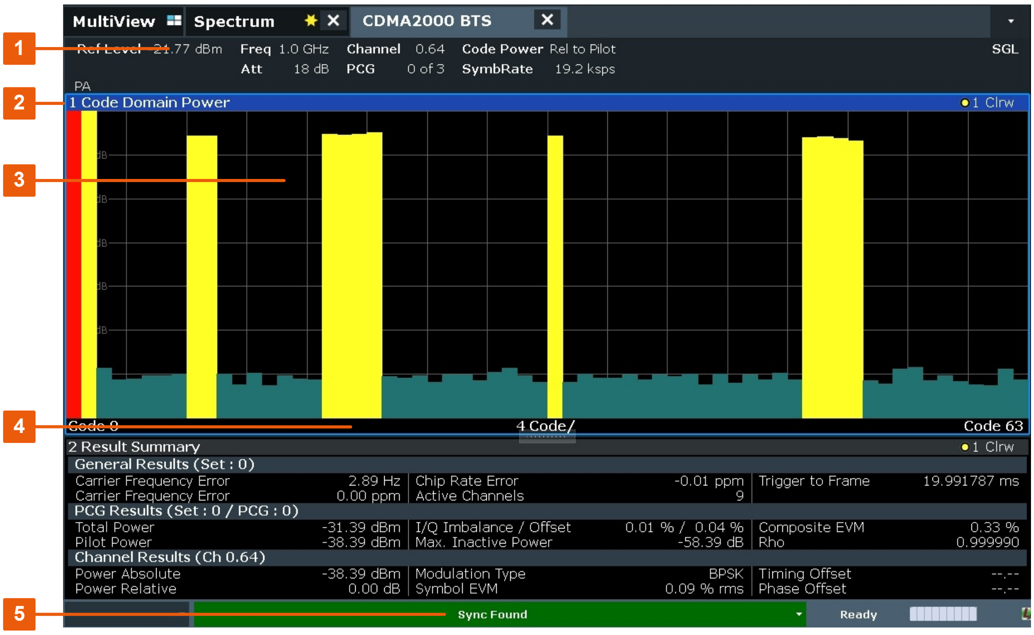
If activated, the measurements configured in the currently active channels are performed one after the other in the order of the tabs. The currently active measurement is indicated by a symbol in the tab label. The result displays of the individual channels are updated in the tabs (as well as the "MultiView")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

For details on the Sequencer function see the FSW User Manual.

2.2 Understanding the display information

The following figure shows a measurement diagram in the CDMA2000 BTS application. All different information areas are labeled. They are explained in more detail in the following sections.

(The basic screen elements are identical in the CDMA2000 MS application.)



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 FSW MSRA User Manual.

Channel bar information

In CDMA2000 applications, the 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 37)
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 FSW Getting Started manual.

Window title bar information

For each diagram, the header provides the following information:

Figure 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

Access: "Overview" > "Select Measurement"

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 51.

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 17.

● Code domain analysis..14
● RF measurements..29

3.1 Code domain analysis

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

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)

Remote command:

`CONF:CDP:MEAS CDP`, see `CONFigure:CDPower[:BTS]:MEASurement` on page 137

- Code domain parameters.....15
- Evaluation methods for code domain analysis.....17

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 FSW. The absolute frequency error is the sum of the frequency error of the 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. It is strongly recommended that you synchronize the transmitter and the receiver. 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 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 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 56.
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 18.

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 application only):** Displays the modulation type of the channel and PCG: BPSK, QPSK, 8PSK, or 16QAM
Mapping	**(MS application 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 102), 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 28.
Timing Offset	Timing offset between the selected channel and the pilot channel If enabled (see "Timing and phase offset calculation" on page 102), 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

Access: "Overview" > "Display Config"

The captured I/Q data can be evaluated using various different methods without having to start a new measurement. All evaluation methods available for the selected CDMA2000 measurement are displayed in the evaluation bar in SmartGrid mode.

The selected evaluation not only affects the result display, but also the results of the trace data query (see TRACe<n>[:DATA] on page 215).

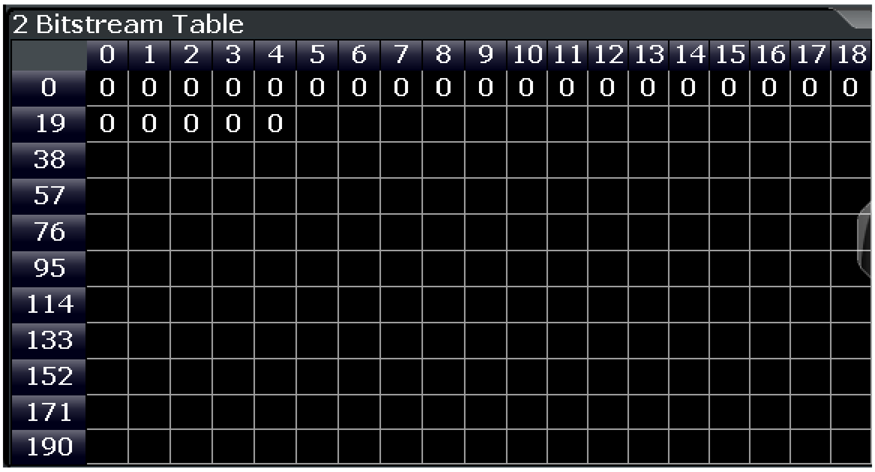
The Code Domain Analyzer provides the following evaluation methods for measurements in the code domain:

Bitstream..17
Channel Table..18
└ Table Configuration..19
Code Domain Power / Code Domain Error Power.......................................20
Composite Constellation...21
Composite EVM..22
Magnitude Error vs Chip...23
Peak Code Domain Error..24
Phase Error vs Chip...24
Power vs PCG..26
Power vs Symbol..26
Result Summary...27
Symbol Constellation..27
Symbol EVM...28
Symbol Magnitude Error...28
Symbol Phase Error...29

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.


2 Bitstream Table

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0														
38																			
57																			
76																			
95																			
114																			
133																			
152																			
171																			
190																			

Figure 3-1: Bitstream result display for the BTS application

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 can display, 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 37.

Remote command:
`LAY:ADD? '1',RIGH, 'XTIM:CDP:BSTR'`, see `LAYout:ADD[:WINDow]?` on page 201

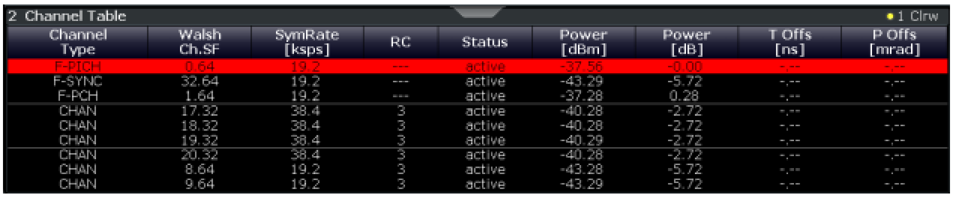
Channel Table
The "Channel Table" evaluation displays the detected channels and the results of the code domain power measurement over the selected PCG. The analysis results for all channels are displayed. Thus, the "Channel Table" can contain up to 128 entries, corresponding to the highest base spreading 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 the BTS application, 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 19).



2 Channel Table ● 1 Clrw

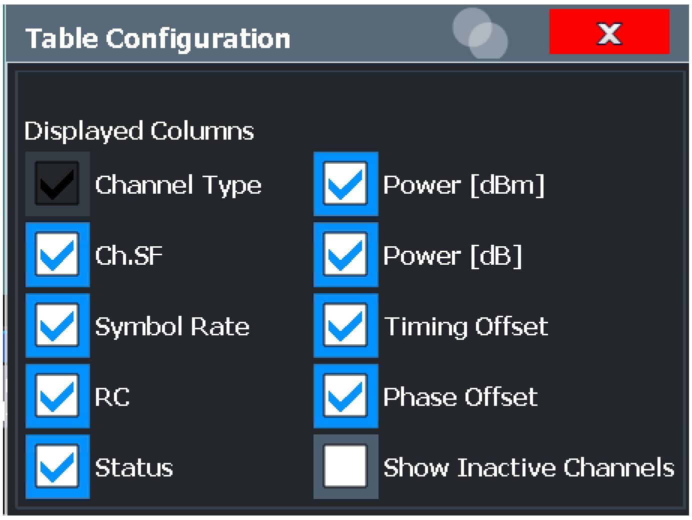
Channel Type	Walsh Ch.SF	SymRate [ksps]	RC	Status	Power [dBm]	Power [dB]	T Offs [ns]	P Offs [mrad]
F-PICH	0.64	19.2	---	active	-37.56	-0.00	-.--	-.--
F-SYNC	32.64	19.2	---	active	-43.29	-5.72	-.--	-.--
F-PCH	1.64	19.2	---	active	-37.28	0.28	-.--	-.--
CHAN	17.32	38.4	3	active	-40.28	-2.72	-.--	-.--
CHAN	18.32	38.4	3	active	-40.28	-2.72	-.--	-.--
CHAN	19.32	38.4	3	active	-40.29	-2.72	-.--	-.--
CHAN	20.32	38.4	3	active	-40.28	-2.72	-.--	-.--
CHAN	8.64	19.2	3	active	-43.28	-5.72	-.--	-.--
CHAN	9.64	19.2	3	active	-43.29	-5.72	-.--	-.--

Figure 3-2: Channel Table display for the BTS application

Remote command:
`LAY:ADD? '1',RIGH, CTABle`, see `LAYout:ADD[:WINDow]?` on page 201

Table Configuration ← Channel Table
You can configure which parameters are displayed in the "Channel Table" by clicking (**not double-clicking**!) a column header.

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



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

The following parameters of the detected channels are determined by the CDP measurement and can be displayed in the "Channel Table" result display. (For details, see Chapter 3.1.1, "Code domain parameters", on page 15.)

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 102), 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.

Parameter	Description
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)
RC	**(BTS application only):** Radio configuration
Mapping	**(MS application 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 102), 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 39).

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

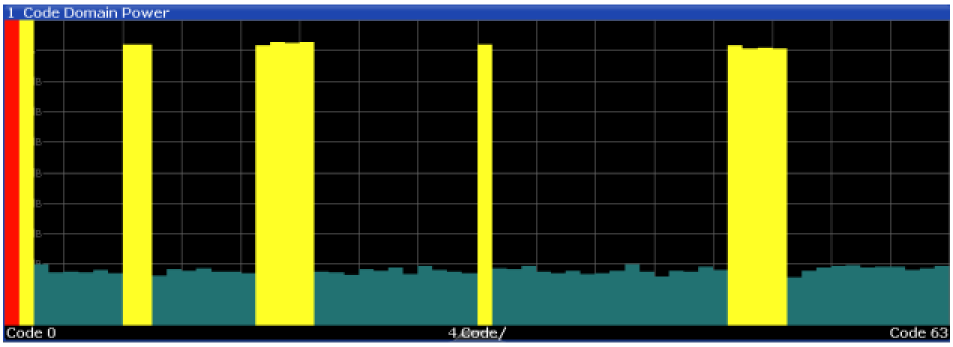


Figure 3-3: Code Domain Power Display for the BTS application

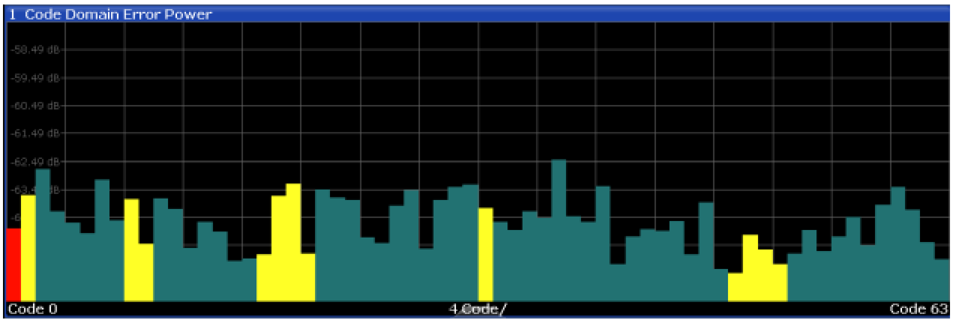


Figure 3-4: Code Domain Error Power result display for the MS application

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 40).

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.

Remote command:
CDP:
`LAY:ADD? '1',RIGH, CDPower`, see `LAYout:ADD[:WINDow]?` on page 201
`CALC:MARK:FUNC:CDP:RES? CDP` or `CALC:MARK:FUNC:CDP:RES? CDPR`; see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 212
CDEP:
`LAY:ADD? '1',RIGH, CDEPower`, see `LAYout:ADD[:WINDow]?` on page 201
`CALC:MARK:FUNC:CDP:RES?`; see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 212.

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.

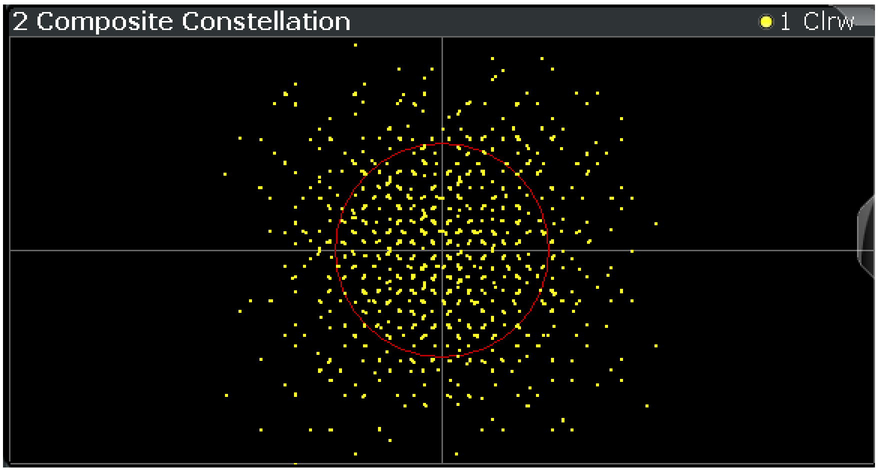


Figure 3-5: Composite Constellation display for the BTS application

Remote command:
`LAY:ADD? '1',RIGH, CCON`, see `LAYout:ADD[:WINDow]?` on page 201
`CALC:MARK:FUNC:CDP:RES?` ; see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 212

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 81).

Figure 3-6: Composite EVM result display

Only the channels detected as being active are used to generate the ideal reference signal. For example, a channel may not be detected as being active due to low power. In this case, the difference between the test signal and the reference signal - and therefore the composite EVM - is very large. Distortions also occur if unassigned codes are wrongly given the status of "active channel". To obtain reliable measurement results, select an adequate channel threshold via the Inactive Channel Threshold setting.

Remote command:

`LAY:ADD? '1',RIGH, CEVM`, see `LAYout:ADD[:WINDow]?` on page 201

`CALC:MARK:FUNC:CDP:RES? MACCuracy`; see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 212

Magnitude Error vs Chip

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

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

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

Where:

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

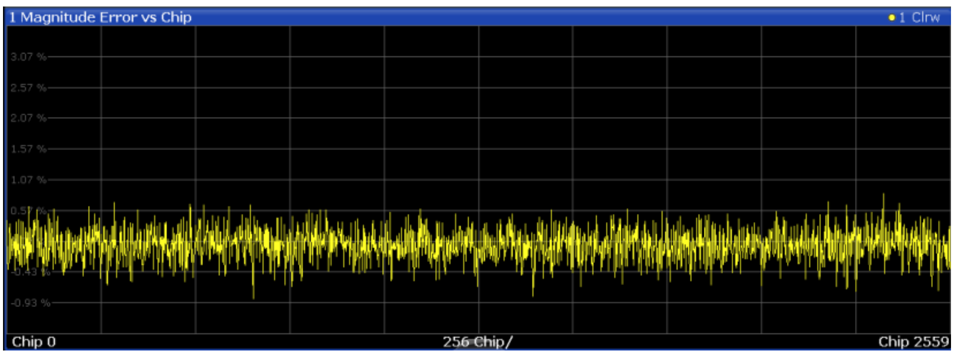


Figure 3-7: Magnitude Error vs Chip display for CDMA2000 BTS measurements

Remote command:
LAY:ADD? '1',RIGH, MECHip, see LAYout:ADD[:WINDow]? on page 201
TRACe<n>[:DATA]? TRACE<1...4>

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 81).

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

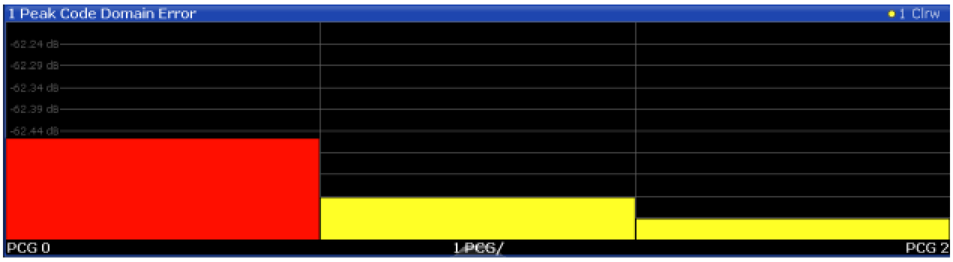


Figure 3-8: Peak Code Domain Error display for the BTS application

Note: Only the channels detected as being active are used to generate the ideal reference signal. For example, a channel may not be detected as being active due to low power. In this case, 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.

Remote command:
LAY:ADD? '1',RIGH, PCDerror, see LAYout:ADD[:WINDow]? on page 201
CALC:MARK:FUNC:CDP:RES? PCDerror; see CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult? on page 212

Phase Error vs Chip

"Phase Error vs Chip" activates the phase error versus chip display. The phase error is displayed for all chips of the selected slot.

The phase error is calculated by the difference of the phase of received signal and phase of reference signal. The reference signal is estimated from the channel configuration of all active channels. The phase error is given in degrees in a range of +180° to -180°.

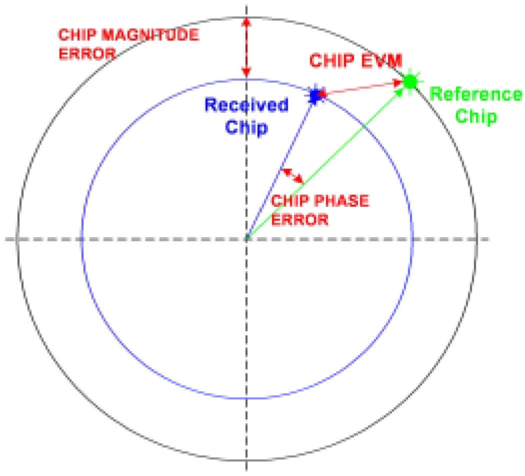
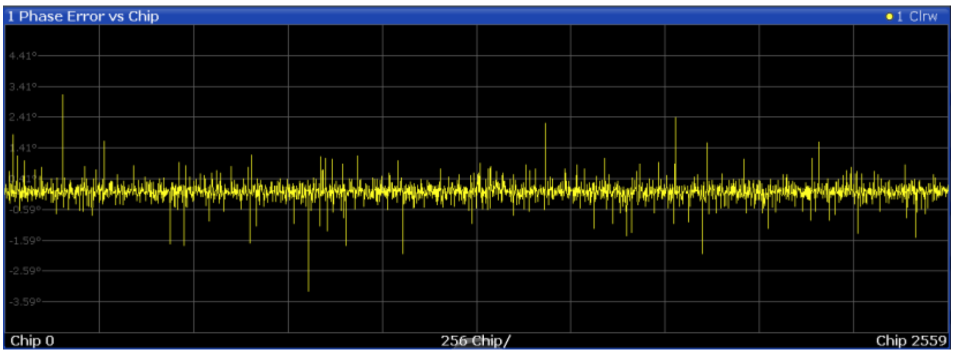


Figure 3-9: Calculating the magnitude, phase and vector error per chip

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

Where:

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



Remote command:
`LAY:ADD? '1',RIGH, PECHip`, see `LAYout:ADD[:WINDow]?` on page 201
`TRACe<n>[:DATA]? TRACE<1...4>`

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. 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 102.

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

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

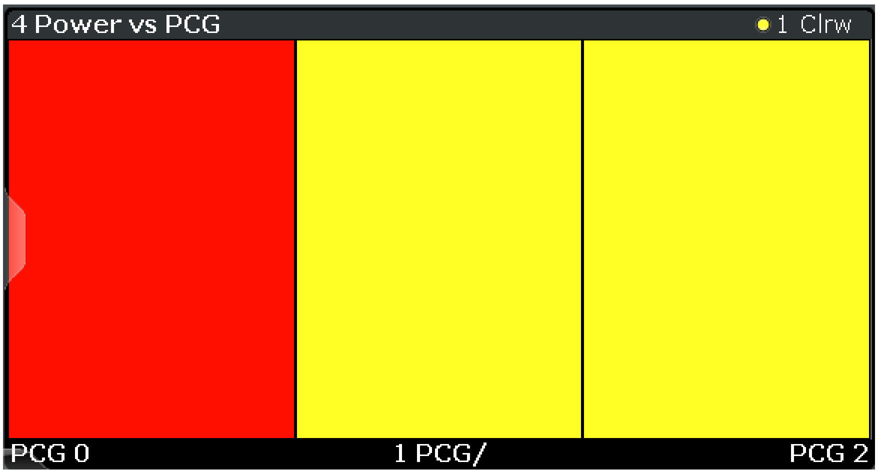


Figure 3-10: Power vs PCG Display for the BTS application

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

Remote command:
`LAY:ADD? '1',RIGH, PSLot`, see `LAYout:ADD[:WINDow]?` on page 201

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.

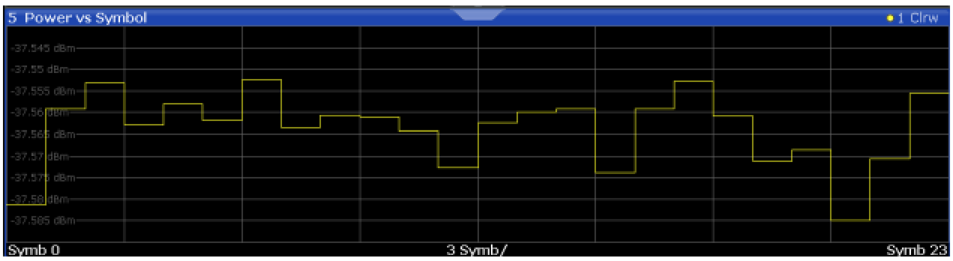


Figure 3-11: Power vs Symbol result display

Remote command:
`LAY:ADD? '1',RIGH, PSYMbol`, see `LAYout:ADD[:WINDow]?` on page 201
`CALC:MARK:FUNC:CDP:RES?` ; see `CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 212

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 15.

Figure 3-12: Result Summary result display

Remote command:
`LAY:ADD? '1',RIGH, RSUMmary`, see `LAYout:ADD[:WINDow]?` on page 201
`CALC:MARK:FUNC:CDP:RES?` ; see`CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?` on page 212

Symbol Constellation

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

The BTS application 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 44 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.

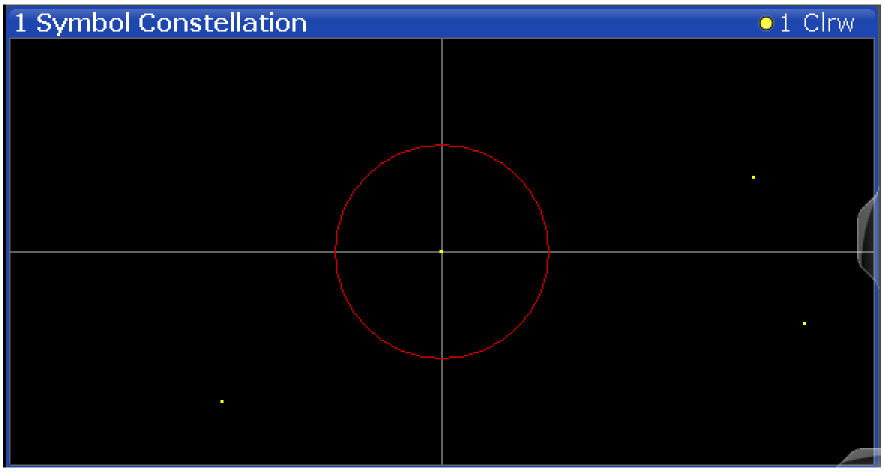


Figure 3-13: Symbol Constellation display for the BTS application

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 37).

Remote command:
LAY:ADD? '1',RIGH, SCONst, see LAYout:ADD[:WINDow]? on page 201
CALC:MARK:FUNC:CDP:RES? ; see CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult? on page 212

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.

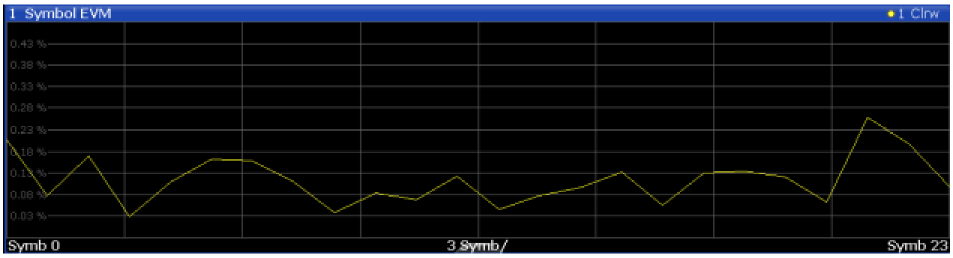


Figure 3-14: Symbol EVM display for the BTS application

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 37).

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

Remote command:
LAY:ADD? '1',RIGH, SEVM, see LAYout:ADD[:WINDow]? on page 201
CALC:MARK:FUNC:CDP:RES? ; see CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult? on page 212

Symbol Magnitude Error

The "Symbol Magnitude Error" is calculated analogous to symbol EVM. The result is one symbol magnitude error value for each symbol of the slot of a special channel. Positive values of symbol magnitude error indicate a symbol magnitude that is larger than the expected ideal value. Negative symbol magnitude errors indicate a symbol magnitude that is less than the expected ideal value. The symbol magnitude error is the difference between the magnitude of the received symbol and that of the reference symbol, related to the magnitude of the reference symbol.

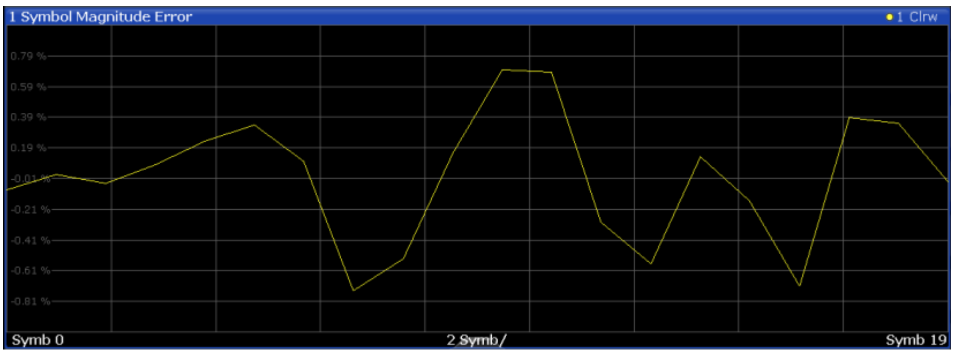


Figure 3-15: Symbol Magnitude Error display for CDMA2000 BTS measurements

Remote command:
LAY:ADD? '1',RIGH, SMERror, see LAYout:ADD[:WINDow]? on page 201
TRACe<n>[:DATA]? TRACE<1...4>

Symbol Phase Error

The "Symbol Phase Error" is calculated analogous to symbol EVM. The result is one symbol phase error value for each symbol of the slot of a special channel. Positive values of symbol phase error indicate a symbol phase that is larger than the expected ideal value. Negative symbol phase errors indicate a symbol phase that is less than the expected ideal value.

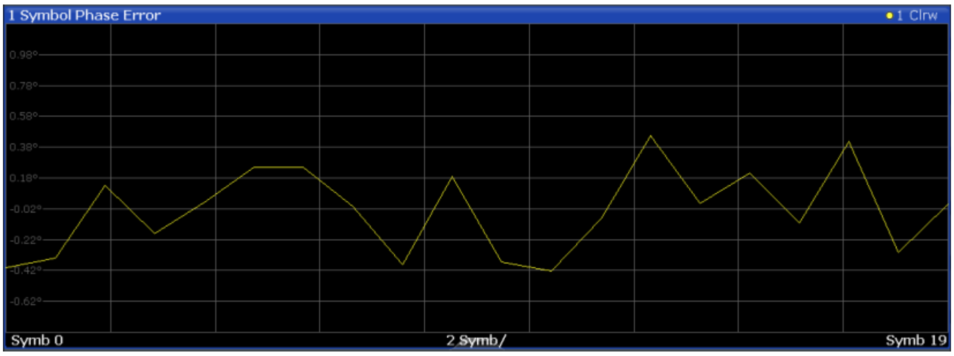


Figure 3-16: Symbol Phase Error display for CDMA2000 BTS measurements

Remote command:
LAY:ADD? '1',RIGH, SPERror, see LAYout:ADD[:WINDow]? on page 201
TRACe<n>[:DATA]? TRACE<1...4>

3.2 RF measurements

Access: "Overview" > "Select Measurement"

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 FSW User Manual.

3.2.1 RF measurement types and results

The CDMA2000 applications provide the following RF measurements:

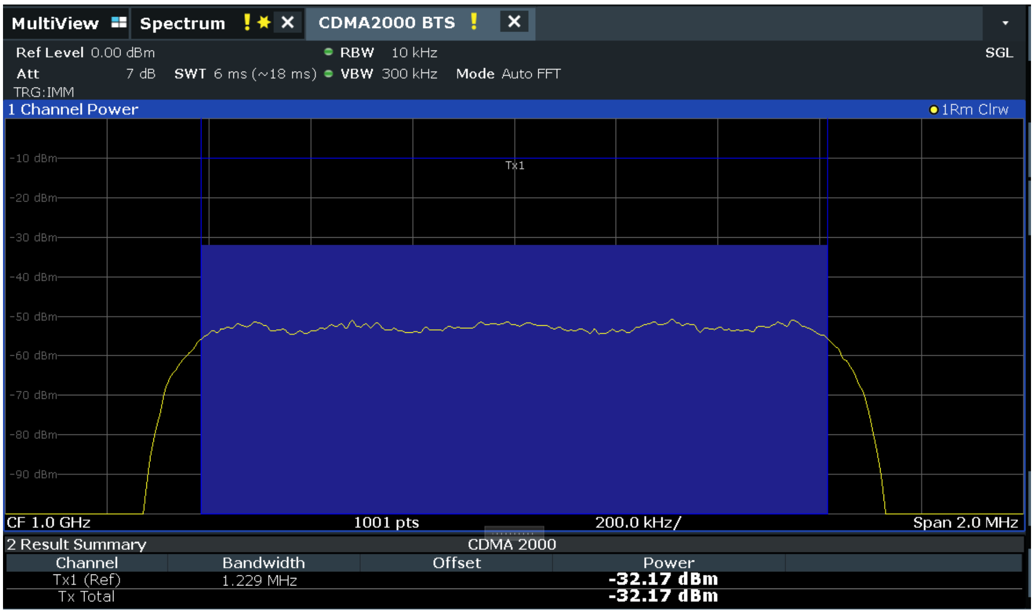
Power....................30
Channel Power ACLR....................30
Spectrum Emission Mask....................31
Occupied Bandwidth....................32
CCDF....................33

Power

Access: "Overview" > "Select Measurement" > "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".



Remote command:

CONF:CDP:MEAS POW, see CONFigure:CDPower[:BTS]:MEASurement on page 137

Querying results: CALC:MARK:FUNC:POW:RES? CPOW, see CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult? on page 231

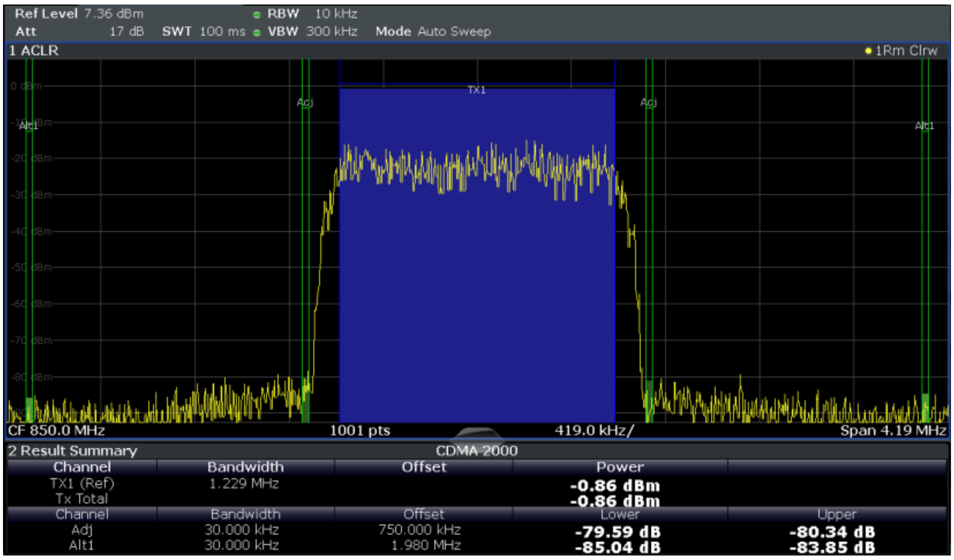
CALC:MARK:FUNC:POW:RES? ACP, see CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult? on page 231

Channel Power ACLR

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

"Channel Power ACLR" performs an adjacent channel power measurement in the default setting according to CDMA2000 specifications (adjacent channel leakage ratio).

The 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".



Remote command:
`CONF:CDP:MEAS ACLR`, see `CONFigure:CDPower[:BTS]:MEASurement` on page 137
Querying results:
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 231
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 231

Spectrum Emission Mask

Access: "Overview" > "Select Measurement" > "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 bandclass. 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.

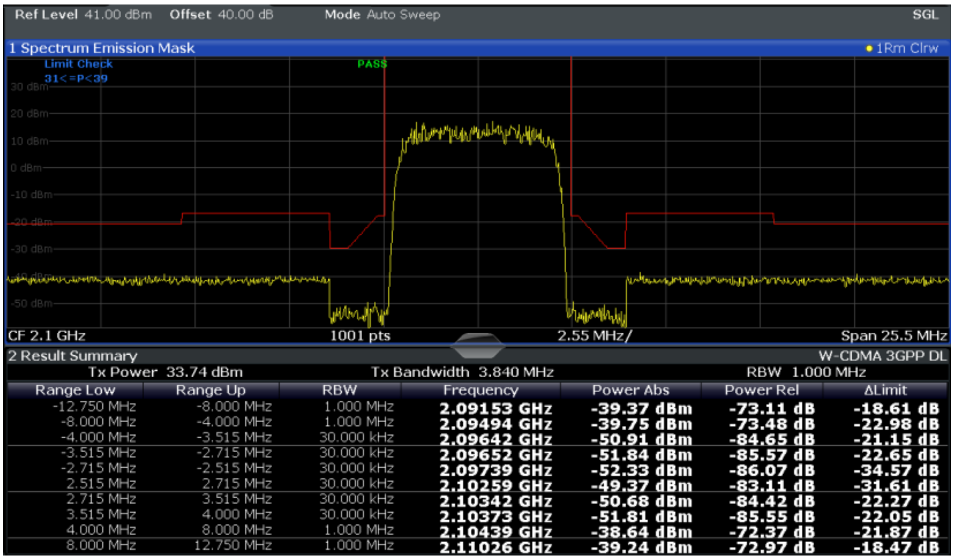


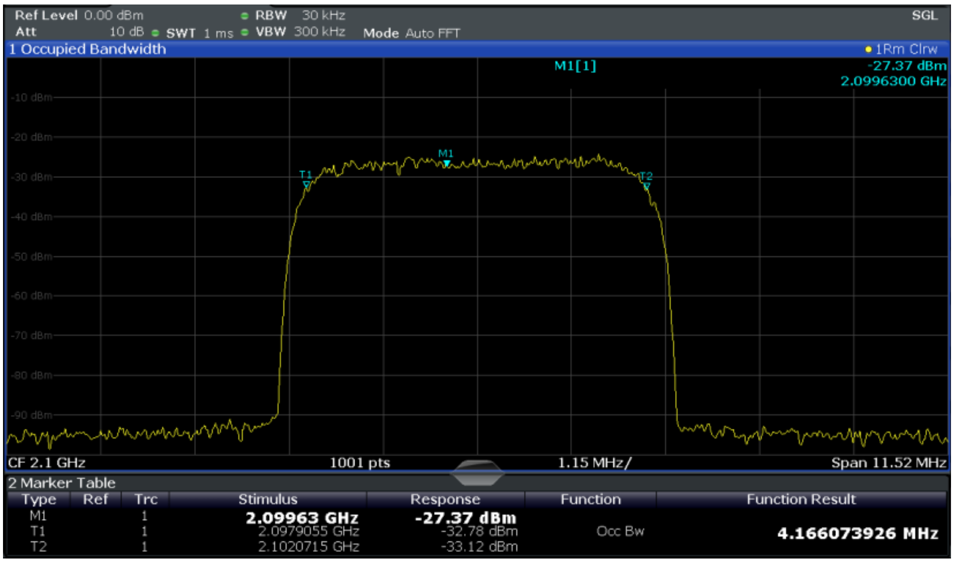
Figure 3-17: SEM measurement results for the BTS application

Remote command:
`CONF:CDP:MEAS ESP`, see `CONFigure:CDPower[:BTS]:MEASurement` on page 137
Querying results:
`CALC:MARK:FUNC:POW:RES? CPOW`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 231
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 231
`CALCulate<n>:LIMit<li>:FAIL?` on page 230

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

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

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



Remote command:
CONF:CDP:MEAS OBAN, see CONFigure:CDPower[:BTS]:MEASurement
on page 137
Querying results:
CALC:MARK:FUNC:POW:RES? OBW, see CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult? on page 231
CALC:MARK:FUNC:POW:RES? ACP, see CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult? on page 231

CCDF

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

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

Figure 3-18: CCDF measurement results for the BTS application

Remote command:
`CONF:CDP:MEAS CCDF`, see `CONFigure:CDPower[:BTS]:MEASurement` on page 137
Querying results:
`CALCulate<n>:MARKer<m>:Y?` on page 214
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 231
`CALC:MARK:FUNC:POW:RES? ACP`, see `CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?` on page 231
`CALCulate<n>:STATistics:RESult<res>?` on page 233

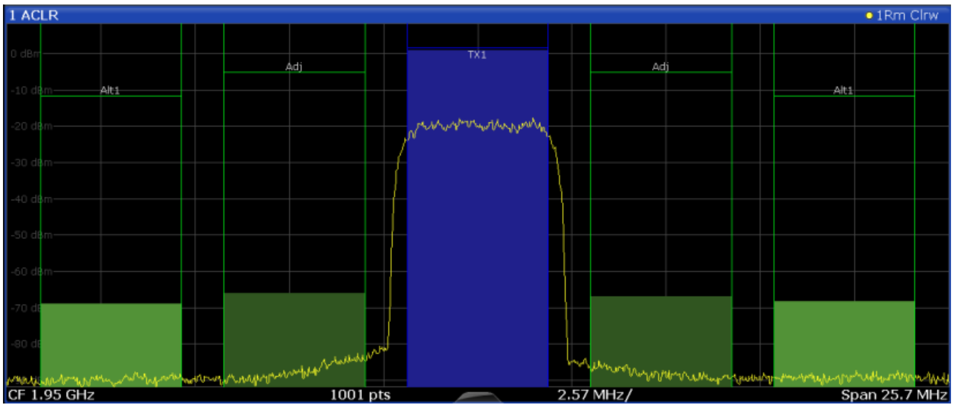
3.2.2 Evaluation methods for RF measurements

Access: "Overview" > "Display Config"

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

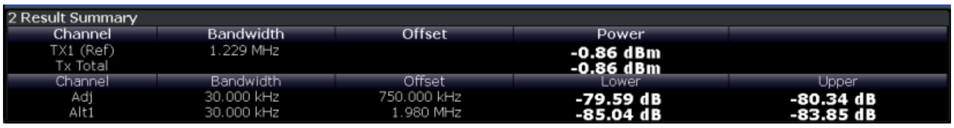
Diagram....................34
Result Summary....................35
Marker Table....................35
Marker Peak List....................36

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



Remote command:
`LAY:ADD? '1',RIGH, DIAG`, see `LAYout:ADD[:WINDow]?` on page 201
Results:

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



2 Result Summary

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

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

Remote command:
`LAY:ADD? '1',RIGH, RSUM`, see `LAYout:ADD[:WINDow]?` on page 201

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

This table is displayed automatically if configured accordingly.

(See "Marker Table Display" on page 109).

1 Marker Table

Wnd	Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
2	M1		1	2.1725 ms	-6.80 dBm		
2	D2	M1	1	13.859 ms	-0.00 dB		
2	D3	M1	1	4.6259 ms	-0.00 dB		
2	D4	M1	1	9.2331 ms	-0.00 dB		

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

Remote command:
`LAY:ADD? '1',RIGH, MTAB`, see `LAYout:ADD[:WINDow]?` on page 201
Results:
`CALCulate<n>:MARKer<m>:X` on page 236
`CALCulate<n>:MARKer<m>:Y?` on page 214

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.

3 Marker Peak List

Wnd	No	X-Value	Y-Value
2	1	1.086245 ms	-75.810 dBm
2	2	2.172490 ms	-6.797 dBm
2	3	3.258736 ms	-76.448 dBm
2	4	4.831918 ms	-76.676 dBm
2	5	6.255274 ms	-76.482 dBm
2	6	6.798397 ms	-6.800 dBm
2	7	9.233084 ms	-76.519 dBm
2	8	10.075861 ms	-76.172 dBm
2	9	11.405574 ms	-6.801 dBm

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

Remote command:

`LAY:ADD? '1',RIGH, PEAK`, see `LAYout:ADD[:WINDow]?` on page 201

Results:

`CALCulate<n>:MARKer<m>:X` on page 236

`CALCulate<n>:MARKer<m>:Y?` on page 214

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.

- PCGs and sets....37
- Channels, codes and symbols....37
- Code display and sort order....39
- Scrambling via PN offsets and long codes....41
- Code mapping and branches....41
- Radio configuration....42
- Transmission with multiple carriers and multiple antennas....42
- Channel detection and channel types....44
- Test setup for CDMA2000 tests....47
- CDA measurements in MSRA operating mode....48

4.1 PCGs and sets

The user data is transmitted in individual data packages, each of which can 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. To improve performance during measurement and analysis, the R&S FSW CDMA2000 Measurements application does not process the captured PCGs all at once, but rather in **sets**, one at a time. One set consists of 64 PCGs. You can select how many sets are 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 distributed on two antennas (see Chapter 4.7.2, "Antenna diversity", on page 43). 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

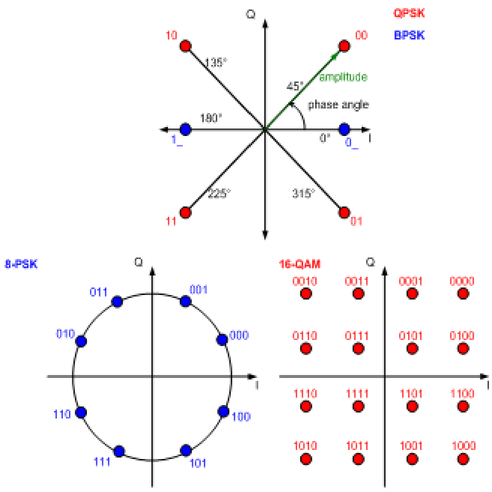


Figure 4-1: Bits per symbol constellations for different modulation types in the BTS application

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 Chapter 4.8, "Channel detection and channel types", on page 44.)

However, in CDMA2000 signals, the codes that belong to the same channel need not lie next to each other in the code domain, they can 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.

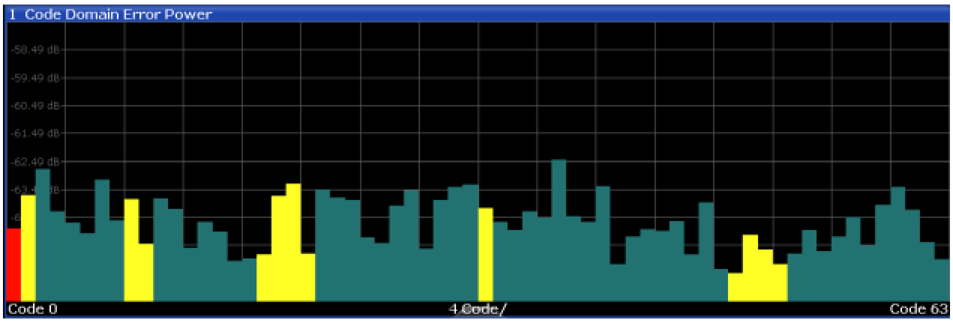


Figure 4-2: Code Domain Error Power result display in Hadamard code sorting order

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 can be displayed:

0.64, 32.64, 16.64, 48.64, 8.64, 40.64, …, 15.64, 47.64,31.64, 63.64

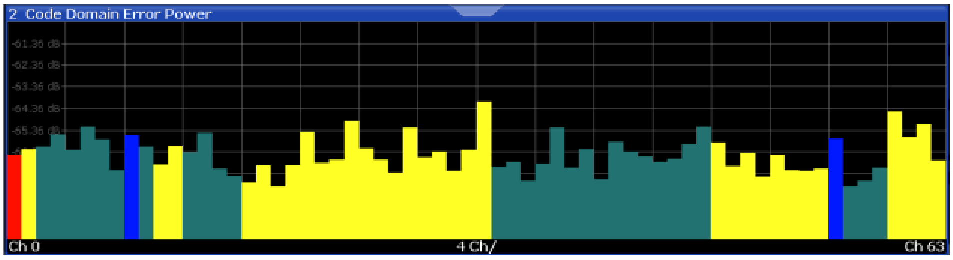


Figure 4-3: Code Domain Error Power result display in BitReverse code sorting order

For the display in the CDMA2000 BTS application, the scale for code-based diagrams displays 64 codes by default (32 in the MS application). 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 considered than the code actually occupies, for example when calculating the power level. 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 CDMA2000 BTS application can distinguish the signals from different base stations quickly if both of the following conditions apply:

- The "PN Offset" is defined in the signal description
- 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. The CDMA2000 MS application requires these settings to distinguish the senders. They 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 independently. Thus, when analyzing MS signals, you must define which branch results you want to analyze. Especially for code power measurements the results can vary considerably. While a channel can be active on one branch, the other branch can 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 the BTS application, the radio configuration can be customized for two channel types: PDCH and CHAN (see Chapter 4.8.1, "BTS channel types", on page 44). 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 255).

The following RCs are used in the BTS application:

Table 4-3: RCs used in the BTS application:

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 Multicarrier mode

The CDMA2000 applications can filter out and analyze one carrier out of a multicarrier signal, if a special multicarrier 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.

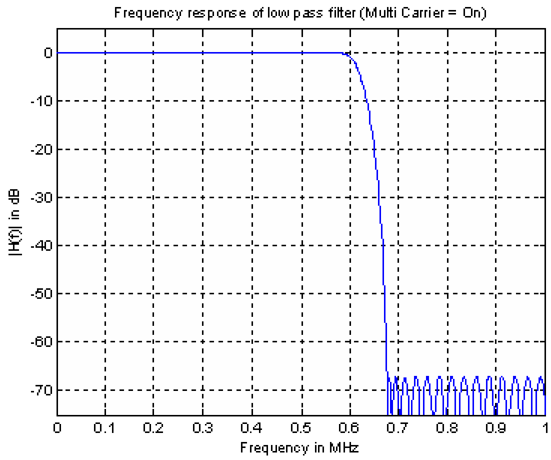


Figure 4-4: Frequency response of the low-pass multicarrier filter

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 46):

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 84).
  Any channel that does not have a predefined channel number and symbol rate is considered to be a data channel.
  In the MS application, 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 255.

Quasi-inactive channels in the MS application

In the MS application, only one branch in the code domain is analyzed at a time (see also Chapter 4.5, "Code mapping and branches", on page 41). However, even if the code on the analyzed branch is inactive, the code with the same number on the other branch can 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
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	0.32	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 Transmit 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 tests

Before a CDMA measurement can be performed, the FSW must be set up in a test environment. This section describes the required settings of the FSW if it is used as a CDMA2000 base or mobile station tester. The FSW must be supplied with power and configured correctly, as described in the 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 FSW Getting Started manual or in the Release Notes.

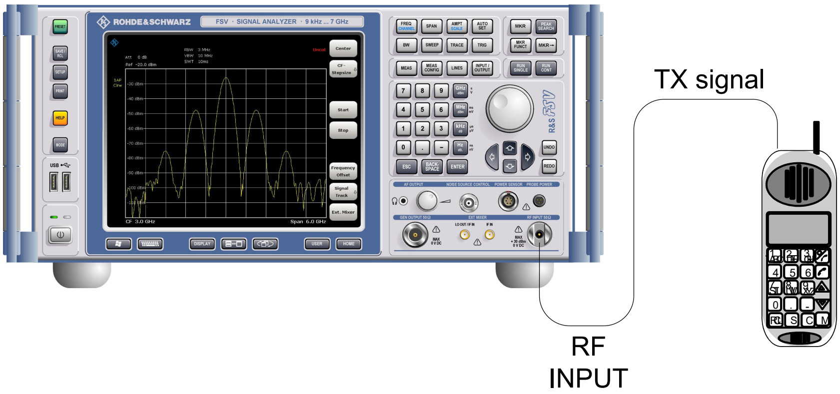
Required units and accessories

The measurements are performed with the following units and accessories:

- An 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 FSW. Use a power attenuator exhibiting suitable attenuation.



The following values for external attenuation are recommended to ensure that the RF input of the 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
≥ 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

Maximum Power	Recommended external attenuation
≥ 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 FSW.
- The 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 device under test (DUT) has a trigger output, connect the trigger output of the DUT to one of the trigger inputs ([TRIGGER INPUT]) of the FSW (see "Trigger 2/3" on page 79).

Presettings

(For details see Chapter 6.2, "Code domain analysis", on page 52)

- 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 primary 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.

Data coverage for each active application

Generally, if a signal contains multiple data channels for multiple standards, separate applications are used to analyze each data channel. Thus, it is of interest to know which application is analyzing which data channel. The MSRA primary display indicates the data covered by each application, restricted to the channel bandwidth used by the corresponding standard (for CDMA2000: 1.2288 MHz), by vertical blue lines labeled with the application name.

Analysis interval

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

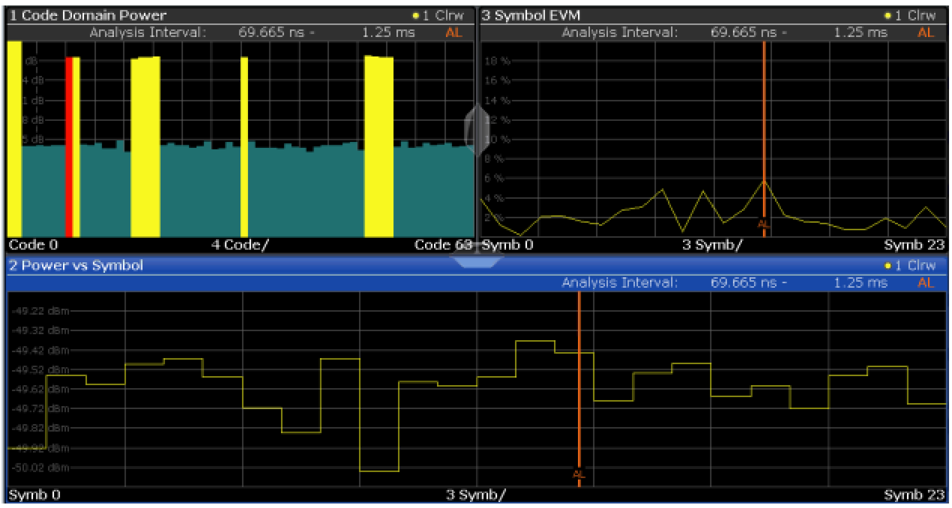
In the CDMA2000 BTS application, the analysis interval is automatically determined according to the selected set, PCG or code to analyze, which is defined for the evaluation range, depending on the result display. The analysis interval cannot be edited directly in the CDMA2000 BTS application, but is changed automatically when you change the evaluation range.

Analysis line

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

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

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



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

5 I/Q data import and export

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

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

- Generating and saving I/Q signals in an RF or baseband signal generator or in external software tools to analyze them with the FSW later.
  The FSW supports various I/Q data formats for import.
  For details on formats, see the FSW I/Q Analyzer and I/Q Input user manual.
- Capturing and saving I/Q signals with the FSW to analyze them with the FSW or an external software tool later
  As opposed to storing trace data, which can be averaged or restricted to peak values, I/Q data is stored as it was captured, without further processing. Multi-channel data is not supported.
  The data is stored as complex values in 32-bit floating-point format.
  The file type is determined by the file extension. If no file extension is provided, the file type is assumed to be `.iq.tar`. For `.mat` files, Matlab® v4 is assumed.
  For a detailed description, see the FSW I/Q Analyzer and I/Q Input User Manual.

An application note on converting Rohde & Schwarz I/Q data files is available from the Rohde & Schwarz website:

1EF85: Converting R&S I/Q data files

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.

See the FSW I/Q Analyzer and I/Q Input User Manual.

Export only in MSRA mode

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

6 Configuration

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.

Only one measurement type can be configured per channel; however, several channels for CDMA2000 applications can be configured in parallel on the 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 either switch through the results easily or monitor all results at the same time in the "MultiView" tab.

For details on the Sequencer function see the 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:
   - Select "Overview". In the "Overview", select "Select Measurement". Select the required measurement.
   - Press [MEAS]. In the "Select Measurement" dialog box, select the required measurement.

- Result display....................51
- Code domain analysis....................52
- RF measurements....................95

6.1 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 "Display" in the "Overview".
- Press [MEAS].
- Select "Display Config" 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 17.

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

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

6.2 Code domain analysis

Access: [MODE] > "CDMA2000 BTS"/"CDMA2000 MS"

CDMA2000 measurements require a special application on the FSW

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 [MEAS CONFIG].

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 "Overview" from any menu.

Importing and Exporting I/Q Data

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

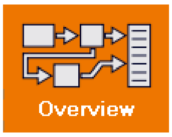
The CDMA2000 applications can not only measure the CDMA2000 I/Q data to be evaluated. They can also import I/Q data, provided it has the correct format. Furthermore, the evaluated I/Q data from the CDMA2000 applications can be exported for further analysis in external applications.

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

- Configuration overview.....53
- Signal description.....55
- Data input and output settings.....60
- Frontend settings.....68

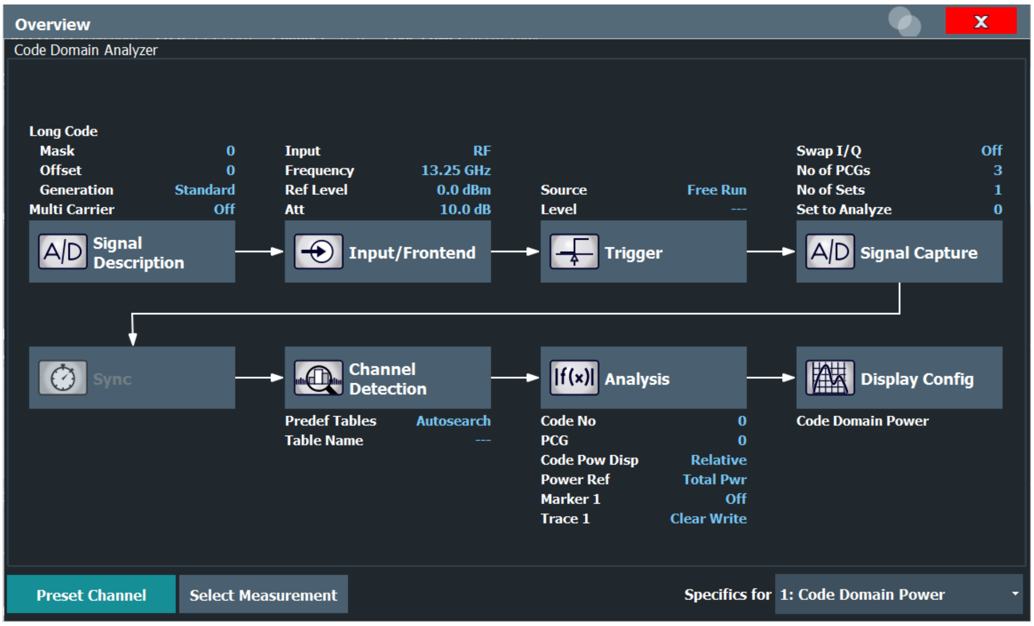
- Trigger settings.. 75
- Signal capture (data acquisition)..80
- Application data (MSRA)...82
- Channel detection.. 82
- Sweep settings...91
- Automatic settings...93

6.2.1 Configuration overview



Access: all menus

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



In addition to the main measurement settings, the "Overview" provides quick access to the main settings dialog boxes. Thus, you can easily configure an entire measurement channel from input over processing to 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 6.3, "RF measurements", on page 95.

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 51
2. "Signal Description"

See Chapter 6.2.2, "Signal description", on page 55

3. "Input/ Frontend"
   See Chapter 6.2.3, "Data input and output settings", on page 60 and Chapter 6.2.4, "Frontend settings", on page 68
4. (Optionally:) "Trigger"
   See Chapter 6.2.5, "Trigger settings", on page 75
5. "Signal Capture"
   See Chapter 6.2.6, "Signal capture (data acquisition)", on page 80

   Note: The "Synchronization" button indicated in the "Overview" is not required for CDMA2000 measurements.
6. "Channel Detection"
   See Chapter 6.2.8, "Channel detection", on page 82
7. "Analysis"
   See Chapter 7, "Analysis", on page 100
8. "Display Configuration"
   See Chapter 3.1.2, "Evaluation methods for code domain analysis", on page 17

To configure settings

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

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

Note: Do not confuse "Preset Channel" with the [Preset] *key*, which restores the entire instrument to its default values and thus closes *all channels* on the FSW (except for the default channel)!

Remote command:
`SYSTem:PRESet:CHANnel[:EXEC]` on page 136

Select Measurement
Selects a different measurement to be performed.

See "Selecting the measurement type" on page 51.

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

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

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

6.2.2 Signal description

Access: "Overview" > "Signal Description"

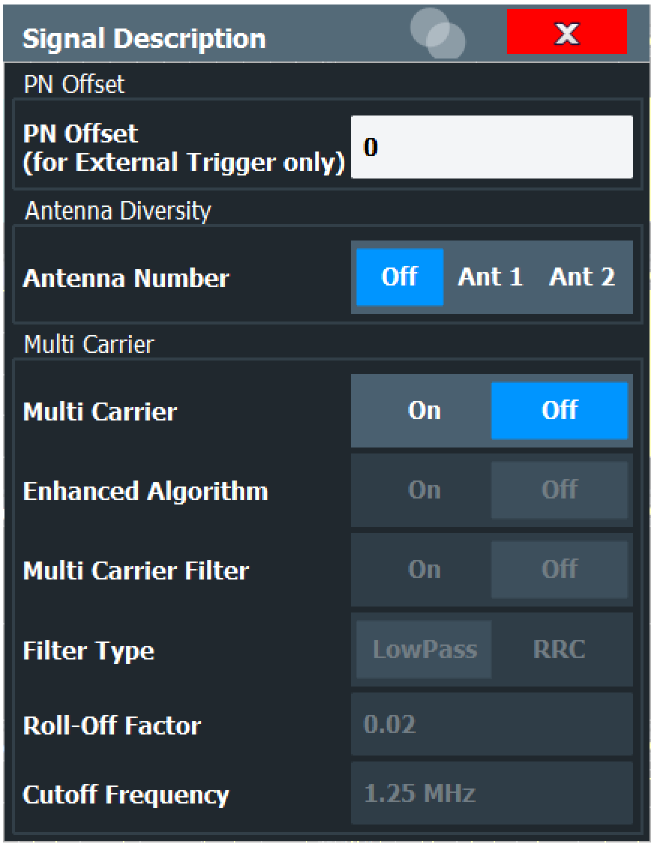
The signal description provides information on the expected input signal.

● BTS signal description ... 55
● MS signal description ... 57

6.2.2.1 BTS signal description

Access: "Overview" > "Signal Description"

These settings describe the input signal in BTS measurements.



PN Offset ... 56
Antenna Diversity - Antenna Number ... 56
Multicarrier ... 56
└ Enhanced Algorithm ... 56
└ Multicarrier Filter ... 56
└ Filter Type ... 56
└ Roll-Off Factor ... 57
└ Cut Off Frequency ... 57

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 41.

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

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 43.

"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.

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

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

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier[:STATe]` on page 140

Enhanced Algorithm ← Multicarrier
Activates or deactivates the enhanced algorithm that is used for signal detection on multicarrier signals. This algorithm slightly increases the calculation time.

This setting is only available if "Multicarrier" on page 56 is activated.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:MALGo` on page 140

Multicarrier Filter ← Multicarrier
Activates or deactivates the usage of a filter for signal detection on multicarrier signals.

This setting is only available if "Multicarrier" on page 56 is activated.

For details, see Chapter 4.7.1, "Multicarrier mode", on page 43.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe]` on page 139

Filter Type ← Multicarrier
Selects the filter type if Multicarrier Filter 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.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE` on page 140

Roll-Off Factor ← Filter Type ← Multicarrier
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.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE` on page 140
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF` on page 139

Cut Off Frequency ← Filter Type ← Multicarrier
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

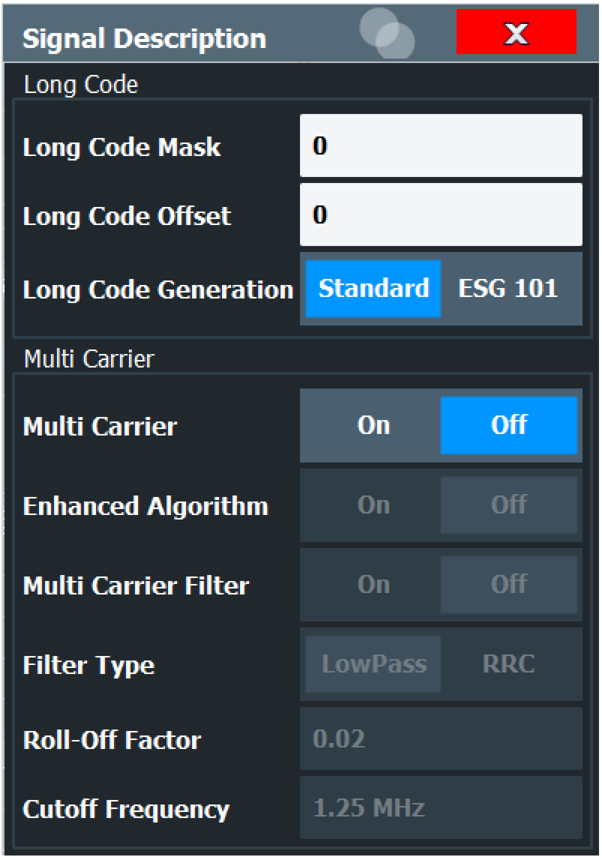
This parameter is available for the RRC filter.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE` on page 140
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency` on page 138

6.2.2.2 MS signal description

Access: "Overview" > "Signal Description"

These settings describe the input signal in MS measurements.



Long Code Mask....................58
Long Code Offset....................58
Long Code Generation....................59
Multicarrier....................59
└ Enhanced Algorithm....................59
└ Multicarrier Filter....................59
└ Filter Type....................59
  └ Roll-Off Factor....................60
  └ Cut Off Frequency....................60

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 considered.

For more information on long codes, see "Long code scrambling" on page 41.

Remote command:

`[SENSe:]CDPower:LCODe:MASK` on page 142

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 41.

Remote command:
`[SENSe:]CDPower:LCODe:OFFSet` on page 142

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.

Remote command:
`[SENSe:]CDPower:LCODe:MODE` on page 142

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

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier[:STATe]` on page 140

Enhanced Algorithm ← Multicarrier
Activates or deactivates the enhanced algorithm that is used for signal detection on multicarrier signals. This algorithm slightly increases the calculation time.

This setting is only available if "Multicarrier" on page 56 is activated.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:MALGo` on page 140

Multicarrier Filter ← Multicarrier
Activates or deactivates the usage of a filter for signal detection on multicarrier signals.

This setting is only available if "Multicarrier" on page 56 is activated.

For details, see Chapter 4.7.1, "Multicarrier mode", on page 43.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe]` on page 139

Filter Type ← Multicarrier
Selects the filter type if Multicarrier Filter 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.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE` on page 140

Roll-Off Factor ← Filter Type ← Multicarrier
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.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE` on page 140
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF` on page 139

Cut Off Frequency ← Filter Type ← Multicarrier
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.

Remote command:
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE` on page 140
`CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency` on page 138

6.2.3 Data input and output settings

Access: [INPUT / OUTPUT]

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

- Input source settings...60
- Output settings...65
- Digital I/Q output settings..66

6.2.3.1 Input source settings

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

The input source determines which data the FSW analyzes.

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

Input from other sources
The R&S FSW CDMA2000 Measurements application application can also process input from the following optional sources:
- I/Q Input files
- "Digital Baseband" interface
- "Analog Baseband" interface
- Probes

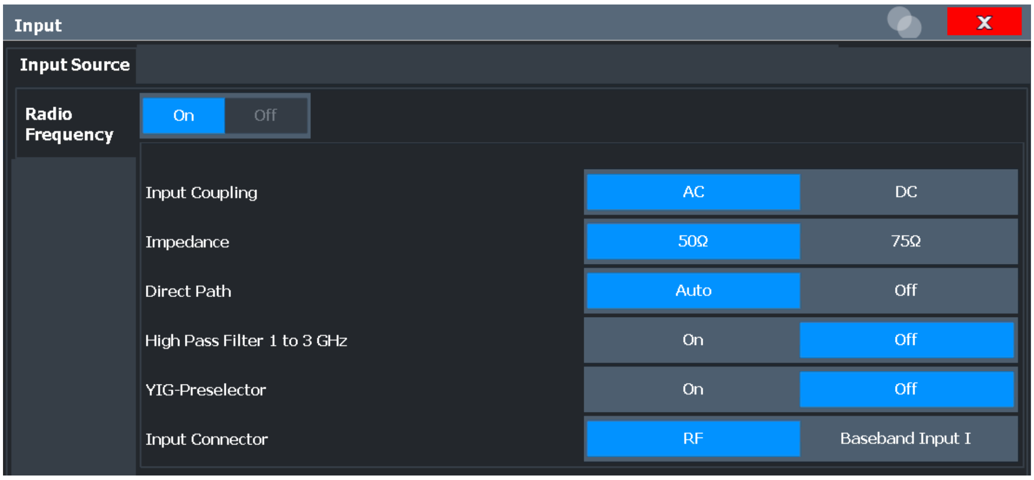
For details, see the FSW I/Q Analyzer and I/Q Input User Manual.

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

- Radio frequency input.....61
- Settings for input from I/Q data files.....64

Radio frequency input

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



RF Input Protection

The RF input connector of the FSW must be protected against signal levels that exceed the ranges specified in the specifications document. Therefore, the FSW is equipped with an overload protection mechanism for DC and signal frequencies up to 30 MHz. This mechanism becomes active as soon as the power at the input mixer exceeds the specified limit. It ensures that the connection between RF input and input mixer is cut off.

When the overload protection is activated, an error message is displayed in the status bar ("INPUT OVLD"), and a message box informs you that the RF input was disconnected. Furthermore, a status bit (bit 3) in the `STAT:QUES:POW` status register is set. In this case, you must decrease the level at the RF input connector and then close the message box. Then measurement is possible again. Reactivating the RF input is also possible via the remote command `INPut:ATTenuation:PROTection:RESet`.

Radio Frequency State.....62
Input Coupling.....62
Impedance.....62
Direct Path.....62
High Pass Filter 1 to 3 GHz.....63
YIG-Preselector.....63
Input Connector.....63

Radio Frequency State
Activates input from the "RF Input" connector.

For FSW85 models with two input connectors, you must define which input source is used for each measurement channel.

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

"Input 2" 1.85 mm RF input connector for frequencies up to 67 GHz

Remote command:
`INPut:SELect` on page 146
`INPut:TYPE` on page 147

Input Coupling
The RF input of the FSW can be coupled by alternating current (AC) or direct current (DC).

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

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

AC coupling blocks any DC voltage from the input signal. AC coupling is activated by default to prevent damage to the instrument. Very low frequencies in the input signal can be distorted.

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

Remote command:
`INPut:COUPling` on page 144

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

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

This value also affects the unit conversion (see "Reference Level" on page 71).

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

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

Remote command:
`INPut:IMPedance` on page 146

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

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

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

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

"Off" The analog mixer path is always used.

Remote command:
INPut:DPATh on page 145

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

This function requires an additional hardware option.

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

Remote command:
INPut:FILTer:HPASs[:STATe] on page 145

YIG-Preselector
Enables or disables the YIG-preselector.

This setting requires an additional option on the FSW.

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

Note: 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.

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

The YIG-"Preselector" is off by default.

Remote command:
INPut:FILTer:YIG[:STATe] on page 145

Input Connector
Determines which connector the input data for the measurement is taken from.

For more information on the optional "Analog Baseband" interface, see the FSW I/Q Analyzer and I/Q Input user manual.

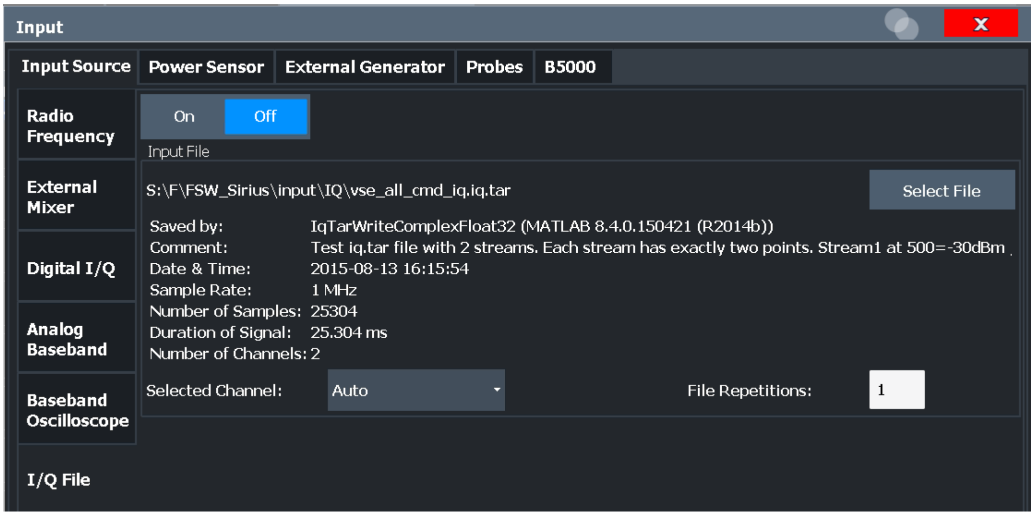
"RF"	(Default:) The "RF Input" connector
"RF Probe"	The "RF Input" connector with an adapter for a modular probe This setting is only available if a probe is connected to the "RF Input" connector.
"Baseband Input I"	The optional "Baseband Input I" connector This setting is only available if the optional "Analog Baseband" interface is installed and active for input. It is not available for the FSW67. For FSW85 models with two input connectors, this setting is only available for "Input 1".

Remote command:
INPut:CONNector on page 144

Settings for input from I/Q data files

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

Or: [INPUT/OUTPUT] > "Input Source Config" > "Input Source" > "I/Q File"



I/Q Input File State....................................64
Select I/Q data file....................................65
File Repetitions....................................65

I/Q Input File State

Enables input from the selected I/Q input file.

If enabled, the application performs measurements on the data from this file. Thus, most measurement settings related to data acquisition (attenuation, center frequency, measurement bandwidth, sample rate) cannot be changed. The measurement time can only be decreased to perform measurements on an extract of the available data only.

Note: Even when the file input is disabled, the input file remains selected and can be enabled again quickly by changing the state.

Remote command:
`INPut:SELect` on page 146

Select I/Q data file
Opens a file selection dialog box to select an input file that contains I/Q data.

The I/Q data file must be in one of the following supported formats:

- `.iq.tar`
- `.iqw`
- `.csv`
- `.mat`
- `.wv`
- `.aid`

For details on formats, see the FSW I/Q Analyzer and I/Q Input user manual.

The file type is determined by the file extension. If no file extension is provided, the file type is assumed to be `.iq.tar`. For `.mat` files, Matlab® v4 is assumed.

Note: Only a single data stream or channel can be used as input, even if multiple streams or channels are stored in the file.

Note: For some file formats that do not provide the sample rate and measurement time or record length, you must define these parameters manually. Otherwise the traces are not visible in the result displays.

The default storage location for I/Q data files is `C:\R_S\INSTR\USER`.

Remote command:
`INPut:FILE:PATH` on page 147

File Repetitions
Determines how often the data stream is repeatedly copied in the I/Q data memory to create a longer record. If the available memory is not sufficient for the specified number of repetitions, the largest possible number of complete data streams is used.

Remote command:
`TRACe:IQ:FILE:REPetition:COUNt` on page 149

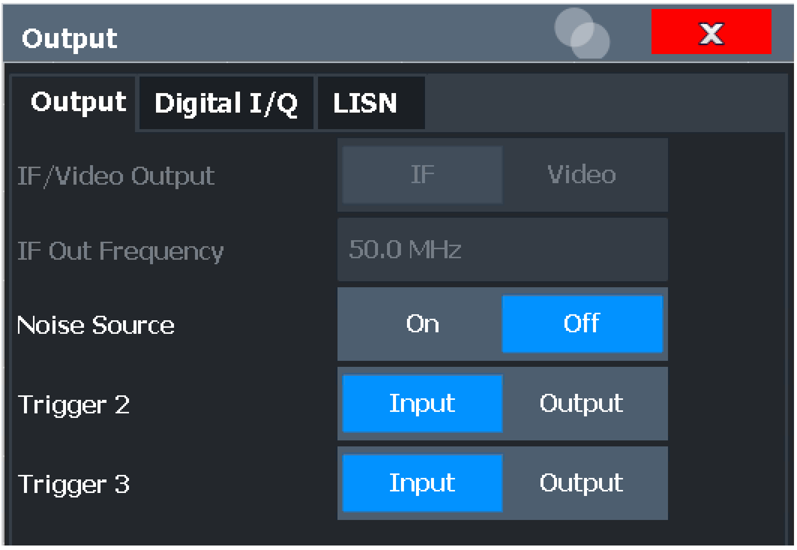
6.2.3.2 Output settings

Access: [Input/Output] > "Output"

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

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

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



Noise Source Control......66

Noise Source Control

Enables or disables the 28 V voltage supply for an external noise source connected to the "Noise source control / Power sensor") connector. By switching the supply voltage for an external noise source on or off in the firmware, you can enable or disable the device as required.

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

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

Remote command:
`DIAGnostic:SERVice:NSOurce` on page 164

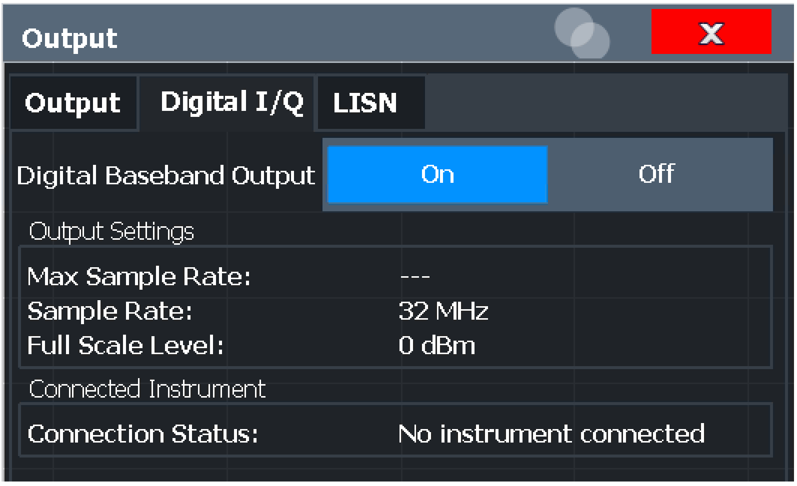
6.2.3.3 Digital I/Q output settings

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

The optional "Digital Baseband" interface allows you to output I/Q data from any FSW application that processes I/Q data to an external device.

These settings are only available if the "Digital Baseband" interface option is installed on the FSW.

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



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

Digital Baseband Output..67
Output Settings Information...67
Connected Instrument...67

Digital Baseband Output

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

Note: If digital baseband output is active, the sample rate is restricted to 200 MHz (max. 160 MHz bandwidth).
The only data source that can be used for digital baseband output is RF input.

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

Remote command:
`OUTPut:DIQ[:STATe]` on page 151

Output Settings Information

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

The following information is displayed:

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

Remote command:
`OUTPut<up>:DIQ:CDEVice?` on page 152

Connected Instrument

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

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

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

Remote command:
`OUTPut<up>:DIQ:CDEVice?` on page 152

6.2.4 Frontend settings

Access: "Overview" > "Input / Frontend"

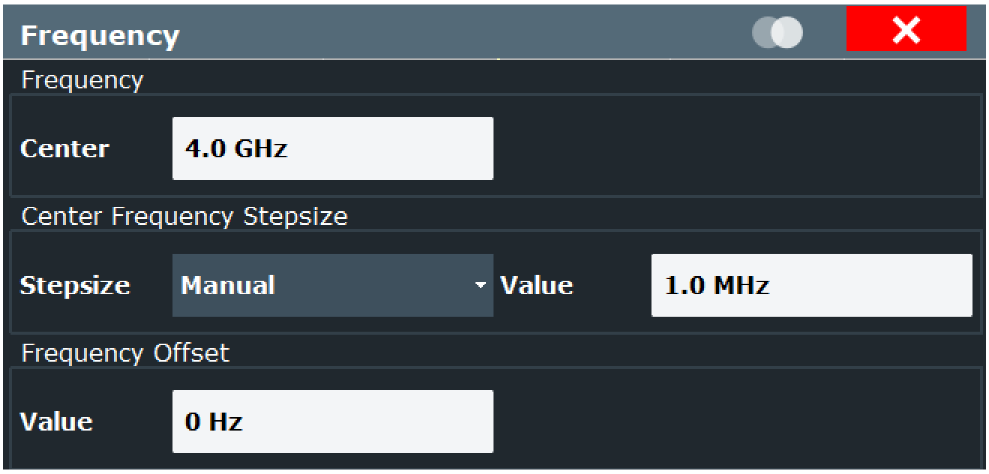
The frequency, amplitude and y-axis scaling settings represent the "frontend" of the measurement setup.

Amplitude settings for analog baseband input
Amplitude settings for analog baseband input are described in the FSW I/Q Analyzer and I/Q Input User Manual

- Frequency settings..68
- Amplitude settings..69
- Y-axis scaling..74

6.2.4.1 Frequency settings

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



Center Frequency..68
Center Frequency Stepsize..69
Frequency Offset..69

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

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

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

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

Remote command:
[SENSe:]FREQuency:CENTer on page 165

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

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

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

This setting is available for frequency and time domain measurements.

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

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

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

Remote command:
[SENSe:]FREQuency:CENTer:STEP on page 165

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

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

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

The allowed values range from -1 THz to 1 THz. The default setting is 0 Hz.

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

Remote command:
[SENSe:]FREQuency:OFFSet on page 167

6.2.4.2 Amplitude settings

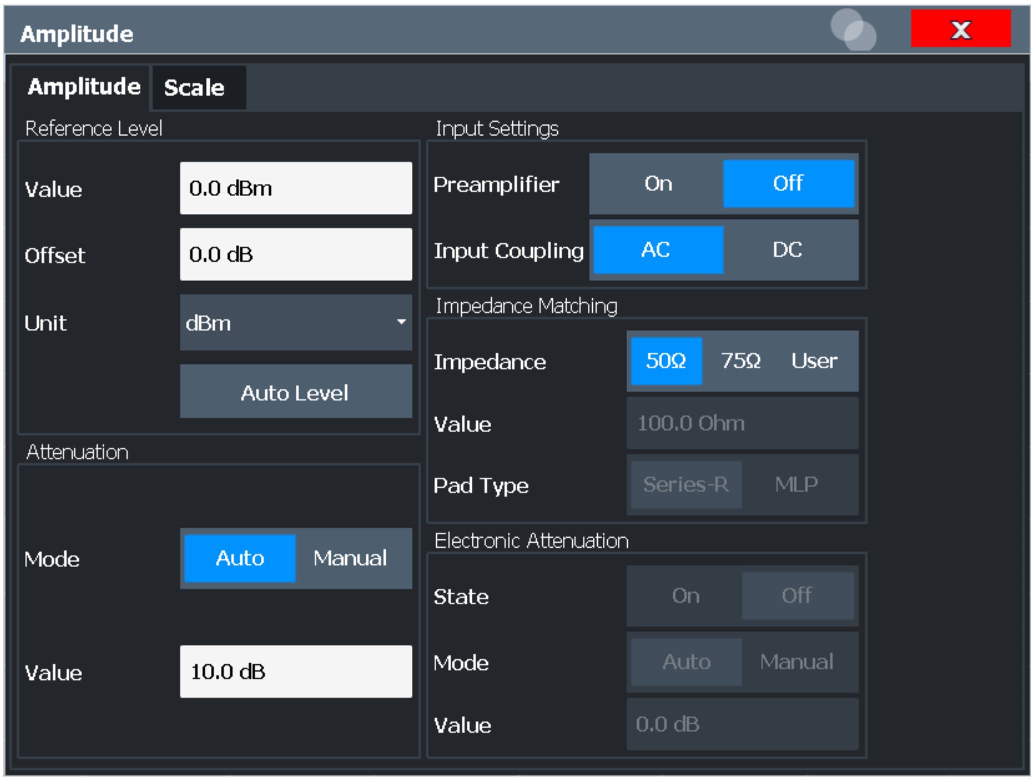
Access: "Overview" > "Input/Frontend" > "Amplitude"

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

Configuring amplitude settings allows you to:

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

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



Reference Level......71
└ Shifting the Display (Offset)......71
└ Unit......71
└ Setting the Reference Level Automatically (Auto Level)......71
Attenuation Mode / Value......71
Using Electronic Attenuation......72
Input Settings......73
└ Preamplifier......73
└ Ext. PA Correction......73

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

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

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel` on page 169

Shifting the Display (Offset) ← Reference Level
Defines an arithmetic level offset. This offset is added to the measured level. In some result displays, the scaling of the y-axis is changed accordingly.

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

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

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

Remote command:
`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet` on page 169

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

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

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

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

You can change the measurement time for the level measurement if necessary (see "Changing the Automatic Measurement Time (Meas Time Manual)" on page 94).

Remote command:
`[SENSe:]ADJust:LEVel` on page 193

Attenuation Mode / Value
Defines the attenuation applied to the RF input of the FSW.

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

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

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

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

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

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

Remote command:
`INPut:ATTenuation` on page 172
`INPut:ATTenuation:AUTO` on page 172

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

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

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

Note: Electronic attenuation is not available for stop frequencies (or center frequencies in zero span) above 15 GHz.
In "Auto" mode, RF attenuation is provided by the electronic attenuator as much as possible to reduce the amount of mechanical switching required. Mechanical attenuation can provide a better signal-to-noise ratio, however.

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

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

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

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

Remote command:
`INPut:EATT:STATe` on page 173
`INPut:EATT:AUTO` on page 173
`INPut:EATT` on page 173

Input Settings

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

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

Preamplifier ← Input Settings

If the (optional) internal preamplifier hardware is installed on the FSW, a preamplifier can be activated for the RF input signal.

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

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

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

For all FSW models except for FSW85, 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.

For FSW85 models, the input signal is amplified by 30 dB if the preamplifier is activated.

Remote command:
`INPut:GAIN:STATe` on page 171
`INPut:GAIN[:VALue]` on page 171

Ext. PA Correction ← Input Settings

This function is only available if an external preamplifier is connected to the FSW, and only for frequencies above 1 GHz. For details on connection, see the preamplifier's documentation.

Using an external preamplifier, you can measure signals from devices under test with low output power, using measurement devices which feature a low sensitivity and do not have a built-in RF preamplifier.

When you connect the external preamplifier, the FSW reads out the touchdown (`.S2P`) file from the EEPROM of the preamplifier. This file contains the s-parameters of the preamplifier. As soon as you connect the preamplifier to the FSW, the preamplifier is permanently on and ready to use. However, you must enable data correction based on the stored data explicitly on the FSW using this setting.

When enabled, the FSW automatically compensates the magnitude and phase characteristics of the external preamplifier in the measurement results. Any internal preamplifier, if available, is disabled.

For FSW85 models with two RF inputs, you can enable correction from the external preamplifier for each input individually, but not for both at the same time.

When disabled, no compensation is performed even if an external preamplifier remains connected.

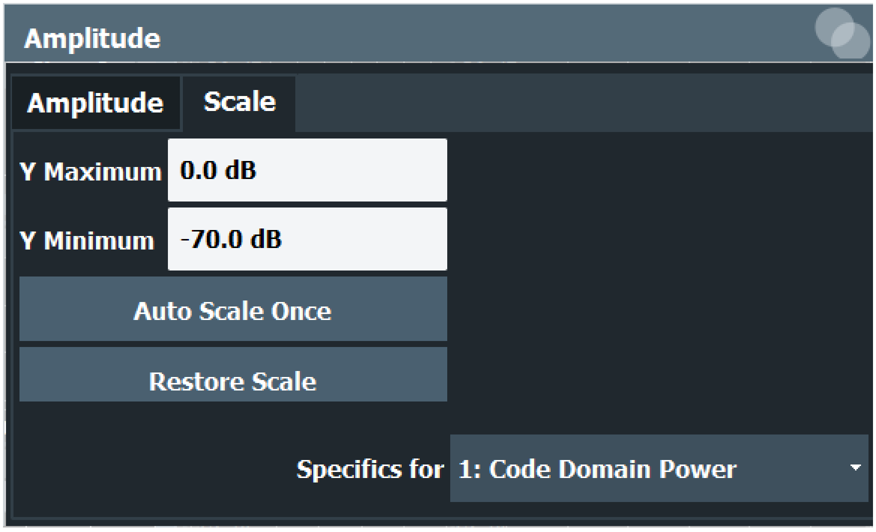
Remote command:
`INPut:EGAin[:STATe]` on page 170

6.2.4.3 Y-axis scaling

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

Or: [AMPT] > "Scale Config"

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



Y-Maximum, Y-Minimum.....74
Auto Scale Once.....74
Restore Scale (Window).....74

Y-Maximum, Y-Minimum

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

Remote command:

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum` on page 169

`DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum` on page 170

Auto Scale Once

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

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

Remote command:

`DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE` on page 168

Restore Scale (Window)

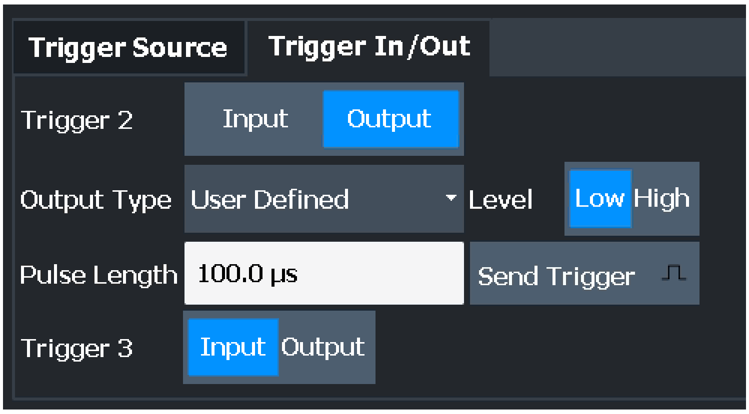
Restores the default scale settings in the currently selected window.

6.2.5 Trigger settings

Access: "Overview" > "Trigger"

Trigger settings determine when the input signal is measured.

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



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

Trigger Source....76
└ Trigger Source....76
└ Free Run....76
└ External Trigger 1/2/3....76
└ Digital I/Q....76
└ IF Power....77
└ Trigger Level....77
└ Trigger Offset....78
└ Slope....78
└ Capture Offset....78
Trigger 2/3....79
└ Output Type....79
└ Level....80
└ Pulse Length....80
└ Send Trigger....80

Trigger Source
The trigger settings define the beginning of a measurement.

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

Remote command:
`TRIGger[:SEQuence]:SOURce` on page 178

Free Run ← Trigger Source ← Trigger Source
No trigger source is considered. Data acquisition is started manually or automatically and continues until stopped explicitly.

Remote command:
`TRIG:SOUR IMM`, see `TRIGger[:SEQuence]:SOURce` on page 178

External Trigger 1/2/3 ← Trigger Source ← Trigger Source
Data acquisition starts when the TTL signal fed into the specified input connector meets or exceeds the specified trigger level.

(See "Trigger Level" on page 77).

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

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

"External Trigger 1"
Trigger signal from the "TRIGGER 1 INPUT" connector.

"External Trigger 2"
Trigger signal from the "TRIGGER 2 INPUT / OUTPUT" connector.
Note: Connector must be configured for "Input" in the "Output" configuration
For FSW85 models, "Trigger 2" is not available due to the second RF input connector on the front panel.
(See the FSW user manual).

"External Trigger 3"
Trigger signal from the "TRIGGER 3 INPUT / OUTPUT" connector on the rear panel.
Note: Connector must be configured for "Input" in the "Output" configuration.
(See FSW user manual).

Remote command:
`TRIG:SOUR EXT`, `TRIG:SOUR EXT2`
`TRIG:SOUR EXT3`
See `TRIGger[:SEQuence]:SOURce` on page 178

Digital I/Q ← Trigger Source ← Trigger Source
For applications that process I/Q data, such as the I/Q Analyzer or optional applications, and only if the optional "Digital Baseband" interface is available:

Defines triggering of the measurement directly via the "LVDS" connector. In the selection list, specify which general-purpose bit ("GP0" to "GP5") provides the trigger data.

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

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

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

Table 6-1: Assignment of general-purpose bits to LVDS connector pins

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

Remote command:
`TRIG:SOUR GP0`, see `TRIGger[:SEQuence]:SOURce` on page 178

IF Power ← Trigger Source ← Trigger Source

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

For frequency sweeps, the third IF represents the start frequency. The trigger threshold depends on the defined trigger level, as well as on the RF attenuation and preamplification. A reference level offset, if defined, is also considered. The trigger bandwidth at the intermediate frequency depends on the RBW and sweep type. For details on available trigger levels and trigger bandwidths, see the instrument specifications document.

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

This trigger source is only available for RF input.

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

Available for input from the optional "Analog Baseband" interface.

Available for input from the optional "Digital Baseband" interface.

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

For details on available trigger levels and trigger bandwidths, see the specifications document.

Remote command:
`TRIG:SOUR IFP`, see `TRIGger[:SEQuence]:SOURce` on page 178

Trigger Level ← Trigger Source

Defines the trigger level for the specified trigger source.

For details on supported trigger levels, see the instrument specifications document.

Remote command:
TRIGger[:SEQuence]:LEVel[:EXTernal<port>] on page 176
For baseband input only:
TRIGger[:SEQuence]:LEVel:BBPower on page 176

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

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

Remote command:
TRIGger[:SEQuence]:HOLDoff[:TIME] on page 175

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

Remote command:
TRIGger[:SEQuence]:SLOPe on page 178

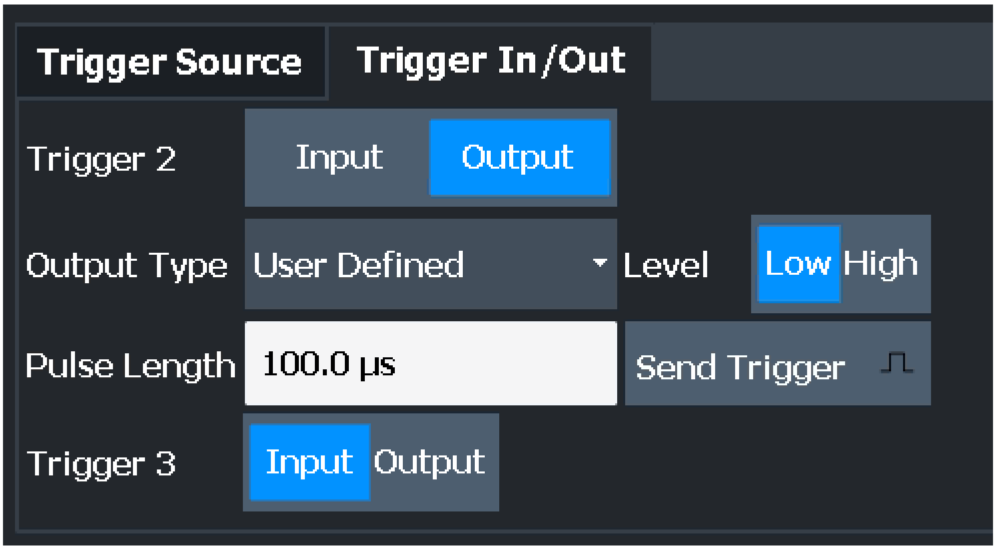
Capture Offset ← Trigger Source
This setting is only available for secondary applications in **MSRA operating mode**. It has a similar effect as the trigger offset in other measurements: it defines the time offset between the capture buffer start and the start of the extracted secondary application data.

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

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

Remote command:
[SENSe:]MSRA:CAPTure:OFFSet on page 248

Trigger 2/3



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

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

"Trigger 1"	"Trigger 1" is input only.
"Trigger 2"	Defines the usage of the variable "Trigger Input/Output" connector on the front panel (not available for FSW85 models with 2 RF input connectors)
"Trigger 3"	Defines the usage of the variable "Trigger 3 Input/Output" connector on the rear panel
"Input"	The signal at the connector is used as an external trigger source by the FSW. Trigger input parameters are available in the "Trigger" dialog box.
"Output"	The FSW sends a trigger signal to the output connector to be used by connected devices. Further trigger parameters are available for the connector.

Remote command:
`OUTPut:TRIGger<tp>:DIRection` on page 179

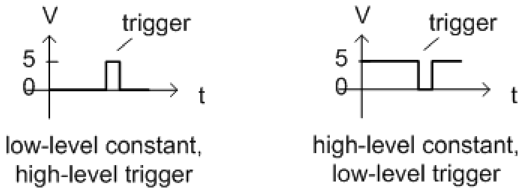
Output Type ← Trigger 2/3
Type of signal to be sent to the output

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

Remote command:
`OUTPut:TRIGger<tp>:OTYPe` on page 180

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

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



Remote command:
`OUTPut:TRIGger<tp>:LEVel` on page 180

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

Remote command:
`OUTPut:TRIGger<tp>:PULSe:LENGth` on page 181

Send Trigger ← Output Type ← Trigger 2/3
Sends a user-defined trigger to the output connector immediately.

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

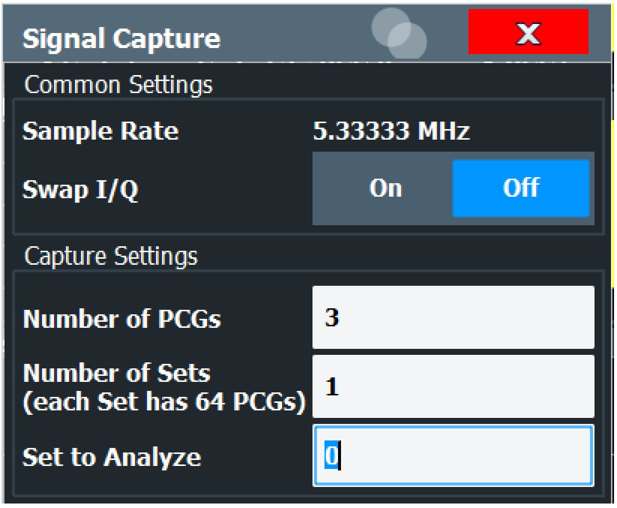
Which pulse level is sent is indicated by a graphic on the button.

Remote command:
`OUTPut:TRIGger<tp>:PULSe:IMMediate` on page 181

6.2.6 Signal capture (data acquisition)

Access: "Overview" > "Signal Capture"

You must define how much and how data is captured from the input signal.



MSRA operating mode

In MSRA operating mode, only the MSRA primary 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 6.2.7, "Application data (MSRA)", on page 82).

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

Sample Rate 81
Invert Q 81
Number of PCGs 81
Number of Sets 82
Set to Analyze 82

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.

Remote command:

`[SENSe:]CDPower:QINVert` on page 182

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 82 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 37.

Remote command:

`[SENSe:]CDPower:IQLength` on page 182

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 application) or 810 (MS application) sets.

The default setting is 1.

If you capture more than one set, the number of slots/PCGs is always 64 (CDMA2000 BTS application: 32) and is not available for modification.

Remote command:
`[SENSe:]CDPower:SET:COUNt` on page 182

Set to Analyze
Selects a specific set for further analysis. The value range is between 0 and "Number of Sets" on page 82 – 1.

Remote command:
`[SENSe:]CDPower:SET[:VALue]` on page 194

6.2.7 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 82).

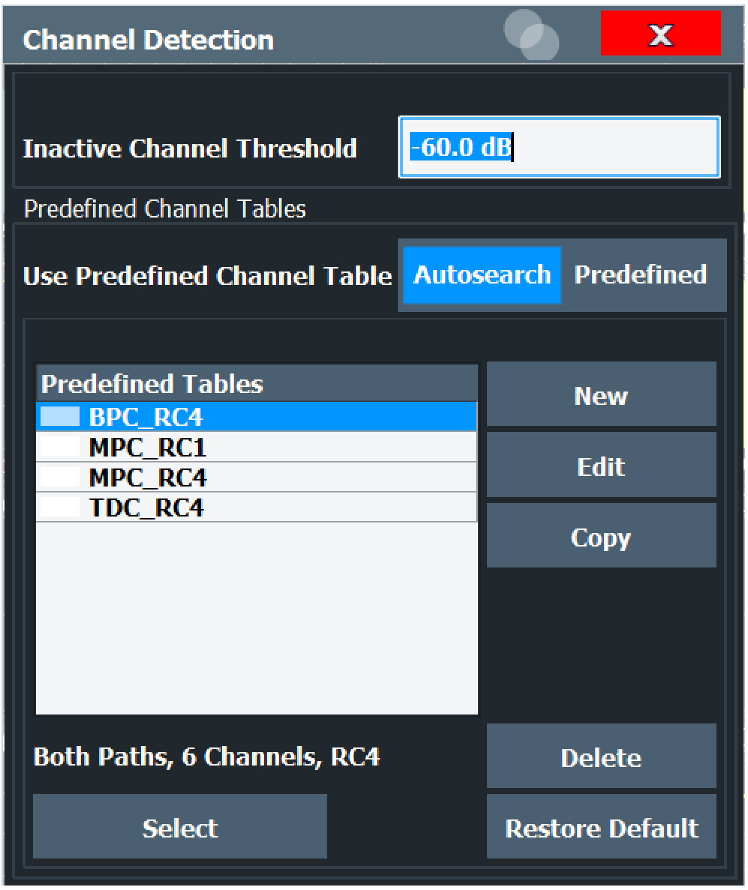
In addition, a capture offset can be defined, i.e. an offset from the start of the captured data to the start of the analysis interval for the CDMA2000 BTS measurement (see "Capture Offset" on page 78).

The **analysis interval** cannot be edited manually. It 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*.

6.2.8 Channel detection

Access: "Overview" > "Channel Detection"

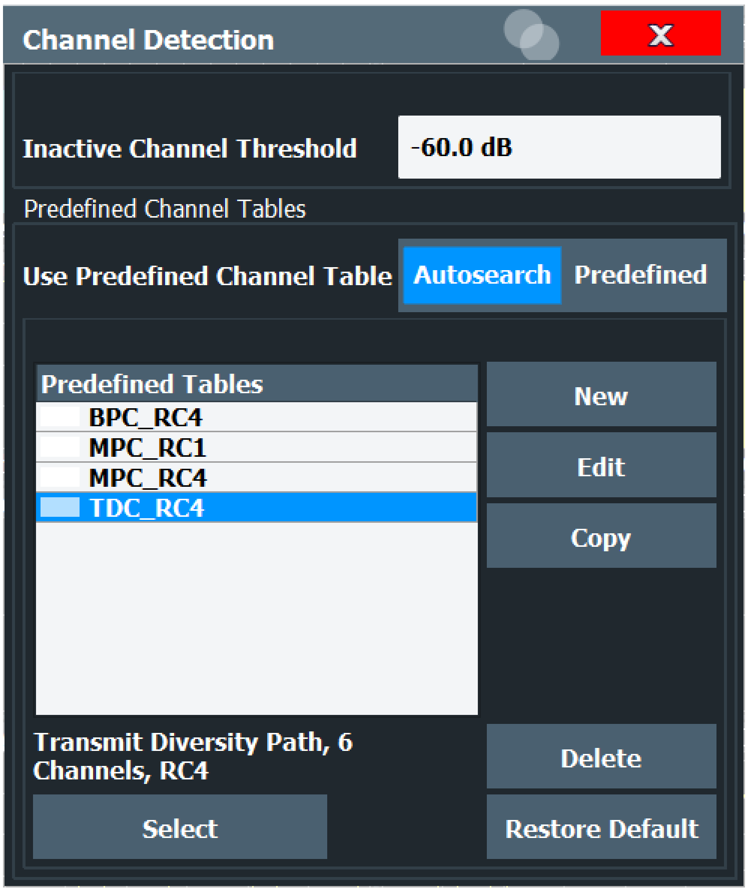
The channel detection settings determine which channels are found in the input signal.



- General channel detection settings....83
- Channel table management....85
- Channel table settings and functions....86
- BTS channel details....87
- MS channel details....89

6.2.8.1 General channel detection settings

Access: "Overview" > "Channel Detection"



Inactive Channel Threshold......84
Using Predefined Channel Tables......84

Inactive Channel Threshold

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

The default value is -60 dB. With this value, the Code Domain Power Analyzer detects all channels with signals such as the CDMA2000 test models. Decrease the "Inactive Channel Threshold" value if not all channels contained in the signal are detected.

Remote command:
`[SENSe:]CDPower:ICTReshold` on page 184

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.

Remote command:
`CONFigure:CDPower[:BTS]:CTABle[:STATe]` on page 186

6.2.8.2 Channel table management

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

Predefined Tables.. 85
Selecting a Table..85
Creating a New Table..85
Editing a Table...86
Copying a Table.. 86
Deleting a Table.. 86
Restoring Default Tables...86

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 255.

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 measurements; configured according to a specific radio configuration

"EACHOP, RCCCHOP, RTCHOP3, RTCHOP5"
Channel tables for MS mode; configured according to a specific radio configuration

Remote command:
`CONFigure:CDPower[:BTS]:CTABle:CATalog` on page 185

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

Remote command:
`CONFigure:CDPower[:BTS]:CTABle:SELect` on page 186

Creating a New Table
Creates a new channel table. For a description of channel table settings and functions, see Chapter 6.2.8.3, "Channel table settings and functions", on page 86.

For step-by-step instructions on creating a new channel table, see "To define or edit a channel table" on page 115.

Remote command:
`CONFigure:CDPower[:BTS]:CTABle:NAME` on page 189

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.

Remote command:
`CONFigure:CDPower[:BTS]:CTABle:COPY` on page 185

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

Remote command:
`CONFigure:CDPower[:BTS]:CTABle:DELete` on page 186

Restoring Default Tables
Restores the predefined channel tables delivered with the instrument.

Remote command:
`CONFigure:CDPower[:BTS]:CTABle:RESTore` on page 186

6.2.8.3 Channel table settings and functions

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

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

For details on channel table entries, see Chapter 6.2.8.4, "BTS channel details", on page 87 or Chapter 6.2.8.5, "MS channel details", on page 89.

Name....86
Comment....86
Adding a Channel....87
Deleting a Channel....87
Creating a New Channel Table from the Measured Signal (Measure Table)....87
Sorting the Table....87
Cancelling the Configuration....87
Saving the Table....87

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

Remote command:
`CONFigure:CDPower[:BTS]:CTABle:NAME` on page 189

Comment
Optional description of the channel table.

Remote command:
CONFigure:CDPower[:BTS]:CTABle:COMMent on page 187

Adding a Channel
Inserts a new row in the channel table to define another channel.

Deleting a Channel
Deletes the currently selected channel from the table.

Creating a New Channel Table from the Measured Signal (Measure Table)
Creates a completely new channel table according to the current measurement data.

Remote command:
CONFigure:CDPower[:BTS]:MEASurement on page 137

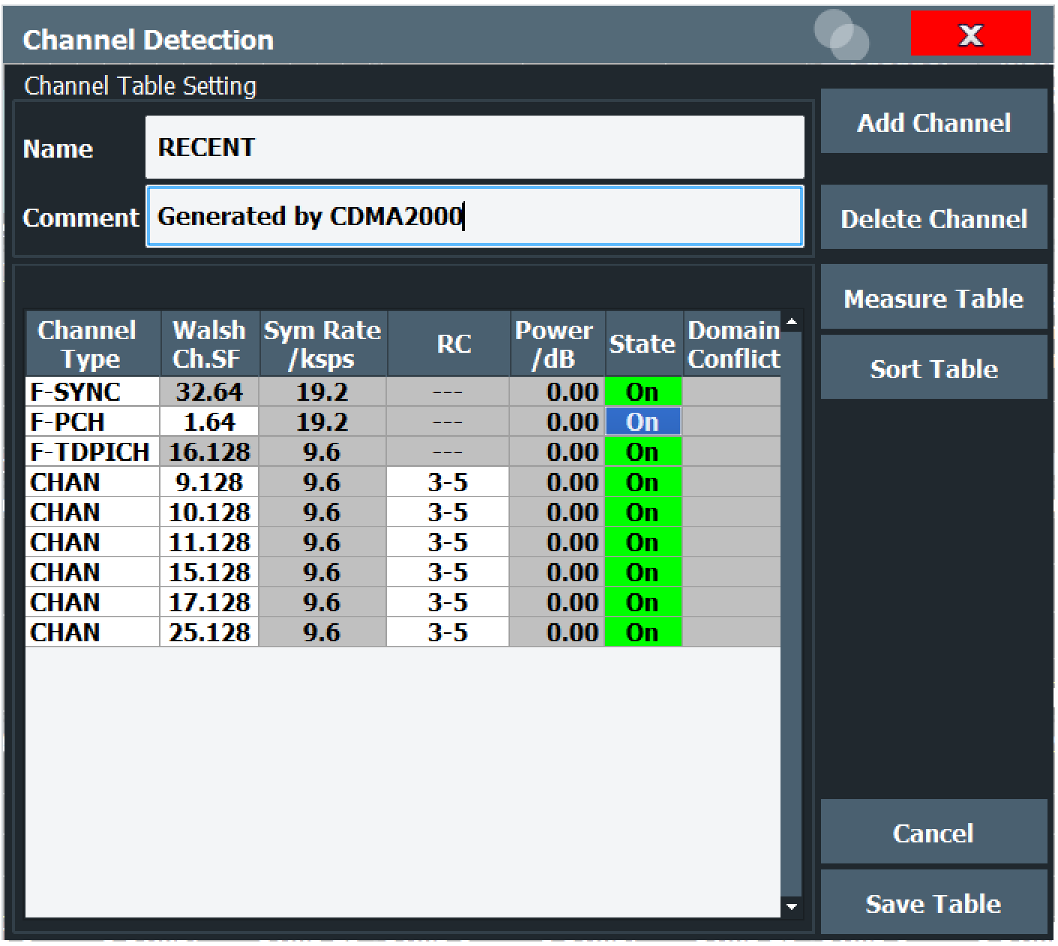
Sorting the Table
Sorts the channel table entries.

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.

6.2.8.4 BTS channel details

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



Channel Type	Walsh Ch.SF	Sym Rate /ksps	RC	Power /dB	State	Domain Conflict
F-SYNC	32.64	19.2	---	0.00	On	
F-PCH	1.64	19.2	---	0.00	On	
F-TDPICH	16.128	9.6	---	0.00	On	
CHAN	9.128	9.6	3-5	0.00	On	
CHAN	10.128	9.6	3-5	0.00	On	
CHAN	11.128	9.6	3-5	0.00	On	
CHAN	15.128	9.6	3-5	0.00	On	
CHAN	17.128	9.6	3-5	0.00	On	
CHAN	25.128	9.6	3-5	0.00	On	

Channel Type 88
Channel Number (Ch. SF) 88
Symbol Rate 89
RC 89
Power 89
Status 89
Domain Conflict 89

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 44 or Chapter 4.8.2, "MS channel types", on page 46.

Remote command:
BTS application:
`CONFigure:CDPower[:BTS]:CTABle:DATA` on page 187
MS application:
`CONFigure:CDPower:MS:CTABle:DATA` on page 189

Channel Number (Ch. SF)

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

Remote command:
BTS application:
CONFigure:CDPower[:BTS]:CTABle:DATA on page 187
MS application:
CONFigure:CDPower:MS:CTABle:DATA on page 189

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 42.

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 87).

Remote command:
BTS application:
CONFigure:CDPower[:BTS]:CTABle:DATA on page 187
MS application:
CONFigure:CDPower:MS:CTABle:DATA on page 189

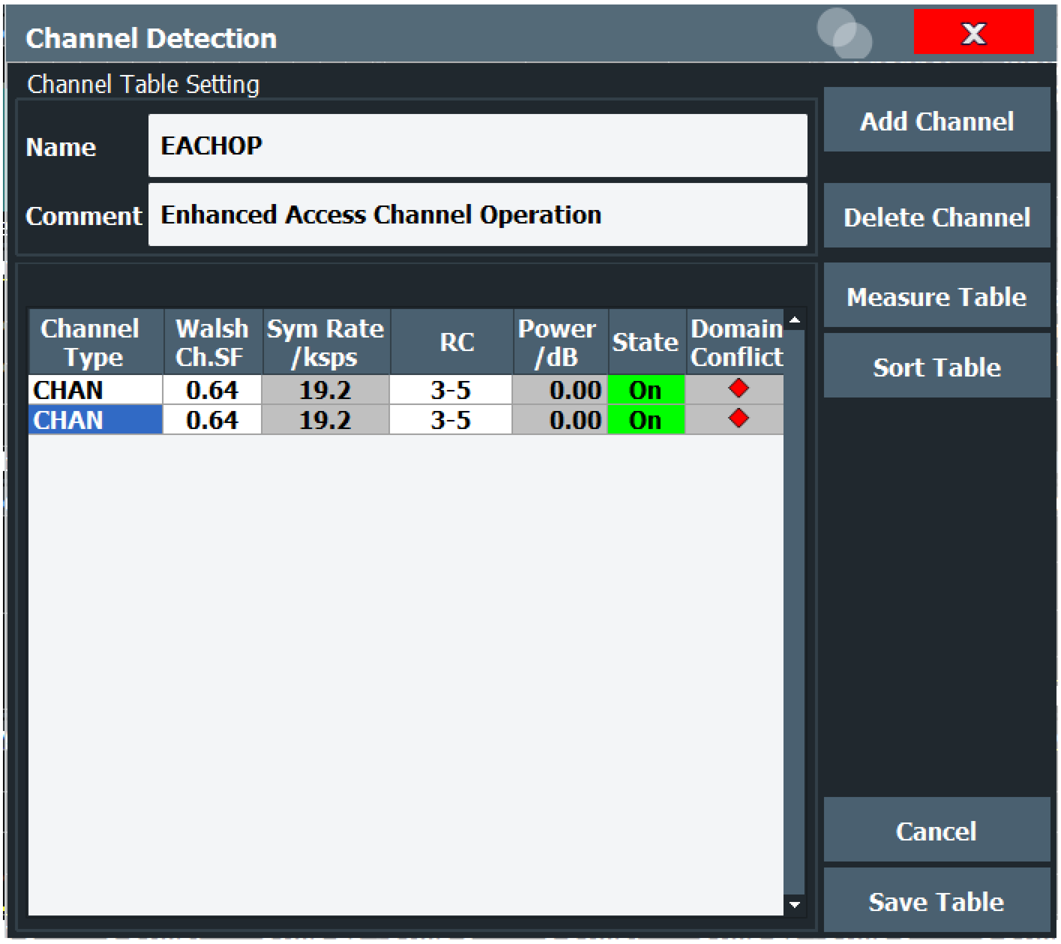
Status
Indicates the channel status. Codes that are not assigned are marked as inactive channels.

Remote command:
BTS application:
CONFigure:CDPower[:BTS]:CTABle:DATA on page 187
MS application:
CONFigure:CDPower:MS:CTABle:DATA on page 189

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

6.2.8.5 MS channel details

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



Channel Type..90
Channel Number (Ch. SF)...90
Symbol Rate...91
Mapping...91
Power...91
Status...91
Domain Conflict..91

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 44 or Chapter 4.8.2, "MS channel types", on page 46.

Remote command:
BTS application:
`CONFigure:CDPower[:BTS]:CTABle:DATA` on page 187
MS application:
`CONFigure:CDPower:MS:CTABle:DATA` on page 189

Channel Number (Ch. SF)

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

Remote command:
BTS application:
CONFigure:CDPower[:BTS]:CTABle:DATA on page 187
MS application:
CONFigure:CDPower:MS:CTABle:DATA on page 189

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 41.

Remote command:
[SENSe:]CDPower:MAPPing on page 194

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 87).

Remote command:
BTS application:
CONFigure:CDPower[:BTS]:CTABle:DATA on page 187
MS application:
CONFigure:CDPower:MS:CTABle:DATA on page 189

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

Remote command:
BTS application:
CONFigure:CDPower[:BTS]:CTABle:DATA on page 187
MS application:
CONFigure:CDPower:MS:CTABle:DATA on page 189

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

6.2.9 Sweep settings

Access: [SWEEP]

The sweep settings define how the data is measured.

Sweep/Average Count....................92
Continuous Sweep / Run Cont....................92
Single Sweep / Run Single....................92
Continue Single Sweep....................93

Sweep/Average Count

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

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

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

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

Remote command:
`[SENSe:]SWEep:COUNt` on page 190
`[SENSe:]AVERage<n>:COUNt` on page 190

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, "Continuous Sweep" and [RUN CONT] 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, "Continuous Sweep" only controls the sweep mode for the currently selected channel. However, the sweep mode only takes effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in continuous sweep mode is swept repeatedly.
Furthermore, [RUN CONT] controls the Sequencer, not individual sweeps. [RUN CONT] starts the Sequencer in continuous mode.

For details on the Sequencer, see the FSW User Manual.

Remote command:
`INITiate<n>:CONTinuous` on page 209

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

Note: Sequencer. If the Sequencer is active, "Single Sweep" only controls the sweep mode for the currently selected channel. However, the sweep mode only takes effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, the Sequencer sweeps a channel in single sweep mode only once.

Furthermore, [RUN SINGLE] 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 channel is updated.

For details on the Sequencer, see the FSW User Manual.

Remote command:
`INITiate<n>[:IMMediate]` on page 210

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

Remote command:
`INITiate<n>:CONMeas` on page 209

6.2.10 Automatic settings

Access: [AUTO SET]

The R&S FSW CDMA2000 Measurements application can adjust some settings automatically according to the current measurement settings. To do so, a measurement is performed. The duration of this measurement can be defined automatically or manually.

MSRA operating mode

In MSRA operating mode, the following automatic settings are not available, as they require a new data acquisition. However, CDMA2000 applications cannot acquire data in MSRA operating mode.

Adjusting all Determinable Settings Automatically (Auto All)....................................... 93
Setting the Reference Level Automatically (Auto Level)... 94
Auto Scale Window.. 94
Auto Scale All... 94
Restore Scale (Window)... 94
Resetting the Automatic Measurement Time (Meas Time Auto)................................. 94
Changing the Automatic Measurement Time (Meas Time Manual)............................. 94
Upper Level Hysteresis.. 95
Lower Level Hysteresis.. 95

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

- Auto Level
- "Auto Scale All" on page 94

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

Remote command:
`[SENSe:]ADJust:ALL` on page 191

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

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

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

You can change the measurement time for the level measurement if necessary (see "Changing the Automatic Measurement Time (Meas Time Manual)" on page 94).

Remote command:
`[SENSe:]ADJust:LEVel` on page 193

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

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

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

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

Remote command:
`[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE` on page 192

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

Note: The maximum measurement duration depends on the currently selected measurement and the installed (optional) hardware. Thus, the measurement duration actually used to determine the automatic settings can be shorter than the value you define here.

Remote command:
[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE on page 192
[SENSe:]ADJust:CONFigure:LEVel:DURation on page 192

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

Remote command:
[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer on page 193

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

Remote command:
[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer on page 193

6.3 RF measurements

Access: "Overview" > "Select Measurement"

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.

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

For details, refer to "Measurements" in the FSW User Manual.

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

- Signal channel power measurements....................95
- Channel power (ACLR) measurements....................96
- Spectrum emission mask....................97
- Occupied bandwidth....................98
- CCDF....................99

6.3.1 Signal channel power measurements

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

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".

To determine the signal channel power, the CDMA2000 application performs a Channel Power measurement as in the Spectrum application with the following settings:

Table 6-2: 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 FSW User Manual.

6.3.2 Channel power (ACLR) measurements

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

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 6-3: 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 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 261.

Remote command:
`CONFigure:CDPower[:BTS]:BANDclass` on page 199

6.3.3 Spectrum emission mask

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

The "Spectrum Emission Mask" measurement shows the quality of the measured signal. It compares 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 6-4: 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 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 261.

Remote command:
`CONFigure:CDPower[:BTS]:BANDclass` on page 199

6.3.4 Occupied bandwidth

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

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

Table 6-5: 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 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 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

6.3.5 CCDF

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

The "CCDF" measurement determines the distribution of the signal amplitudes (complementary cumulative distribution function). The "CCDF" and the Crest factor are displayed. For the purposes of this measurement, a signal section of user-definable length is recorded continuously in 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 6-6: 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 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

7 Analysis

Access: "Overview" > "Analysis"

The remote commands required to perform these tasks are described in Chapter 11.10, "General analysis", on page 234.

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. Only some special marker functions and spectrograms are not available in the CDMA2000 applications.

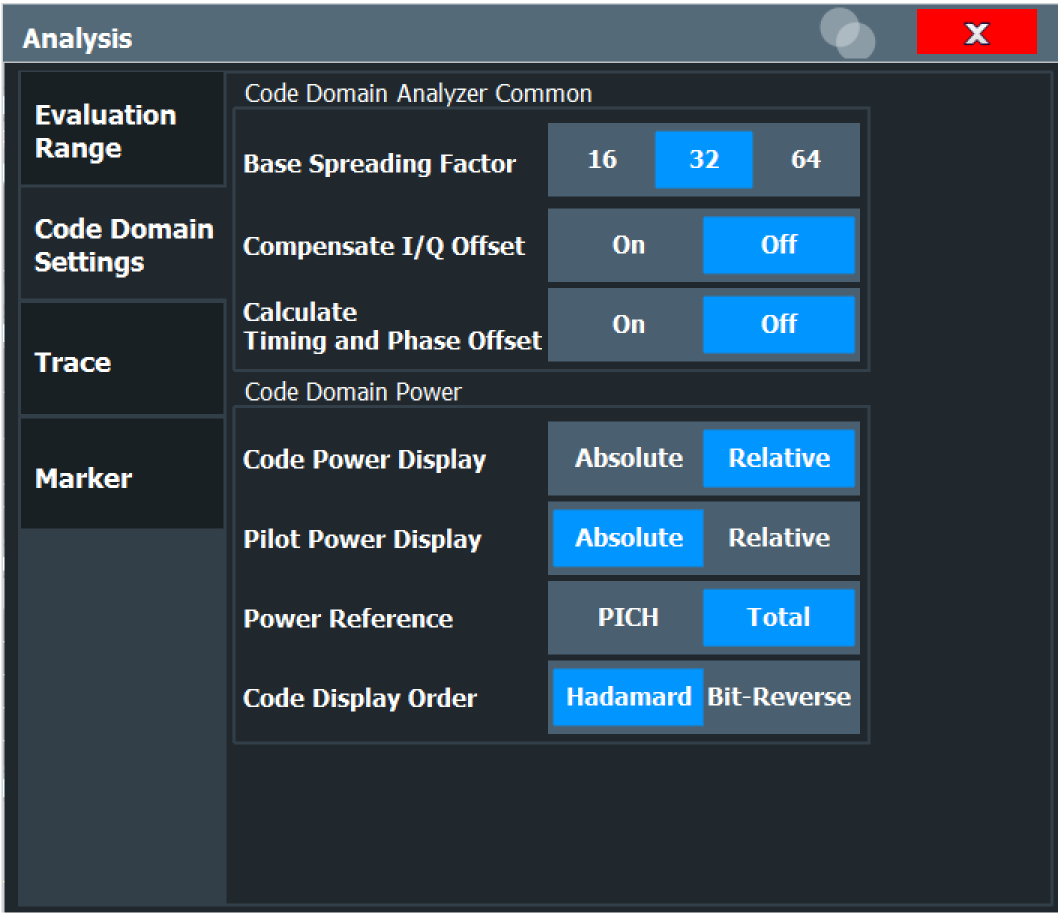
For details, see the "General Measurement Analysis and Display" chapter in the FSW User Manual.

- Code domain analysis settings.. 100
- Evaluation range.. 103
- Traces.. 104
- Markers.. 106

7.1 Code domain analysis settings

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

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



Base Spreading Factor 101
Compensate IQ Offset 101
Timing and phase offset calculation 102
Code Power Display 102
Pilot Power Display (MS application only) 102
Power Reference 102
Code Display Order 102

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 39.

Remote command:
`[SENSe:]CDPower:SFACtor` on page 197

Compensate IQ Offset

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

Remote command:
[SENSe:]CDPower:NORMalize on page 195

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.

Remote command:
[SENSe:]CDPower:TPMeas on page 197

Code Power Display
For "Code Domain Power" evaluation:

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

Remote command:
[SENSe:]CDPower:PDISplay on page 196

Pilot Power Display (MS application only)
For "Code Domain Power" evaluation in the MS application only:

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

Remote command:
[SENSe:]CDPower:PPReference on page 196

Power Reference
For "Code Domain Power" evaluation in the MS application only:

Defines the reference for relative power display.

"Total"	Relative to the total signal power
"PICH"	Relative to the power of the PICH

Remote command:
[SENSe:]CDPower:PREFerence on page 197

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

For further details on the code order, refer to Chapter 4.3, "Code display and sort order", on page 39 and Chapter A.2, "Reference: code tables", on page 258.

"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.

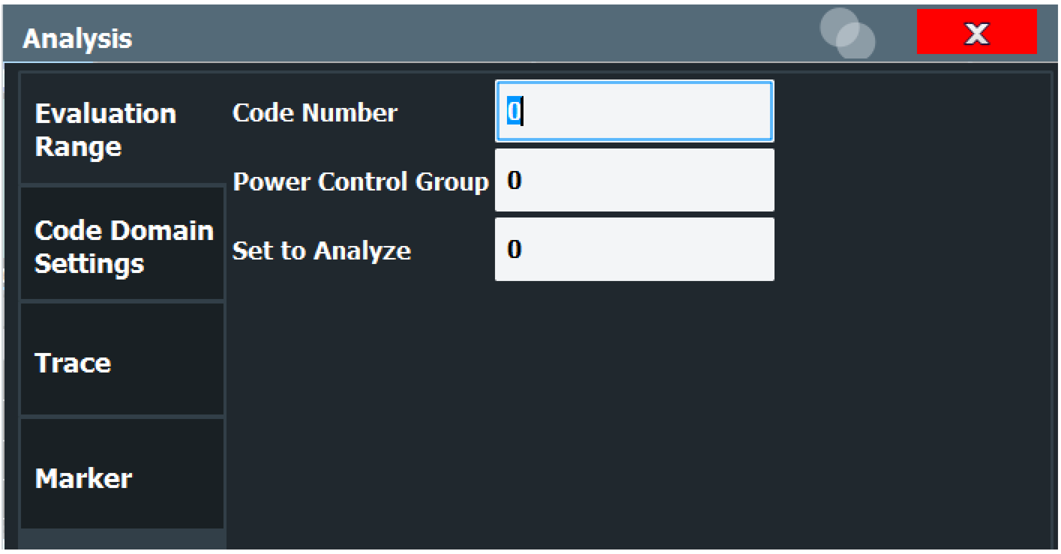
Remote command:
[SENSe:]CDPower:ORDer on page 195

7.2 Evaluation range

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

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...103
Power Control Group...104
Set to Analyze...104
Branch (MS application only)..104

Code Number
Selects a code for the following evaluations (see also Chapter 3.1.2, "Evaluation methods for code domain analysis", on page 17):

- "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 39.

Remote command:
[SENSe:]CDPower:CODE on page 194

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"

Remote command:
[SENSe:]CDPower:SLOT on page 195

Set to Analyze
Selects a specific set for further analysis. The value range is between 0 and "Number of Sets" on page 82 – 1.

Remote command:
[SENSe:]CDPower:SET[:VALue] on page 194

Branch (MS application 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"

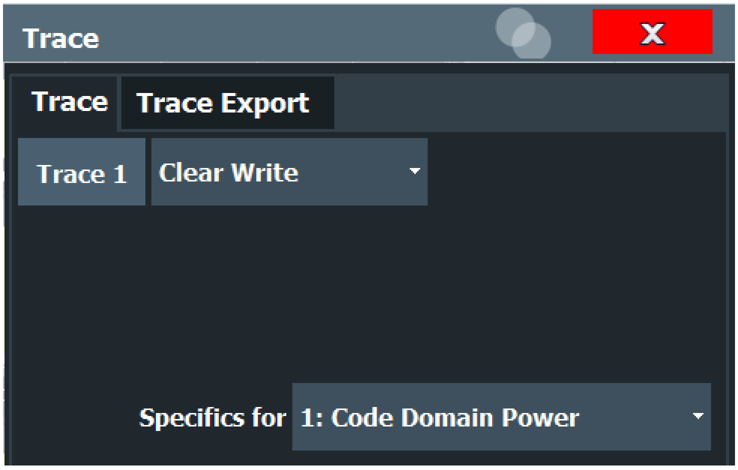
Remote command:
[SENSe:]CDPower:MAPPing on page 194

7.3 Traces

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

Or: [TRACE] > "Trace Config"

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



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

Window-specific configuration

The settings in this dialog box are specific to the selected window. To configure the settings for a different window, select the window outside the displayed dialog box, or select the window from the "Specifics for" selection list in the dialog box.

Trace Mode

Defines the update mode for subsequent traces.

"Clear/ Write" Overwrite mode (default): the trace is overwritten by each measurement.
All available detectors can be selected.

"Max Hold" The maximum value is determined over several measurements and displayed. The FSW saves the measurement result in the trace memory only if the new value is greater than the previous one.

"Min Hold" The minimum value is determined from several measurements and displayed. The FSW saves the measurement result in the trace memory only if the new value is lower than the previous one.

"Average" The average is formed over several measurements.
The Sweep/Average Count determines the number of averaging procedures.

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

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

"Blank" Removes the selected trace from the display.

Remote command:
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE on page 234

7.4 Markers

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

Or: [MKR]

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

Markers in Code Domain Analysis measurements

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

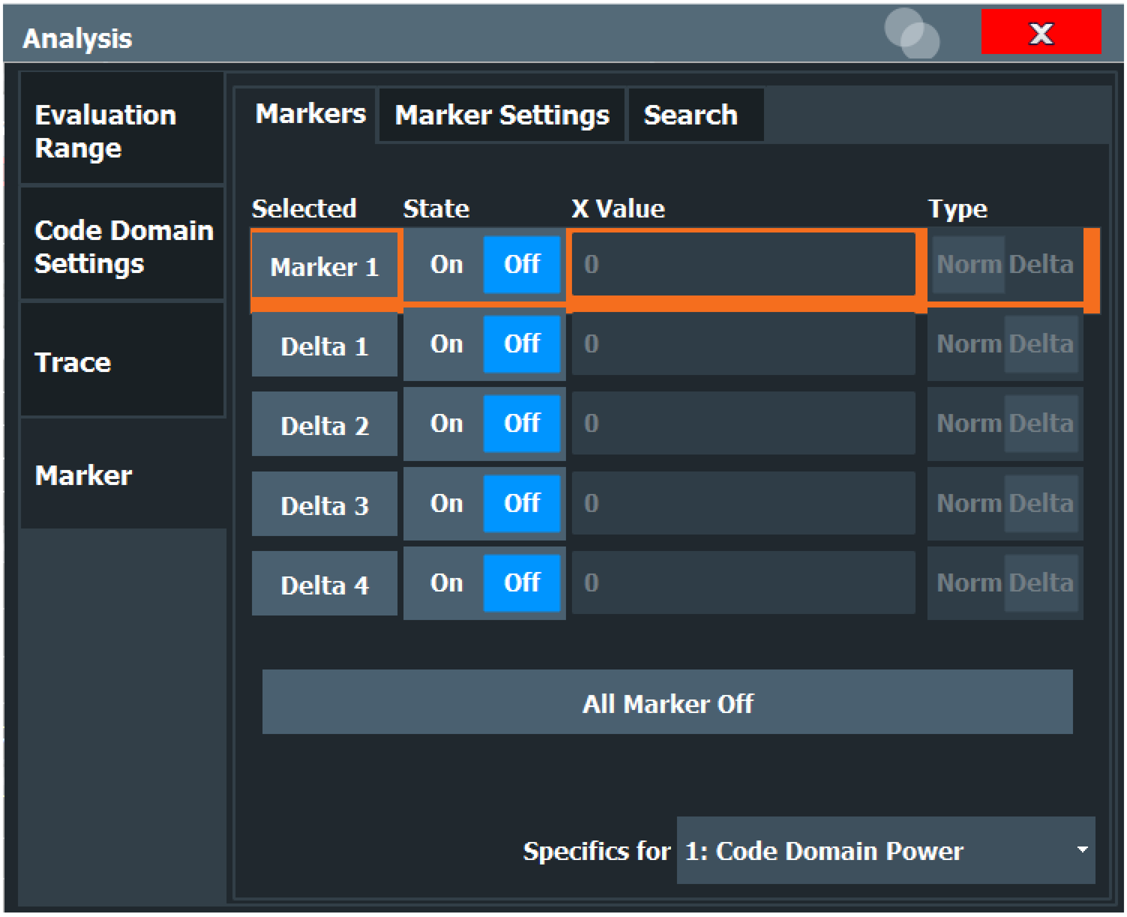
- Individual marker settings....................106
- General marker settings....................108
- Marker search settings....................109
- Marker positioning functions....................110

7.4.1 Individual marker settings

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

Or: [MKR] > "Marker Config"

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



Selected Marker....107
Marker State....107
X-value....107
Marker Type....108
All Markers Off....108

Selected Marker

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

Remote command:

Marker selected via suffix <m> in remote commands.

Marker State

Activates or deactivates the marker in the diagram.

Remote command:

`CALCulate<n>:MARKer<m>[:STATe]` on page 236

`CALCulate<n>:DELTamarker<m>[:STATe]` on page 237

X-value

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

Remote command:
`CALCulate<n>:DELTamarker<m>:X` on page 238
`CALCulate<n>:MARKer<m>:X` on page 236

Marker Type

Toggles the marker type.

The type for marker 1 is always "Normal", the type for delta marker 1 is always "Delta". These types cannot be changed.

Note: If normal marker 1 is the active marker, switching the "Mkr Type" activates an additional delta marker 1. For any other marker, switching the marker type does not activate an additional marker, it only switches the type of the selected marker.

"Normal"	A normal marker indicates the absolute value at the defined position in the diagram.
"Delta"	A delta marker defines the value of the marker relative to the specified reference marker (marker 1 by default).

Remote command:
`CALCulate<n>:MARKer<m>[:STATe]` on page 236
`CALCulate<n>:DELTamarker<m>[:STATe]` on page 237

All Markers Off

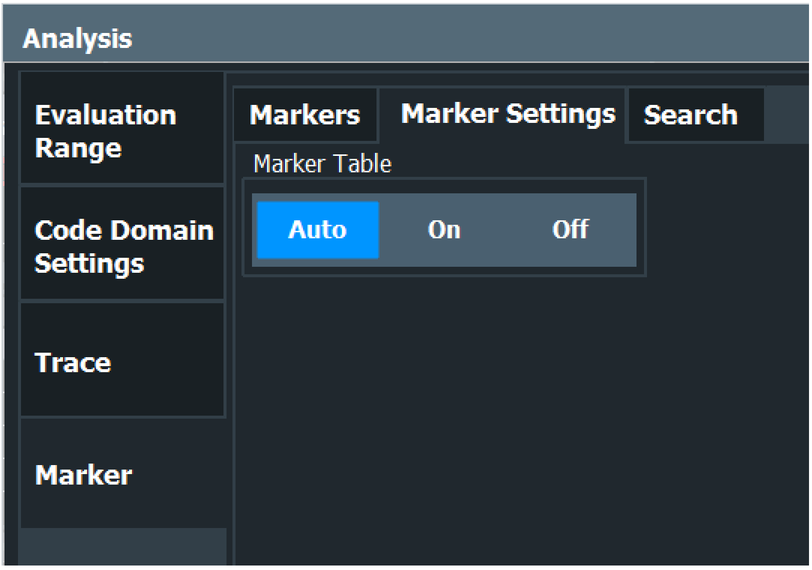
Deactivates all markers in one step.

Remote command:
`CALCulate<n>:MARKer<m>:AOFF` on page 236

7.4.2 General marker settings

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

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



Marker Table Display

Defines how the marker information is displayed.

"On"	Displays the marker information in a table in a separate area beneath the diagram.
"Off"	No separate marker table is displayed. The marker information is displayed within the diagram area.
"Auto"	(Default) If more than two markers are active, the marker table is displayed automatically. The marker information for up to two markers is displayed in the diagram area.

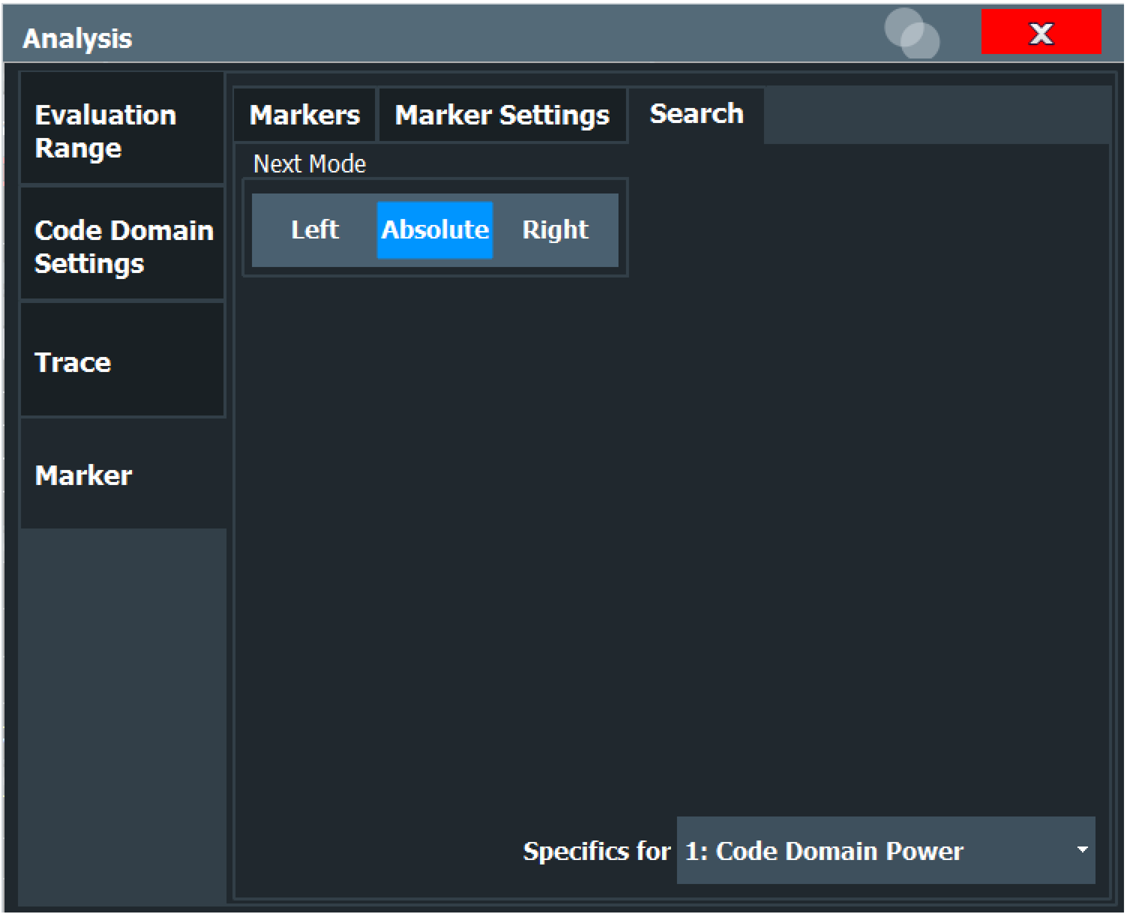
Remote command:
`DISPlay[:WINDow<n>]:MTABle` on page 239

7.4.3 Marker search settings

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

Access: [MKR ->] > "Search Config"

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



Search Mode for Next Peak..110

Search Mode for Next Peak

Selects the search mode for the next peak search.

"Left"	Determines the next maximum/minimum to the left of the current peak.
"Absolute"	Determines the next maximum/minimum to either side of the current peak.
"Right"	Determines the next maximum/minimum to the right of the current peak.

Remote command:
Chapter 11.10.2.3, "Positioning the marker", on page 239

7.4.4 Marker positioning functions

Access: [MKR ->]

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

Markers in Code Domain Analysis measurements

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

Search Next Peak....................111
Search Next Minimum....................111
Peak Search....................111
Search Minimum....................111
Marker To PICH....................112
Marker To TDPICH....................112

Search Next Peak

Sets the selected marker/delta marker to the next (lower) maximum of the assigned trace. If no marker is active, marker 1 is activated.

Remote command:

CALCulate<n>:MARKer<m>:MAXimum:NEXT on page 240
CALCulate<n>:MARKer<m>:MAXimum:RIGHt on page 241
CALCulate<n>:MARKer<m>:MAXimum:LEFT on page 240
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT on page 243
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt on page 243
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT on page 242

Search Next Minimum

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

Remote command:

CALCulate<n>:MARKer<m>:MINimum:NEXT on page 241
CALCulate<n>:MARKer<m>:MINimum:LEFT on page 241
CALCulate<n>:MARKer<m>:MINimum:RIGHt on page 242
CALCulate<n>:DELTamarker<m>:MINimum:NEXT on page 244
CALCulate<n>:DELTamarker<m>:MINimum:LEFT on page 243
CALCulate<n>:DELTamarker<m>:MINimum:RIGHt on page 244

Peak Search

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

Remote command:

CALCulate<n>:MARKer<m>:MAXimum[:PEAK] on page 241
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK] on page 243

Search Minimum

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

Remote command:

CALCulate<n>:MARKer<m>:MINimum[:PEAK] on page 242
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK] on page 244

Marker To PICH

Sets the marker to the PICH channel.

Remote command:
`CALCulate<n>:MARKer<m>:FUNCtion:PICH` on page 239

Marker To TDPICH

Sets the marker to the TDPICH channel.

Remote command:
`CALCulate<n>:MARKer<m>:FUNCtion:TDPich` on page 240

8 Optimizing and troubleshooting the measurement

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

Synchronization fails:

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

8.1 Error messages

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

A short explanation of the 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.

9 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 [MODE] 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 "Overview" to display the "Overview" for Code Domain Analysis.
3. Select "Signal Description" and configure the expected input signal.
4. Select "Input/Frontend" and then the "Frequency" tab to define the input signal's center frequency.
5. Optionally, select "Trigger" 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 "Signal Capture" 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 116.
7. Select "Channel Detection" 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 115.
8. Select "Display Config" 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 "Overview" to display the "Overview" again.
10. Select "Analysis" 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 [RUN SINGLE].

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 "Channel Detection" to open the "Channel Detection" dialog box.
2. To define a new channel table, select "New" next to the "Predefined Tables" list.
   To edit an existing channel table:
   a) Select the existing channel table in the "Predefined Tables" list.
   b) Select "Edit" 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 "Measure Table" to create a table that consists of the channels detected in the currently measured signal.
   Or:
   a) Select "Add Channel" 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 "Save Table" to store the channel table.

   The table is stored and the dialog box is closed. The new channel table is included in the "Predefined Tables" list in the "Channel Detection" dialog box.
6. To activate the use of the new channel table:
   a) Select the table in the "Predefined Tables" list.
   b) Select "Select".
      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 [MODE] 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 RF measurement:
   a) Press [MEAS].
   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 FSW User Manual.

4. Select "Display Config" 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 "Overview" to display the "Overview" again.

6. Select "Analysis" 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 primary 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 "Overview" to display the "Overview" for Code Domain Analysis.

2. Select "Signal Capture".

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 "Refresh" in the "Sweep" menu to update the result displays for the changed application data.

10 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 tests", on page 47.

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 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 FSW with Application Firmware 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:

- Meas 1: measuring the signal channel power..118
- Meas 2: measuring the spectrum emission mask...119
- Meas 3: measuring the relative code domain power and frequency error............120
- Meas 4: measuring the triggered relative code domain power............................122
- Meas 5: measuring the composite EVM..123
- Meas 6: measuring the peak code domain error and the RHO factor.................125

10.1 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 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 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.

10.2 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 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 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.

10.3 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 FSW.
2. Connect the reference input ([REF INPUT]) on the rear panel of the 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 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 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 FSW.

10.4 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 FSW.
2. Connect the reference input ([REF INPUT]) on the rear panel of the 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 of the FSW ([TRIGGER INPUT]) to the external trigger output 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 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 10.3, "Meas 3: measuring the relative code domain power and frequency error", on page 120), 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.

10.4.1 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.

10.4.2 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 FSW is the same as that of the signal. In the "Result Summary" the "Trigger to Frame" value is now correct.

10.5 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 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 FSW.
2. Connect the reference input ([REF INPUT]) on the rear panel of the 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 of the FSW ([TRIGGER INPUT]) to the external trigger output 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 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".

10.6 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 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 FSW.
2. Connect the reference input ([REF INPUT]) on the rear panel of the 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 of the FSW ([TRIGGER INPUT]) to the external trigger output 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 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 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.

11 Remote commands for CDMA2000 measurements

The following commands are required to perform measurements in CDMA2000 applications in a remote environment. It assumes that the FSW has already been set up for remote operation in a network as described in the base unit manual.

Note that basic tasks that are also performed in the base unit in the same way are not described here. For a description of such tasks, see the 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:

- Introduction... 127
- Common suffixes.. 132
- Activating the measurement channel.. 132
- Selecting a measurement.. 137
- Configuring code domain analysis.. 138
- Configuring RF measurements... 198
- Configuring the result display... 199
- Starting a measurement... 208
- Retrieving results.. 212
- General analysis... 234
- Importing and exporting I/Q data and results... 244
- Configuring the secondary application data range (MSRA mode only).............. 246
- Querying the status registers... 248
- Deprecated commands.. 251
- Programming examples for CDMA2000 BTS measurements.................. 252

11.1 Introduction

Commands are program messages that a controller (e.g. a PC) sends to the instrument or software. They operate its functions ('setting commands' or 'events') and request information ('query commands'). Some commands can only be used in one way, others work in two ways (setting and query). If not indicated otherwise, the commands can be used for settings and queries.

The syntax of a SCPI command consists of a header and, usually, one or more parameters. To use a command as a query, you have to append a question mark after the last header element, even if the command contains a parameter.

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

Only the most important characteristics that you need to know when working with SCPI commands are described here. For a more complete description, refer to the user manual of the FSW.

Remote command examples

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

11.1.1 Conventions used in descriptions

The following conventions are used in the remote command descriptions:

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

11.1.2 Long and short form

The keywords have a long and a short form. You can use either the long or the short form, but no other abbreviations of the keywords.

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

Example:

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

11.1.3 Numeric suffixes

Some keywords have a numeric suffix if the command can be applied to multiple instances of an object. In that case, the suffix selects a particular instance (e.g. a measurement window).

Numeric suffixes are indicated by angular brackets (<n>) next to the keyword.

If you do not quote a suffix for keywords that support one, a 1 is assumed.

Example:

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

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

11.1.4 Optional keywords

Some keywords are optional and are only part of the syntax because of SCPI compliance. You can include them in the header or not.

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

Optional keywords are emphasized with square brackets.

Example:

Without a numeric suffix in the optional keyword:

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

With a numeric suffix in the optional keyword:

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

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

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

11.1.5 Alternative keywords

A vertical stroke indicates alternatives for a specific keyword. You can use both keywords to the same effect.

Example:

`[SENSe:]BANDwidth|BWIDth[:RESolution]`

In the short form without optional keywords, `BAND 1MHZ` would have the same effect as `BWID 1MHZ`.

11.1.6 SCPI parameters

Many commands feature one or more parameters.

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

Example:

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

Parameters can have different forms of values.

- Numeric values.. 130
- Boolean..131
- Character data.. 131
- Character strings...132
- Block data.. 132

11.1.6.1 Numeric values

Numeric values can be entered in any form, i.e. with sign, decimal point or exponent. For physical quantities, you can also add the unit. If the unit is missing, the command uses the basic unit.

Example:

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

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

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

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

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

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

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

Querying numeric values

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

Example:

Setting: `SENSe:FREQuency:CENTer 1GHZ`

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

Sometimes, numeric values are returned as text.

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

11.1.6.2 Boolean

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

Querying Boolean parameters

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

Example:

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

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

11.1.6.3 Character data

Character data follows the syntactic rules of keywords. You can enter text using a short or a long form. For more information, see Chapter 11.1.2, "Long and short form", on page 129.

Querying text parameters

When you query text parameters, the system returns its short form.

Example:

Setting: `SENSe:BANDwidth:RESolution:TYPE NORMal`

Query: `SENSe:BANDwidth:RESolution:TYPE?` would return `NORM`

11.1.6.4 Character strings

Strings are alphanumeric characters. They have to be in straight quotation marks. You can use a single quotation mark (') or a double quotation mark (").

Example:

`INSTRument:DELete 'Spectrum'`

11.1.6.5 Block data

Block data is a format which is suitable for the transmission of large amounts of data.

The ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. The data bytes follow. During the transmission of these data bytes, all end or other control signs are ignored until all bytes are transmitted. #0 specifies a data block of indefinite length. The use of the indefinite format requires an `NL^END` message to terminate the data block. This format is useful when the length of the transmission is not known or if speed or other considerations prevent segmentation of the data into blocks of definite length.

11.2 Common suffixes

In the R&S FSW CDMA2000 Measurements application, the following common suffixes are used in remote commands:

Table 11-1: Common suffixes used in remote commands in the R&S FSW CDMA2000 Measurements application

Suffix	Value range	Description
<m>	1 to 4 (RF: 1 to 16)	Marker
<n>	1 to 16	Window (**in the currently selected channel**)
<t>	1 (RF: 1 to 6)	Trace
	1 to 8	Limit line

11.3 Activating the measurement channel

CDMA2000 measurements require a special application on the FSW. The measurement is started immediately with the default settings.

INSTrument:CREate:DUPLicate....133
INSTrument:CREate[:NEW]....133
INSTrument:CREate:REPLace....133
INSTrument:DELete....134
INSTrument:LIST?....134
INSTrument:REName....136
INSTrument[:SELect]....136
SYSTem:PRESet:CHANnel[:EXEC]....136

INSTrument:CREate:DUPLicate

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

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

Is not available if the MSRA primary channel is selected.

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

Usage: Event

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

Adds a measurement channel. You can configure up to 10 measurement channels at the same time (depending on available memory).

Parameters:

<ChannelType> Channel type of the new channel.
For a list of available channel types, see `INSTrument:LIST?` on page 134.

<ChannelName> String containing the name of the channel.
Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.

Example:
```
INST:CRE SAN, 'Spectrum 2'
```
Adds a spectrum display named "Spectrum 2".

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

Replaces a channel with another one.

Setting parameters:

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

<ChannelType> Channel type of the new channel.
For a list of available channel types, see `INSTrument:LIST?` on page 134.

<ChannelName2> String containing the name of the new channel.
Note: If the specified name for a new channel already exists, the default name, extended by a sequential number, is used for the new channel (see `INSTrument:LIST?` on page 134).
Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

Example: `INST:CRE:REPL 'IQAnalyzer2',IQ,'IQAnalyzer'`
Replaces the channel named "IQAnalyzer2" by a new channel of type "IQ Analyzer" named "IQAnalyzer".

Usage: Setting only

INSTrument:DELete <ChannelName>

Deletes a channel.

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

Setting parameters:
<ChannelName> String containing the name of the channel you want to delete.
A channel must exist to delete it.

Example: `INST:DEL 'IQAnalyzer4'`
Deletes the channel with the name 'IQAnalyzer4'.

Usage: Setting only

INSTrument:LIST?

Queries all active channels. The query is useful to obtain the names of the existing channels, which are required to replace or delete the channels.

Return values:
<ChannelType>, <ChannelName> For each channel, the command returns the channel type and channel name (see tables below).
Tip: to change the channel name, use the `INSTrument:REName` command.

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

Usage: Query only

Table 11-2: Available channel types and default channel names in Signal and Spectrum Analyzer mode

Application	<ChannelType> parameter	Default Channel name*)
Spectrum	SANALYZER	Spectrum
1xEV-DO BTS (FSW-K84)	BDO	1xEV-DO BTS
1xEV-DO MS (FSW-K85)	MDO	1xEV-DO MS
3GPP FDD BTS (FSW-K72)	BWCD	3G FDD BTS
3GPP FDD UE (FSW-K73)	MWCD	3G FDD UE
802.11ad (FSW-K95)	WIGIG	802.11ad
802.11ay (FSW-K97)	EDMG	802.11ay EDMG
Amplifier Measurements (FSW-K18)	AMPLifier	Amplifier
AM/FM/PM Modulation Analysis (FSW-K7)	ADEM	Analog Demod
Avionics (FSW-K15)	AVIonics	Avionics
Bluetooth (FSW-K8)	BTO	Bluetooth
cdma2000 BTS (FSW-K82)	BC2K	CDMA2000 BTS
cdma2000 MS (FSW-K83)	MC2K	CDMA2000 MS
DOCSIS 3.1 (FSW-K192/193)	DOCSis	DOCSIS 3.1
Fast Spur Search (FSW-K50)	SPUR	Spurious
GSM (FSW-K10)	GSM	GSM
HRP UWB (FSW-K149)	UWB	HRP UWB
I/Q Analyzer	IQ	IQ Analyzer
LTE (FSW-K10x)	LTE	LTE
Multi-Carrier "Group Delay" (FSW-K17)	MCGD	MC "Group Delay"
NB-IoT (FSW-K106)	NIOT	NB-IoT
Noise (FSW-K30)	NOISE	Noise
5G NR (FSW-K144)	NR5G	5G NR
OFDM VSA (FSW-K96)	OFDMVSA	OFDM VSA
OneWeb (FSW-K201)	OWEB	OneWeb
Phase Noise (FSW-K40)	PNOISE	Phase Noise
Pulse (FSW-K6)	PULSE	Pulse
"Real-Time Spectrum"	RTIM	"Real-Time Spectrum"
TD-SCDMA BTS (FSW-K76)	BTDS	TD-SCDMA BTS
TD-SCDMA UE (FSW-K77)	MTDS	TD-SCDMA UE
*) 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*)
Transient Analysis (FSW-K60)	TA	Transient Analysis
Verizon 5GTF Measurement Application (V5GTF, FSW-K118)	V5GT	V5GT
VSA (FSW-K70)	DDEM	VSA
WLAN (FSW-K91)	WLAN	WLAN
*) 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>

Renames a channel.

Setting parameters:

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

<ChannelName2> String containing the new channel name.
Note that you cannot assign an existing channel name to a new channel. If you do, an error occurs.
Channel names can have a maximum of 31 characters, and must be compatible with the Windows conventions for file names. In particular, they must not contain special characters such as ":", "*", "?".

Example: `INST:REN 'IQAnalyzer2','IQAnalyzer3'`
Renames the channel with the name 'IQAnalyzer2' to 'IQAnalyzer3'.

Usage: Setting only

INSTrument[:SELect] <ChannelType>

This command activates a new measurement channel with the defined channel type, or selects an existing measurement channel with the specified name.

See also `INSTrument:CREate[:NEW]` on page 133.

For a list of available channel types see `INSTrument:LIST?` on page 134.

Parameters:

<ChannelType> **BC2K**
cdma2000 BTS option, FSW–K82

MC2K
cdma2000 MS option, FSW–K83

SYSTem:PRESet:CHANnel[:EXEC]

Restores the default instrument settings in the current channel.

Use `INST:SEL` to select the channel.

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

Usage: Event

Manual operation: See "Preset Channel" on page 54

11.4 Selecting a measurement

The following commands are required to define the measurement type in a remote environment. For details on available measurements see Chapter 3, "Measurements and result displays", on page 14.

CONFigure:CDPower[:BTS]:MEASurement...137

CONFigure:CDPower[:BTS]:MEASurement <Measurement>

Selects the RF measurement type (with predefined settings according to the CDMA2000 standard).

Parameters:

<Measurement> POWer | ACLR | MCAClr | ESPectrum | OBANdwidth | OBWidth | CDPower | CCDF

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 operation: See "Power" on page 30
See "Channel Power ACLR" on page 30
See "Spectrum Emission Mask" on page 31
See "Occupied Bandwidth" on page 32
See "CCDF" on page 33
See "Creating a New Channel Table from the Measured Signal (Measure Table)" on page 87

11.5 Configuring code domain analysis

- Signal description....................138
- Configuring the data input and output....................143
- Frontend configuration....................165
- Configuring triggered measurements....................174
- Signal capturing....................182
- Channel detection....................183
- Sweep settings....................190
- Automatic settings....................191
- Evaluation range....................194
- Code domain analysis settings....................195

11.5.1 Signal description

The signal description provides information on the expected input signal.

- BTS signal description....................138
- MS signal description....................141

11.5.1.1 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 42.

CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency....................138
CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF....................139
CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe]....................139
CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE....................140
CONFigure:CDPower[:BTS]:MCARrier:MALGo....................140
CONFigure:CDPower[:BTS]:MCARrier[:STATe]....................140
[SENSe:]CDPower:ANTenna....................141
[SENSe:]CDPower:PNOFfset....................141

CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency <Frequency>

Sets the cut-off frequency for the RRC filter.

Parameters:

<Frequency> Range: 0.1 MHz to 2.4 MHz
*RST: 1.25
Default unit: HZ

Example:
`CONF:CDP:MCAR ON`
Activates multicarrier mode
`CONF:CDP:MCAR:FILT ON`
Activates an additional filter for multicarrier 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 operation: See "Cut Off Frequency" on page 57

CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF <RollOffFactor>

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 multicarrier mode
`CONF:CDP:MCAR:FILT ON`
Activates an additional filter for multicarrier 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 operation: See "Roll-Off Factor" on page 57

CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe] <State>

Activates or deactivates the usage of a filter for multicarrier measurements.

Parameters:

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

Example:
`CONF:CDP:MCAR ON`
Activates multicarrier mode
`CONF:CDP:MCAR:FILT OFF`
Activates an additional filter for multicarrier measurements

Manual operation: See "Multicarrier Filter" on page 56

CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE <Type>

Sets the filter type to be used in multicarrier 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 | RRC

*RST: LPAS

Example:
`CONF:CDP:MCAR ON`
Activates multicarrier mode
`CONF:CDP:MCAR:FILT ON`
Activates an additional filter for multicarrier measurements
`CONF:CDP:MCAR:FILT:TYPE RRC`
Activates the RRC filter

Manual operation:
See "Filter Type" on page 56
See "Roll-Off Factor" on page 57
See "Cut Off Frequency" on page 57

CONFigure:CDPower[:BTS]:MCARrier:MALGo <State>

Activates or deactivates the enhanced algorithm for the filters in multicarrier mode.

Parameters:

<State> ON | OFF | 1 | 0

*RST: 1

Example:
`CONF:CDP:MCAR ON`
Activates multicarrier mode
`CONF:CDP:MCAR:FILT ON`
Activates an additional filter for multicarrier measurements
`CONF:CDP:MCAR:MALG OFF`
Deactivates the enhanced algorithm

Manual operation:
See "Enhanced Algorithm" on page 56

CONFigure:CDPower[:BTS]:MCARrier[:STATe] <State>

Activates or deactivates the multicarrier mode.

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

Example:
`CONF:CDP:MCAR ON`
Activates the multicarrier settings.

Manual operation:
See "Multicarrier" on page 56

[SENSe:]CDPower:ANTenna <AntennaState>

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 43.

Parameters:

<AntennaState>

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 56.

Example: `CDP:ANT 2`
Selects antenna 2.

Manual operation: See "Antenna Diversity - Antenna Number" on page 56

[SENSe:]CDPower:PNOFfset <Offset>

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 operation: See "PN Offset" on page 56

11.5.1.2 MS signal description

The following commands describe the input signal in MS measurements.

For more information see "Long code scrambling" on page 41.

Useful commands for describing MS signals described elsewhere:

- `CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency` on page 138
- `CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF` on page 139
- `CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE` on page 140
- `CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe]` on page 139
- `CONFigure:CDPower[:BTS]:MCARrier:MALGo` on page 140
- `CONFigure:CDPower[:BTS]:MCARrier[:STATe]` on page 140

Remote commands exclusive to describing MS signals:

[SENSe:]CDPower:LCODe:MASK ... 142
[SENSe:]CDPower:LCODe:MODE ... 142
[SENSe:]CDPower:LCODe:OFFSet ... 142

[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 operation: See "Long Code Mask" on page 58

[SENSe:]CDPower:LCODe:MODE <Mode>

Selects the mode of the long code generation.

Parameters:

<Mode> STANdard | ESG101

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 operation: See "Long Code Generation" on page 59

[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).

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 operation: See "Long Code Offset" on page 58

11.5.2 Configuring the data input and output

The following commands are required to configure data input and output. For more information see Chapter 6.2.3, "Data input and output settings", on page 60.

- RF input....................143
- Configuring file input....................147
- Remote commands for the Digital Baseband interface (FSW-B17)....................149
- Configuring input via the optional Analog Baseband interface....................156
- Setting up probes....................158
- Configuring the outputs....................164

11.5.2.1 RF input

INPut:ATTenuation:PROTection:RESet....................144
INPut:CONNector....................144
INPut:COUPling....................144
INPut:DPATh....................145
INPut:FILTer:HPASs[:STATe]....................145
INPut:FILTer:YIG[:STATe]....................145
INPut:IMPedance....................146
INPut:SELect....................146
INPut:TYPE....................147

INPut:ATTenuation:PROTection:RESet

Resets the attenuator and reconnects the RF input with the input mixer for the FSW after an overload condition occurred and the protection mechanism intervened. The error status bit (bit 3 in the `STAT:QUES:POW` status register) and the `INPUT OVLD` message in the status bar are cleared.

(For details on the status register see the FSW base unit user manual).

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

Example: `INP:ATT:PROT:RES`

INPut:CONNector <ConnType>

Determines which connector the input for the measurement is taken from.

Parameters:

<ConnType>

RF
RF input connector

AIQI
Analog Baseband I connector
This setting is only available if the "Analog Baseband" interface (FSW-B71) is installed and active for input. It is not available for the FSW67 or FSW85.
For more information on the "Analog Baseband" interface (FSW-B71), see the FSW I/Q Analyzer and I/Q Input User Manual.

RFPRobe
Active RF probe

*RST: RF

Example: `INP:CONN RF`
Selects input from the RF input connector.

Manual operation: See "Input Connector" on page 63

INPut:COUPling <CouplingType>

Selects the coupling type of the RF input.

The command is not available for measurements with the optional "Digital Baseband" interface.

Parameters:

<CouplingType> AC | DC

AC
AC coupling

DC
DC coupling

*RST: AC

Example: `INP:COUP DC`

Manual operation: See "Input Coupling" on page 62

INPut:DPATh <DirectPath>

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

Parameters:

<DirectPath> AUTO | OFF

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

OFF | 0
The analog mixer path is always used.

Example: `INP:DPAT OFF`

Manual operation: See "Direct Path" on page 62

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 FSW to measure the harmonics for a DUT, for example.

Requires an additional high-pass filter hardware option.

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

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

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

Manual operation: See "High Pass Filter 1 to 3 GHz" on page 63

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

Enables or disables the YIG filter.

Parameters:

<State> ON | OFF | 0 | 1

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

Manual operation: See "YIG-Preselector" on page 63

INPut:IMPedance <Impedance>

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

The command is not available for measurements with the optional "Digital Baseband" interface.

Parameters:

<Impedance> 50 | 75

*RST: 50 Ω
Default unit: OHM

Example: `INP:IMP 75`

Manual operation: See "Impedance" on page 62

INPut:SELect <Source>

Selects the signal source for measurements, i.e. it defines which connector is used to input data to the FSW.

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

For FSW85 models with two RF input connectors, you must select the input connector to configure first using `INPut:TYPE`.

Parameters:

<Source>

RF
Radio Frequency ("RF INPUT" connector)

FIQ
I/Q data file
Not available for Input2.

DIQ
Digital IQ data (only available with optional "Digital Baseband" interface)
For details on I/Q input see the FSW I/Q Analyzer User Manual.
Not available for Input2.

AIQ
Analog Baseband signal (only available with optional "Analog Baseband" interface)
Not available for Input2.

*RST: RF

Example: `INP:TYPE INP1`
For FSW85 models with two RF input connectors: selects the 1.00 mm RF input connector for configuration.
`INP:SEL RF`

Manual operation: See "Radio Frequency State" on page 62
See "I/Q Input File State" on page 64

INPut:TYPE <Input>

The command selects the input path.

Parameters:

<Input>

INPUT1
Selects RF input 1.
1 mm [RF Input] connector

INPUT2
Selects RF input 2.
For FSW85 models with two RF input connectors:
1.85 mm [RF2 Input] connector
For all other models: not available

*RST: INPUT1

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

Manual operation: See "Radio Frequency State" on page 62

11.5.2.2 Configuring file input

The following commands are required to define input from a file.

Useful commands for configuring file input described elsewhere:

- `INPut:SELect` on page 146

Remote commands exclusive to configuring input from files:

INPut:FILE:PATH 147
MMEMory:LOAD:IQ:STReam 148
MMEMory:LOAD:IQ:STReam:AUTO 148
MMEMory:LOAD:IQ:STReam:LIST? 149
TRACe:IQ:FILE:REPetition:COUNt 149

INPut:FILE:PATH <FileName>[, <AnalysisBW>]

Selects the I/Q data file to be used as input for further measurements.

The I/Q data file must be in one of the following supported formats:

- `.iq.tar`
- `.iqw`
- `.csv`
- `.mat`
- `.wv`
- `.aid`

Only a single data stream or channel can be used as input, even if multiple streams or channels are stored in the file.

For some file formats that do not provide the sample rate and measurement time or record length, you must define these parameters manually. Otherwise the traces are not visible in the result displays.

Parameters:

<FileName> String containing the path and name of the source file.
The file type is determined by the file extension. If no file extension is provided, the file type is assumed to be `.iq.tar`.
For `.mat` files, Matlab® v4 is assumed.

<AnalysisBW> Optionally: The analysis bandwidth to be used by the measurement. The bandwidth must be smaller than or equal to the bandwidth of the data that was stored in the file.
Default unit: HZ

Example:
```
INP:FILE:PATH 'C:\R_S\Instr\user\data.iq.tar'
```
Uses I/Q data from the specified file as input.

Example:
```
//Load an IQW file
INP:SEL:FIQ
INP:FILE:PATH 'C:\R_S\Instr\user\data.iqw'
//Define the sample rate
TRAC:IQ:SRAT 10MHz
//Define the measurement time
SENSe:SWEep:TIME  0.001001
//Start the measurement
INIT:IMM
```

Manual operation: See "Select I/Q data file" on page 65

MMEMory:LOAD:IQ:STReam <Channel>

Only available for files that contain more than one data stream from multiple channels: selects the data stream to be used as input for the currently selected channel.

Automatic mode (`MMEMory:LOAD:IQ:STReam:AUTO`) is set to OFF.

Parameters:

<Channel> String containing the channel name.

Example:
```
MMEM:LOAD:IQ:STR?
//Result: 'Channel1','Channel2'
MMEM:LOAD:IQ:STR 'Channel2'
```

MMEMory:LOAD:IQ:STReam:AUTO <State>

Only available for files that contain more than one data stream from multiple channels: automatically defines which data stream in the file is used as input for the channel.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
The data stream specified by MMEMory:LOAD:IQ:STReam is used as input for the channel.

ON | 1
The first data stream in the file is used as input for the channel. Applications that support multiple data streams use the first data stream in the file for the first input stream, the second for the second stream etc.

*RST: 1

MMEMory:LOAD:IQ:STReam:LIST?

Returns the available channels in the currently loaded input file.

Example:
```
MMEM:LOAD:IQ:STR?
//Result: 'Channel1','Channel2'
```

Usage: Query only

TRACe:IQ:FILE:REPetition:COUNt <RepetitionCount>

Determines how often the data stream is repeatedly copied in the I/Q data memory. If the available memory is not sufficient for the specified number of repetitions, the largest possible number of complete data streams is used.

Parameters:
<RepetitionCount> integer

Example:
```
TRAC:IQ:FILE:REP:COUN 3
```

Manual operation: See "File Repetitions" on page 65

11.5.2.3 Remote commands for the Digital Baseband interface (FSW-B17)

The following commands are required to control the "Digital Baseband" interface (FSW-B17) in a remote environment.They are only available if this option is installed.

Information on the STATus:QUEStionable:DIQ register can be found in "STATus:QUEStionable:DIQ register" on page 153.

- Configuring digital I/Q input and output....149
- STATus:QUEStionable:DIQ register....153

Configuring digital I/Q input and output

Remote commands exclusive to digital I/Q data input and output

INPut:DIQ:CDEVice....150
INPut:DIQ:RANGe:COUPling....150
INPut:DIQ:RANGe[:UPPer]....150
INPut:DIQ:RANGe[:UPPer]:AUTO....150

INPut:DIQ:RANGe[:UPPer]:UNIT....151
INPut:DIQ:SRATe....151
INPut:DIQ:SRATe:AUTO....151
OUTPut:DIQ[:STATe]....151
OUTPut<up>:DIQ:CDEVice?....152

INPut:DIQ:CDEVice

Queries the current configuration and the status of the digital I/Q input from the optional "Digital Baseband" interface.

For details see the section "Interface Status Information" for the optional "Digital Baseband" interface in the FSW I/Q Analyzer User Manual.

Return values:
<Value>

Example:
```
INP:DIQ:CDEV?
```
Result:
```
1,SMW200A,101190,BBMM 1 OUT,
100000000,200000000,Passed,Passed,1,1.#QNAN
```

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.

Is only available if the optional "Digital Baseband" interface is installed.

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

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".

Is only available if the optional "Digital Baseband" interface is installed.

Parameters:
<Level> Range: 1 µV to 7.071 V
*RST: 1 V
Default unit: DBM

INPut:DIQ:RANGe[:UPPer]:AUTO <State>

If enabled, the digital input full scale level is automatically set to the value provided by the connected device (if available).

Is only available if the optional "Digital Baseband" interface is installed.

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

INPut:DIQ:RANGe[:UPPer]:UNIT <Level>

Defines the unit of the full scale level. The availability of units depends on the measurement application you are using.

Is only available if the optional "Digital Baseband" interface is installed.

Parameters:

<Level> DBM | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere

*RST: Volt

INPut:DIQ:SRATe <SampleRate>

Specifies or queries the sample rate of the input signal from the optional "Digital Baseband" interface.

Parameters:

<SampleRate> Range: 1 Hz to 20 GHz

*RST: 32 MHz

Default unit: HZ

Example: `INP:DIQ:SRAT 200 MHz`

INPut:DIQ:SRATe:AUTO <State>

If enabled, the sample rate of the digital I/Q input signal is set automatically by the connected device.

Is only available if the optional "Digital Baseband" interface is installed.

Parameters:

<State> ON | OFF | 1 | 0

*RST: 0

OUTPut:DIQ[:STATe] <State>

Turns continuous output of I/Q data to the optional "Digital Baseband" interface on and off.

Using the digital input and digital output simultaneously is not possible.

If digital baseband output is active, the sample rate is restricted to 100 MHz (200 MHz if enhanced mode is possible; max. 160 MHz bandwidth).

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `OUTP:DIQ ON`

Manual operation: See "Digital Baseband Output" on page 67

OUTPut<up>:DIQ:CDEVice?

Queries the current configuration and the status of the digital I/Q data output to the optional "Digital Baseband" interface.

Suffix:
<up>

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> Current data transfer rate of the connected device in Hz

<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

<NotUsed> to be ignored

<Placeholder> for future use; currently "0"

Example: `OUTP:DIQ:CDEV?`
Result:
`1,SMW200A,101190,CODER 1 IN,`
`0,200000000,Passed,Done,0,0`

Usage: Query only

Manual operation: See "Output Settings Information" on page 67
See "Connected Instrument" on page 67

STATus:QUEStionable:DIQ register

This register contains information about the state of the digital I/Q input and output. This register is used by the optional "Digital Baseband" interface.

The status of the `STATus:QUESTionable:DIQ` register is indicated in bit 14 of the `STATus:QUESTionable` register.

You can read out the state of the register with `STATus:QUEStionable:DIQ:CONDition?` on page 154 and `STATus:QUEStionable:DIQ[:EVENt]?` on page 155.

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 SMW) 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 SMW) is established.
3	**Digital I/Q Input PLL unlocked** This bit is set if the PLL of the Digital I/Q input is out of lock due to missing or unstable clock provided by the connected Digital I/Q TX device. To solve the problem the Digital I/Q connection has to be newly initialized after the clock has been restored.
4	**Digital I/Q Input DATA Error** This bit is set if the data from the Digital I/Q input module is erroneous. Possible reasons: ● Bit errors in the data transmission. The bit will only be set if an error occurred at the current measurement. ● Protocol or data header errors. May occur due to data synchronization problems or vast transmission errors. The bit will be set constantly and all data will be erroneous. To solve the problem the Digital I/Q connection has to be newly initialized. NOTE: If this error is indicated repeatedly either the Digital I/Q LVDS connection cable or the receiving or transmitting device might be defect.
5	Not used

Bit No.	Meaning
6	**Digital I/Q Input FIFO Overload** This bit is set if the sample rate on the connected instrument is higher than the input sample rate setting on the FSW. Possible solution: ● Reduce the sample rate on the connected instrument ● Increase the input sample rate setting on the FSW
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 SMW) 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 SMW) is established.
11	**Digital I/Q Output FIFO Overload** This bit is set if an overload of the Digital I/Q Output FIFO occurred. This happens if the output data rate is higher than the maximal data rate of the connected instrument. Reduce the sample rate to solve the problem.
12-14	Not used
15	This bit is always set to 0.

STATus:QUEStionable:DIQ:CONDition?..........154
STATus:QUEStionable:DIQ:ENABle..........154
STATus:QUEStionable:DIQ:NTRansition..........155
STATus:QUEStionable:DIQ:PTRansition..........155
STATus:QUEStionable:DIQ[:EVENt]?..........155

STATus:QUEStionable:DIQ:CONDition? <ChannelName>

Reads out the CONDition section of the `STATus:QUEStionable:DIQ:CONDition` status register.

The command does not delete the contents of the EVENt section.

Query parameters:

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Example: `STAT:QUES:DIQ:COND?`

Usage: Query only

STATus:QUEStionable:DIQ:ENABle <BitDefinition>, <ChannelName>

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

STATus:QUEStionable:DIQ:NTRansition <BitDefinition>,<ChannelName>

Controls the Negative TRansition part of a register.

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

Parameters:

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Setting parameters:

<BitDefinition> Range: 0 to 65535

STATus:QUEStionable:DIQ:PTRansition <BitDefinition>,<ChannelName>

Controls the Positive TRansition part of a register.

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

Parameters:

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Setting parameters:

<BitDefinition> Range: 0 to 65535

STATus:QUEStionable:DIQ[:EVENt]? <ChannelName>

Queries the contents of the "EVENt" section of the `STATus:QUEStionable:DIQ` register for IQ measurements.

Readout deletes the contents of the "EVENt" section.

Query parameters:

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Example: `STAT:QUES:DIQ?`

Usage: Query only

11.5.2.4 Configuring input via the optional Analog Baseband interface

The following commands are required to control the optional "Analog Baseband" interface in a remote environment. They are only available if this option is installed.

For more information on the "Analog Baseband" interface, see the FSW I/Q Analyzer User Manual.

Useful commands for Analog Baseband data described elsewhere:

- `INP:SEL AIQ` (see `INPut:SELect` on page 146)
- `[SENSe:]FREQuency:CENTer` on page 165

Commands for the Analog Baseband calibration signal are described in the FSW User Manual.

Remote commands exclusive to Analog Baseband data input and output

INPut:IQ:BALanced[:STATe]........ 156
INPut:IQ:FULLscale:AUTO........ 157
INPut:IQ:FULLscale[:LEVel]........ 157
INPut:IQ:TYPE........ 157
CALibration:AIQ:HATiming[:STATe]........ 158

INPut:IQ:BALanced[:STATe] <State>

Defines whether the input is provided as a differential signal via all 4 Analog Baseband connectors or as a plain I/Q signal via 2 single-ended lines.

Parameters:

<State> ON | OFF | 1 | 0

ON | 1
Differential

OFF | 0
Single ended

*RST: 1

Example: `INP:IQ:BAL OFF`

INPut:IQ:FULLscale:AUTO <State>

Defines whether the full scale level (i.e. the maximum input power on the Baseband Input connector) is defined automatically according to the reference level, or manually.

Parameters:

<State>

ON | 1
Automatic definition

OFF | 0
Manual definition according to `INPut:IQ:FULLscale[:LEVel]` on page 157

*RST: 1

Example: `INP:IQ:FULL:AUTO OFF`

INPut:IQ:FULLscale[:LEVel] <PeakVoltage>

Defines the peak voltage at the Baseband Input connector if the full scale level is set to manual mode (see `INPut:IQ:FULLscale:AUTO` on page 157).

Parameters:

<PeakVoltage> 0.25 V | 0.5 V | 1 V | 2 V

Peak voltage level at the connector.
For probes, the possible full scale values are adapted according to the probe's attenuation and maximum allowed power.

*RST: 1V
Default unit: V

Example: `INP:IQ:FULL 0.5V`

INPut:IQ:TYPE <DataType>

Defines the format of the input signal.

Parameters:

<DataType> IQ | I | Q

IQ
The input signal is filtered and resampled to the sample rate of the application.
Two input channels are required for each input signal, one for the in-phase component, and one for the quadrature component.

I
The in-phase component of the input signal is filtered and resampled to the sample rate of the application. If the center frequency is not 0, the in-phase component of the input signal is down-converted first (Low IF I).

Q
The quadrature component of the input signal is filtered and resampled to the sample rate of the application. If the center frequency is not 0, the quadrature component of the input signal is down-converted first (Low IF Q).

*RST: IQ

Example: `INP:IQ:TYPE Q`

CALibration:AIQ:HATiming[:STATe] <State>

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

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

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `CAL:AIQ:HAT:STAT ON`

11.5.2.5 Setting up probes

Modular probes can be connected to the RF input connector of the FSW.

For details see the FSW User Manual.

Probes can also be connected to the optional "Baseband Input" connectors, if the "Analog Baseband" interface (option FSW-B71) is installed.

[SENSe:]PROBe<pb>:ID:PARTnumber?.. 158
[SENSe:]PROBe<pb>:ID:SRNumber?.. 159
[SENSe:]PROBe<pb>:SETup:ATTRatio.. 159
[SENSe:]PROBe<pb>:SETup:CMOFfset.. 160
[SENSe:]PROBe<pb>:SETup:DMOFfset.. 160
[SENSe:]PROBe<pb>:SETup:MODE.. 161
[SENSe:]PROBe<pb>:SETup:NAME?.. 161
[SENSe:]PROBe<pb>:SETup:NMOFfset.. 161
[SENSe:]PROBe<pb>:SETup:PMODe.. 162
[SENSe:]PROBe<pb>:SETup:PMOFfset.. 162
[SENSe:]PROBe<pb>:SETup:STATe?.. 163
[SENSe:]PROBe<pb>:SETup:TYPE?.. 163

[SENSe:]PROBe<pb>:ID:PARTnumber?

Queries the R&S part number of the probe.

Suffix:
<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Return values:
<PartNumber>

Example: //Query part number
`PROB3:ID:PART?`

Usage: Query only

[SENSe:]PROBe<pb>:ID:SRNumber?

Queries the serial number of the probe.

Suffix:
<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Return values:
<SerialNo>

Example: //Query serial number
`PROB3:ID:SRN?`

Usage: Query only

[SENSe:]PROBe<pb>:SETup:ATTRatio <AttenuationRatio>

Defines the attenuation applied to the input at the probe. This setting is only available for modular probes.

Suffix:
<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Parameters:
<AttenuationRatio> **10**
Attenuation by 20 dB (ratio= 10:1)
2
Attenuation by 6 dB (ratio= 2:1)
*RST: 10
Default unit: DB

[SENSe:]PROBe<pb>:SETup:CMOFfset <CMOffset>

Sets the common mode offset. The setting is only available if a differential probe in CM-mode is connected to the FSW.

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

Note that if the offset for DM-mode or CM-mode is changed, the offsets for the P-mode and N-mode are adapted accordingly, and vice versa.

For details see the FSW User Manual.

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Parameters:

<CMOffset> Offset of the mean voltage between the positive and negative input terminal vs. ground

Range: -16 V to +16 V
Default unit: V

[SENSe:]PROBe<pb>:SETup:DMOFfset <DMOffset>

Sets the DM-mode offset. The setting is only available if a modular probe in DM-mode is connected to the FSW.

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

Note that if the offset for DM-mode or CM-mode is changed, the offsets for the P-mode and N-mode are adapted accordingly, and vice versa.

For details see the FSW User Manual.

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Parameters:

<DMOffset> Voltage offset between the positive and negative input terminal

Default unit: V

[SENSe:]PROBe<pb>:SETup:MODE <Mode>

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Parameters:

<Mode> RSINgle | NOACtion

RSINgle
Run single: starts one data acquisition.

NOACtion
Nothing is started on pressing the micro button.

[SENSe:]PROBe<pb>:SETup:NAME?

Queries the name of the probe.

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Return values:

<Name> String containing the name of the probe.

Example: //Query name of the probe
`PROB3:SET:NAME?`

Usage: Query only

[SENSe:]PROBe<pb>:SETup:NMOFfset <NMOffset>

Sets the N-mode offset. The setting is only available if a modular probe in N-mode is connected to the FSW. The maximum voltage difference between the positive and negative input terminals is 16 V.

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

Note that if the offset for DM-mode or CM-mode is changed, the offsets for the P-mode and N-mode are adapted accordingly, and vice versa.

For details see the FSW User Manual.

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Parameters:

<NMOffset> The voltage offset between the negative input terminal and ground.

Default unit: V

[SENSe:]PROBe<pb>:SETup:PMODe <Mode>

Determines the mode of a multi-mode modular probe.

For details see the FSW User Manual.

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Parameters:

<Mode> CM | DM | PM | NM

DM
Voltage between the positive and negative input terminal

CM
Mean voltage between the positive and negative input terminal vs. ground

PM
Voltage between the positive input terminal and ground

NM
Voltage between the negative input terminal and ground

Example: `SENS:PROB:SETU:PMOD PM`
Sets the probe to P-mode.

[SENSe:]PROBe<pb>:SETup:PMOFfset <PMOffset>

Sets the P-mode offset. The setting is only available if a modular probe in P-mode is connected to the FSW. The maximum voltage difference between the positive and negative input terminals is 16 V.

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

Note that if the offset for DM-mode or CM-mode is changed, the offsets for the P-mode and N-mode are adapted accordingly, and vice versa.

For details see the FSW User Manual.

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Parameters:

<PMOffset> The voltage offset between the positive input terminal and ground.

Default unit: V

[SENSe:]PROBe<pb>:SETup:STATe?

Queries if the probe at the specified connector is active (detected) or not active (not detected).

To switch the probe on, i.e. activate input from the connector, use `INP:SEL:AIQ` (see `INPut:SELect` on page 146).

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Return values:

<State> DETected | NDETected

Example: //Query connector state
`PROB3:SET:STAT?`

Usage: Query only

[SENSe:]PROBe<pb>:SETup:TYPE?

Queries the type of the probe.

Suffix:

<pb> 1..n
Selects the connector:
1 = Baseband Input I
2 = Baseband Input Q
3 = RF

Return values:

<Type> String containing one of the following values:
–"None" (no probe detected)
–"active differential"
–"active single-ended"
–"active modular"

Example: //Query probe type
`PROB3:SET:TYPE?`

Usage: Query only

11.5.2.6 Configuring the outputs

The following commands are required to provide output from the FSW.

Configuring trigger input/output is described in Chapter 11.5.4.2, "Configuring the trigger output", on page 179.

DIAGnostic:SERVice:NSOurce....................164
SYSTem:SPEaker:VOLume....................164

DIAGnostic:SERVice:NSOurce <State>

Turns the 28 V supply of the BNC connector labeled [noise source control] on the FSW on and off.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `DIAG:SERV:NSO ON`

Manual operation: See "Noise Source Control" on page 66

SYSTem:SPEaker:VOLume <Volume>

Defines the volume of the built-in loudspeaker for demodulated signals. This setting is maintained for all applications.

The command is available in the time domain in Spectrum mode and in Analog Modulation Analysis mode.

Parameters:

<Volume> Percentage of the maximum possible volume.

Range: 0 to 1
*RST: 0.5

Example: `SYST:SPE:VOL 0`
Switches the loudspeaker to mute.

11.5.3 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 6.2.4, "Frontend settings", on page 68.

- Frequency....................165
- Amplitude and scaling settings....................167
- Configuring the attenuation....................172

11.5.3.1 Frequency

[SENSe:]FREQuency:CENTer....................165
[SENSe:]FREQuency:CENTer:STEP....................165
[SENSe:]FREQuency:CENTer:STEP:AUTO....................166
[SENSe:]FREQuency:CENTer:STEP:LINK....................166
[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor....................166
[SENSe:]FREQuency:OFFSet....................167

[SENSe:]FREQuency:CENTer <Frequency>

Defines the center frequency.

Parameters:

<Frequency> For the allowed range and f_{max}, refer to the specifications document.

*RST: fmax/2
Default unit: Hz

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

Manual operation: See "Center Frequency" on page 68

[SENSe:]FREQuency:CENTer:STEP <StepSize>

Defines the center frequency step size.

You can increase or decrease the center frequency quickly in fixed steps using the `SENS:FREQ UP` AND `SENS:FREQ DOWN` commands, see `[SENSe:]FREQuency:CENTer` on page 165.

Parameters:

<StepSize> For f_{max}, refer to the specifications document.

Range: 1 to fMAX
*RST: 0.1 x span
Default unit: Hz

Example: //Set the center frequency to 110 MHz.

```
FREQ:CENT 100 MHz
FREQ:CENT:STEP 10 MHz
FREQ:CENT UP
```

Manual operation: See "Center Frequency Stepsize" on page 69

[SENSe:]FREQuency:CENTer:STEP:AUTO <State>

Couples or decouples the center frequency step size to the span.

In time domain (zero span) measurements, the center frequency is coupled to the RBW.

Parameters:

<State> ON | OFF | 0 | 1

*RST: 1

Example: `FREQ:CENT:STEP:AUTO ON`

Activates the coupling of the step size to the span.

[SENSe:]FREQuency:CENTer:STEP:LINK <CouplingType>

Couples and decouples the center frequency step size to the span or the resolution bandwidth.

Parameters:

<CouplingType> SPAN | RBW | OFF

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: //Couple step size to span

```
FREQ:CENT:STEP:LINK SPAN
```

[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <Factor>

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

Default unit: PCT

Example: //Couple frequency step size to span and define a step size factor
`FREQ:CENT:STEP:LINK SPAN`
`FREQ:CENT:STEP:LINK:FACT 20PCT`

[SENSe:]FREQuency:OFFSet <Offset>

Defines a frequency offset.

If this value is not 0 Hz, the application assumes that the input signal was frequency shifted outside the application. All results of type "frequency" will be corrected for this shift numerically by the application.

See also "Frequency Offset" on page 69.

Note: In MSRA mode, the setting command is only available for the MSRA primary application. For MSRA secondary applications, only the query command is available.

Parameters:
<Offset> Range: -1 THz to 1 THz
*RST: 0 Hz
Default unit: HZ

Example: `FREQ:OFFS 1GHZ`

Manual operation: See "Frequency Offset" on page 69

11.5.3.2 Amplitude and scaling settings

Useful commands for amplitude settings described elsewhere:

- `INPut:COUPling` on page 144
- `INPut:IMPedance` on page 146
- `[SENSe:]ADJust:LEVel` on page 193

Remote commands exclusive to amplitude settings:

CALCulate<n>:UNIT:POWer ... 167
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE ... 168
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision ... 168
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel ... 169
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet ... 169
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum ... 169
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum ... 170
INPut:EGAin[:STATe] ... 170
INPut:GAIN:STATe ... 171
INPut:GAIN[:VALue] ... 171

CALCulate<n>:UNIT:POWer <Unit>

Selects the unit of the y-axis.

The unit applies to all power-based measurement windows with absolute values.

Suffix:

<n> irrelevant

Parameters:

<Unit> DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | DBM_mhz | DBM_hz | DBUa_mhz | DBUV_mhz | DBmV_mhz | DBpW_mhz

(Units based on 1 MHz require installed R&S FSW-K54 (EMI measurements) option.)

*RST: dBm

Example: `CALC:UNIT:POW DBM`

Sets the power unit to dBm.

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE

Automatic scaling of the y-axis is performed once, then switched off again (for all traces).

Suffix:

<n> Window

<t> irrelevant

Manual operation: See "Auto Scale Once" on page 74

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision <Value>

This remote command determines the grid spacing on the Y-axis for all diagrams, where possible.

In spectrum displays, for example, this command is not available.

Suffix:

<n> Window

<w> subwindow
Not supported by all applications

<t> irrelevant

Parameters:

<Value> numeric value WITHOUT UNIT (unit according to the result display)

Defines the range per division (total range = 10*<Value>)

*RST: depends on the result display
Default unit: DBM

Example: `DISP:TRAC:Y:PDIV 10`

Sets the grid spacing to 10 units (e.g. dB) per division
(For example 10 dB in the "Code Domain Power" result display.)

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel <ReferenceLevel>

Defines the reference level (for all traces in all windows).

With a reference level offset ≠ 0, the value range of the reference level is modified by the offset.

Suffix:

<n> irrelevant

<w> subwindow
Not supported by all applications

<t> irrelevant

Parameters:

<ReferenceLevel> The unit is variable.

Range: see specifications document
*RST: 0 dBm
Default unit: DBM

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

Manual operation: See "Reference Level" on page 71

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

Defines a reference level offset (for all traces in all windows).

Suffix:

<n> irrelevant

<w> subwindow
Not supported by all applications

<t> irrelevant

Parameters:

<Offset> Range: -200 dB to 200 dB
*RST: 0dB
Default unit: DB

Example: `DISP:TRAC:Y:RLEV:OFFS -10dB`

Manual operation: See "Shifting the Display (Offset)" on page 71

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum <Value>

Defines the maximum value on the y-axis in the specified window.

Suffix:

<n> Window

<t> irrelevant

Parameters:

<Max> numeric value

Example: `DISP:WIND2:TRAC:Y:SCAL:MAX 10`

Manual operation: See "Y-Maximum, Y-Minimum" on page 74

DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum <Value>

Defines the minimum value on the y-axis in the specified window.

Suffix:

<n> Window

<t> irrelevant

Parameters:

<Min> numeric value

Example: `DISP:WIND2:TRAC:Y:SCAL:MIN -90`

Manual operation: See "Y-Maximum, Y-Minimum" on page 74

INPut:EGAin[:STATe] <State>

Before this command can be used, the external preamplifier must be connected to the FSW. See the preamplifier's documentation for details.

When activated, the FSW automatically compensates the magnitude and phase characteristics of the external preamplifier in the measurement results.

Note that when an optional external preamplifier is activated, the internal preamplifier is automatically disabled, and vice versa.

For FSW85 models with two RF inputs, you must enable correction from the external preamplifier for each input individually. Correction cannot be enabled for both inputs at the same time.

When deactivated, no compensation is performed even if an external preamplifier remains connected.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
No data correction is performed based on the external preamplifier

ON | 1
Performs data corrections based on the external preamplifier

*RST: 0

Example: `INP:EGA ON`

Manual operation: See "Ext. PA Correction" on page 73

INPut:GAIN:STATe <State>

Turns the internal preamplifier on and off. It requires the optional preamplifier hardware.

Note that if an optional external preamplifier is activated, the internal preamplifier is automatically disabled, and vice versa.

Is not available for input from the optional "Digital Baseband" interface.

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

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

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

Example:
```
INP:GAIN:STAT ON
INP:GAIN:VAL 15
```
Switches on 15 dB preamplification.

Manual operation: See "Preamplifier" on page 73

INPut:GAIN[:VALue] <Gain>

Selects the "gain" if the preamplifier is activated (`INP:GAIN:STAT ON`, see `INPut:GAIN:STATe` on page 171).

The command requires the additional preamplifier hardware option.

Parameters:

<Gain> For all FSW models except for FSW85, the following settings are available:
15 dB and 30 dB
All other values are rounded to the nearest of these two.
For FSW85 models:
FSW43 or higher:
30 dB

Default unit: DB

Example:
```
INP:GAIN:STAT ON
INP:GAIN:VAL 30
```
Switches on 30 dB preamplification.

Manual operation: See "Preamplifier" on page 73

11.5.3.3 Configuring the attenuation

INPut:ATTenuation.......... 172
INPut:ATTenuation:AUTO.......... 172
INPut:EATT.......... 173
INPut:EATT:AUTO.......... 173
INPut:EATT:STATe.......... 173

INPut:ATTenuation <Attenuation>

Defines the total attenuation for RF input.

If an electronic attenuator is available and active, the command defines a mechanical attenuation (see `INPut:EATT:STATe` on page 173).

If you set the attenuation manually, it is no longer coupled to the reference level, but the reference level is coupled to the attenuation. Thus, if the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

Is not available if the optional "Digital Baseband" interface is active.

Parameters:

<Attenuation>
Range: see specifications document
Increment: 5 dB (with optional electr. attenuator: 1 dB)
*RST: 10 dB (AUTO is set to ON)
Default unit: DB

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

Manual operation: See "Attenuation Mode / Value" on page 71

INPut:ATTenuation:AUTO <State>

Couples or decouples the attenuation to the reference level. Thus, when the reference level is changed, the FSW determines the signal level for optimal internal data processing and sets the required attenuation accordingly.

Is not available if the optional "Digital Baseband" interface is active.

Parameters:

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

Example:
`INP:ATT:AUTO ON`
Couples the attenuation to the reference level.

Manual operation: See "Attenuation Mode / Value" on page 71

INPut:EATT <Attenuation>

Defines an electronic attenuation manually. Automatic mode must be switched off (`INP:EATT:AUTO OFF`, see `INPut:EATT:AUTO` on page 173).

If the current reference level is not compatible with an attenuation that has been set manually, the command also adjusts the reference level.

Requires the electronic attenuation hardware option.

It is not available if the optional "Digital Baseband" interface is active.

Parameters:

<Attenuation> attenuation in dB

Range: see specifications document
Increment: 1 dB
*RST: 0 dB (OFF)
Default unit: DB

Example:
```
INP:EATT:AUTO OFF
INP:EATT 10 dB
```

Manual operation: See "Using Electronic Attenuation" on page 72

INPut:EATT:AUTO <State>

Turns automatic selection of the electronic attenuation on and off.

If on, electronic attenuation reduces the mechanical attenuation whenever possible.

Requires the electronic attenuation hardware option.

It is not available if the optional "Digital Baseband" interface is active.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 1

Example:
```
INP:EATT:AUTO OFF
```

Manual operation: See "Using Electronic Attenuation" on page 72

INPut:EATT:STATe <State>

Turns the electronic attenuator on and off.

Requires the electronic attenuation hardware option.

It is not available if the optional "Digital Baseband" interface is active.

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

*RST: 0

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

Manual operation: See "Using Electronic Attenuation" on page 72

11.5.4 Configuring triggered measurements

The following commands are required to configure a triggered measurement in a remote environment.

The tasks for manual operation are described in Chapter 6.2.5, "Trigger settings", on page 75

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

● Configuring the triggering conditions....174
● Configuring the trigger output....179

11.5.4.1 Configuring the triggering conditions

The following commands are required to configure a triggered measurement.

TRIGger[:SEQuence]:DTIMe....175
TRIGger[:SEQuence]:HOLDoff[:TIME]....175
TRIGger[:SEQuence]:IFPower:HOLDoff....175
TRIGger[:SEQuence]:IFPower:HYSTeresis....175
TRIGger[:SEQuence]:LEVel:BBPower....176
TRIGger[:SEQuence]:LEVel[:EXTernal<port>]....176
TRIGger[:SEQuence]:LEVel:IFPower....177
TRIGger[:SEQuence]:LEVel:RFPower....177
TRIGger[:SEQuence]:LEVel:VIDeo....177
TRIGger[:SEQuence]:SLOPe....178
TRIGger[:SEQuence]:SOURce....178
TRIGger[:SEQuence]:TIME:RINTerval....179

TRIGger[:SEQuence]:DTIMe <DropoutTime>

Defines the time the input signal must stay below the trigger level before a trigger is detected again.

For input from the "Analog Baseband" interface using the baseband power trigger (BBP), the default drop out time is set to 100 ns to avoid unintentional trigger events (as no hysteresis can be configured in this case).

Parameters:

<DropoutTime> Dropout time of the trigger.

Range: 0 s to 10.0 s
*RST: 0 s
Default unit: S

TRIGger[:SEQuence]:HOLDoff[:TIME] <Offset>

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

Parameters:

<Offset>

*RST: 0 s
Default unit: S

Example: `TRIG:HOLD 500us`

Manual operation: See "Trigger Offset" on page 78

TRIGger[:SEQuence]:IFPower:HOLDoff <Period>

Defines the holding time before the next trigger event.

Note that this command can be used for **any trigger source**, not just IF Power (despite the legacy keyword).

Note: If you perform gated measurements in combination with the IF Power trigger, the FSW ignores the holding time for frequency sweep, FFT sweep, zero span and I/Q data measurements.

Parameters:

<Period> Range: 0 s to 10 s
*RST: 0 s
Default unit: S

Example: `TRIG:SOUR EXT`
Sets an external trigger source.
`TRIG:IFP:HOLD 200 ns`
Sets the holding time to 200 ns.

TRIGger[:SEQuence]:IFPower:HYSTeresis <Hysteresis>

Defines the trigger hysteresis, which is only available for "IF Power" trigger sources.

Parameters:
<Hysteresis> Range: 3 dB to 50 dB
*RST: 3 dB
Default unit: DB

Example: `TRIG:SOUR IFP`
Sets the IF power trigger source.
`TRIG:IFP:HYST 10DB`
Sets the hysteresis limit value.

TRIGger[:SEQuence]:LEVel:BBPower <Level>

Sets the level of the baseband power trigger.

Is available for the optional "Digital Baseband" interface.

Is available for the optional "Analog Baseband" interface.

Parameters:
<Level> Range: -50 dBm to +20 dBm
*RST: -20 dBm
Default unit: DBM

Example: `TRIG:LEV:BBP -30DBM`

Manual operation: See "Trigger Level" on page 77

TRIGger[:SEQuence]:LEVel[:EXTernal<port>] <TriggerLevel>

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<tp>:DIRection` command.

Suffix:
<port> Selects the trigger port.
1 = trigger port 1 (TRIGGER INPUT connector on front panel)
2 = trigger port 2 (TRIGGER INPUT/OUTPUT connector on front panel)
(Not available for FSW85 models with two RF input connectors.)
3 = trigger port 3 (TRIGGER3 INPUT/OUTPUT connector on rear panel)

Parameters:
<TriggerLevel> Range: 0.5 V to 3.5 V
*RST: 1.4 V
Default unit: V

Example: `TRIG:LEV 2V`

Manual operation: See "Trigger Level" on page 77

TRIGger[:SEQuence]:LEVel:IFPower <TriggerLevel>

Defines the power level at the third intermediate frequency that must be exceeded to cause a trigger event.

Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

For compatibility reasons, this command is also available for the "Baseband Power" trigger source when using the "Analog Baseband" interface.

Parameters:

<TriggerLevel> For details on available trigger levels and trigger bandwidths, see the specifications document.

*RST: -20 dBm
Default unit: DBM

Example: `TRIG:LEV:IFP -30DBM`

TRIGger[:SEQuence]:LEVel:RFPower <TriggerLevel>

Defines the power level the RF input must exceed to cause a trigger event. Note that any RF attenuation or preamplification is considered when the trigger level is analyzed. If defined, a reference level offset is also considered.

The input signal must be between 500 MHz and 8 GHz.

Parameters:

<TriggerLevel> For details on available trigger levels and trigger bandwidths, see the specifications document.

*RST: -20 dBm
Default unit: DBM

Example: `TRIG:LEV:RFP -30dBm`

TRIGger[:SEQuence]:LEVel:VIDeo <Level>

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
Default unit: PCT

Example: `TRIG:LEV:VID 50PCT`

TRIGger[:SEQuence]:SLOPe <Type>

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

Parameters:

<Type> POSitive | NEGative

POSitive
Triggers when the signal rises to the trigger level (rising edge).

NEGative
Triggers when the signal drops to the trigger level (falling edge).

*RST: POSitive

Example: `TRIG:SLOP NEG`

Manual operation: See "Slope" on page 78

TRIGger[:SEQuence]:SOURce <Source>

Selects the trigger source.

Note on external triggers:

If a measurement is configured to wait for an external trigger signal in a remote control program, remote control is blocked until the trigger is received and the program can continue. Make sure that this situation is avoided in your remote control programs.

Parameters:

<Source>

IMMediate
Free Run

EXTernal
Trigger signal from the "Trigger Input" connector.

EXT2
Trigger signal from the "Trigger Input/Output" connector.
For FSW85 models, Trigger 2 is not available due to the second RF input connector on the front panel. The trigger signal is taken from the "Trigger Input/Output" connector on the rear panel.
Note: Connector must be configured for "Input".

EXT3
Trigger signal from the "TRIGGER 3 INPUT/ OUTPUT" connector.
Note: Connector must be configured for "Input".

TIME
Time interval
(For frequency and time domain measurements only.)

BBPower
Baseband power
For input from the optional "Analog Baseband" interface.
For input from the optional "Digital Baseband" interface.

GP0 | GP1 | GP2 | GP3 | GP4 | GP5
For applications that process I/Q data, such as the I/Q Analyzer or optional applications, and only if the optional "Digital Baseband" interface is available.
Defines triggering of the measurement directly via the LVDS connector. The parameter specifies which general-purpose bit (0 to 5) provides the trigger data.
The assignment of the general-purpose bits used by the Digital IQ trigger to the LVDS connector pins is provided in "Digital I/Q" on page 76.

*RST: IMMediate

Example: `TRIG:SOUR EXT`
Selects the external trigger input as source of the trigger signal

Manual operation: See "Trigger Source" on page 76
See "Free Run" on page 76
See "External Trigger 1/2/3" on page 76
See "Digital I/Q" on page 76
See "IF Power" on page 77

TRIGger[:SEQuence]:TIME:RINTerval <Interval>

Defines the repetition interval for the time trigger.

Parameters:
<Interval> numeric value

Range: 2 ms to 5000 s
*RST: 1.0 s
Default unit: S

Example: `TRIG:SOUR TIME`
Selects the time trigger input for triggering.
`TRIG:TIME:RINT 5`
The measurement starts every 5 s.

11.5.4.2 Configuring the trigger output

The following commands are required to send the trigger signal to one of the variable "TRIGGER INPUT/OUTPUT" connectors on the FSW.

OUTPut:TRIGger<tp>:DIRection.......179
OUTPut:TRIGger<tp>:LEVel.......180
OUTPut:TRIGger<tp>:OTYPe.......180
OUTPut:TRIGger<tp>:PULSe:IMMediate.......181
OUTPut:TRIGger<tp>:PULSe:LENGth.......181

OUTPut:TRIGger<tp>:DIRection <Direction>

Selects the trigger direction for trigger ports that serve as an input as well as an output.

Suffix:

<tp> Selects the used trigger port.
2 = trigger port 2 (front)
(Not available for FSW85 models with two RF input connectors.)
3 = trigger port 3 (rear panel)

Parameters:

<Direction> INPut | OUTPut

INPut
Port works as an input.

OUTPut
Port works as an output.

*RST: INPut

Manual operation: See "Trigger 2/3" on page 79

OUTPut:TRIGger<tp>:LEVel <Level>

Defines the level of the (TTL compatible) signal generated at the trigger output.

Works only if you have selected a user-defined output with `OUTPut:TRIGger<tp>:OTYPe`.

Suffix:

<tp> 1..n
Selects the trigger port to which the output is sent.
2 = trigger port 2 (front)
(Not available for FSW85 models with two RF input connectors.)
3 = trigger port 3 (rear)

Parameters:

<Level>

HIGH
5 V

LOW
0 V

*RST: LOW

Example: `OUTP:TRIG2:LEV HIGH`

Manual operation: See "Level" on page 80

OUTPut:TRIGger<tp>:OTYPe <OutputType>

Selects the type of signal generated at the trigger output.

Suffix:
<tp> 1..n
Selects the trigger port to which the output is sent.
2 = trigger port 2 (front)
(Not available for FSW85 models with two RF input connectors.)
3 = trigger port 3 (rear)

Parameters:
<OutputType> **DEVice**
Sends a trigger signal when the 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<tp>:LEVel`.
*RST: DEVice

Manual operation: See "Output Type" on page 79

OUTPut:TRIGger<tp>:PULSe:IMMediate

Generates a pulse at the trigger output.

Suffix:
<tp> 1..n
Selects the trigger port to which the output is sent.
2 = trigger port 2 (front)
(Not available for FSW85 models with two RF input connectors.)
3 = trigger port 3 (rear)

Manual operation: See "Send Trigger" on page 80

OUTPut:TRIGger<tp>:PULSe:LENGth <Length>

Defines the length of the pulse generated at the trigger output.

Suffix:
<tp> Selects the trigger port to which the output is sent.
2 = trigger port 2 (front)
(Not available for FSW85 models with two RF input connectors.)
3 = trigger port 3 (rear)

Parameters:
<Length> Pulse length in seconds.
Default unit: S

Example: `OUTP:TRIG2:PULS:LENG 0.02`

Manual operation: See "Pulse Length" on page 80

11.5.5 Signal capturing

The following commands configure how much and how data is captured from the input signal.

MSRA operating mode

In MSRA operating mode, only the MSRA primary 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 11.12, "Configuring the secondary application data range (MSRA mode only)", on page 246).

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

[SENSe:]CDPower:IQLength..182
[SENSe:]CDPower:QINVert..182
[SENSe:]CDPower:SET:COUNt..182

[SENSe:]CDPower:IQLength <CaptureLength>

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 operation: See "Number of PCGs" on page 81

[SENSe:]CDPower:QINVert <ONOFF10>

Inverts the Q component of the signal.

Parameters:

<ONOFF10>	*RST:	0

Example: `CDP:QINV ON`
Activates inversion of Q component.

Manual operation: See "Invert Q" on page 81

[SENSe:]CDPower:SET:COUNt <NumberSets>

Sets the number of sets to be captured and stored in the instrument's memory. Refer to "Number of Sets" on page 82 for more information.

Parameters:

<NumberSets>	Range:	1 to 1500 (BTS mode) or 810 (MS mode)
	*RST:	1
<NumberSets>	Range:	1 to 1500
	*RST:	1

Example: `CDP:SET:COUN 10`
Sets the number of sets to be captured to 10.

Manual operation: See "Number of Sets" on page 82

11.5.6 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 11-3: 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
10	CHAN
11	INACTIVE
12	PDCCH
13	PDCH

Table 11-4: 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 11-5: 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

- General channel detection......184
- Managing channel tables......185
- Configuring channel tables......187

11.5.6.1 General channel detection

The following commands configure how channels are detected in general.

Useful commands for general channel detection described elsewhere:

- `CONFigure:CDPower[:BTS]:CTABle[:STATe]` on page 186
- `CONFigure:CDPower[:BTS]:CTABle:SELect` on page 186

Remote commands exclusive to general channel detection:

[SENSe:]CDPower:ICTReshold......184

[SENSe:]CDPower:ICTReshold <ThresholdLevel>

Defines the minimum power that a single channel must have compared to the total signal in order to be regarded as an active channel. Channels below the specified threshold are regarded as "inactive".

Parameters:

<ThresholdLevel> Range: -100 dB to 0 dB
*RST: -60 dB
Default unit: DB

Example: `CDP:ICTR -50`
Sets the Inactice Channel Threshold to -50 dB.

Manual operation: See "Inactive Channel Threshold" on page 84

11.5.6.2 Managing channel tables

CONFigure:CDPower[:BTS]:CTABle:CATalog....185
CONFigure:CDPower[:BTS]:CTABle:COPY....185
CONFigure:CDPower[:BTS]:CTABle:DELete....186
CONFigure:CDPower[:BTS]:CTABle:RESTore....186
CONFigure:CDPower[:BTS]:CTABle:SELect....186
CONFigure:CDPower[:BTS]:CTABle[:STATe]....186

CONFigure:CDPower[:BTS]:CTABle:CATalog

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.

Parameters:

<TotalSize> Sum of file sizes of all channel table files (in bytes)

<FreeMem> Available memory left on hard disk (in bytes)

<FileName> File name of individual channel table file

<FileSize> File size of individual channel table file (in bytes)

Example: `CONF:CDP:CTAB:CAT?`
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
```

Manual operation: See "Predefined Tables" on page 85

CONFigure:CDPower[:BTS]:CTABle:COPY <FileName>

Copies one channel table into another one. The channel table to be copied is selected with command `CONFigure:CDPower[:BTS]:CTABle:NAME` on page 189.

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'.

Manual operation: See "Copying a Table" on page 86

CONFigure:CDPower[:BTS]:CTABle:DELete

Deletes the selected channel table. The channel table to be deleted is selected with the command `CONFigure:CDPower[:BTS]:CTABle:NAME` on page 189.

Example: `CONF:CDP:CTAB:NAME 'NEW_TAB'`
Defines the channel table name to be deleted.
`CONF:CDP:CTAB:DEL`
Deletes the table.

Manual operation: See "Deleting a Table" on page 86

CONFigure:CDPower[:BTS]:CTABle:RESTore

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.

Manual operation: See "Restoring Default Tables" on page 86

CONFigure:CDPower[:BTS]:CTABle:SELect <FileName>

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 186.

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 operation: See "Selecting a Table" on page 85

CONFigure:CDPower[:BTS]:CTABle[:STATe] <State>

Switches the channel table on or off.

When switched on, the measured channel table is stored under the name "RECENT" and is selected for use. After the "RECENT" channel table is switched on, another channel table can be selected with the command `CONFigure:CDPower[:BTS]:CTABle:SELect` on page 186.

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

Example: `CONF:CDP:CTAB ON`

Manual operation: See "Using Predefined Channel Tables" on page 84

11.5.6.3 Configuring channel tables

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

CONFigure:CDPower[:BTS]:CTABle:COMMent....187
CONFigure:CDPower[:BTS]:CTABle:DATA....187
CONFigure:CDPower:MS:CTABle:DATA....189
CONFigure:CDPower[:BTS]:CTABle:NAME....189

CONFigure:CDPower[:BTS]:CTABle:COMMent <Comment>

Defines a comment for the selected channel table:

Prior to this command, the name of the channel table has to be defined with command `CONFigure:CDPower[:BTS]:CTABle:NAME` on page 189.

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 operation: See "Comment" on page 86

CONFigure:CDPower[:BTS]:CTABle:DATA {<ChannelType>, <CodeClass>, <CodeNumber>, <Modulation>, <Reserved1>, <Reserved2>, <Status>, <CDPRelative>}...

Defines a channel table.

Before using this command, you must set the name of the channel table using the `CONFigure:CDPower[:BTS]:CTABle:DATA` command.

For a detailed description of the parameters refer to Chapter 6.2.8.4, "BTS channel details", on page 87.

Parameters:
<ChannelType> The channel type is numerically coded as follows:
0 = PILOT
1 = MAC
2 = PREAMBLE with 64 chip length
3 = PREAMBLE with 128 chip length
4 = PREAMBLE with 256 chip length
5 = PREAMBLE with 512 chip length

	6 = PREAMBLE with 1024 chip length 7 = DATA
<CodeClass>	Depending on channel type, the following values are allowed: PILOT: 5 MAC: 6 PREAMBLE: 5 DATA: 4 (spreading factor = $2^{\text{code class}}$)
<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 application only
Manual operation:	See "Channel Type" on page 88 See "Channel Number (Ch. SF)" on page 88 See "Power" on page 89 See "Status" on page 89

CONFigure:CDPower:MS: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 187.

Before using this command, you must set the name of the channel table using the `CONFigure:CDPower[:BTS]:CTABle:DATA` command.

For a detailed description of the parameters refer to Chapter 6.2.8.5, "MS channel details", on page 89.

Parameters:

<ChannelType> Numeric channel type according to Table 11-5

<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:MS: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 operation: See "Channel Type" on page 88
See "Channel Number (Ch. SF)" on page 88
See "Power" on page 89
See "Status" on page 89

CONFigure:CDPower[:BTS]:CTABle:NAME <Name>

Creates a new channel table file or selects an existing channel table in order to copy or delete it.

Parameters:

<Name> string with a maximum of 8 characters

name of the channel table

*RST: RECENT

Example: `CONF:CDP:CTAB:NAME 'NEW_TAB'`

Manual operation: See "Creating a New Table" on page 85
See "Name" on page 86

11.5.7 Sweep settings

[SENSe:]AVERage<n>:COUNt 190
[SENSe:]SWEep:COUNt 190

[SENSe:]AVERage<n>:COUNt <AverageCount>

Defines the number of measurements that the application uses to average traces.

In case of continuous sweep mode, the application calculates the moving average over the average count.

In case of single sweep mode, the application stops the measurement and calculates the average after the average count has been reached.

Suffix:

<n> irrelevant

Parameters:

<AverageCount> If you set an average count of 0 or 1, the application performs one single measurement in single sweep mode.
In continuous sweep mode, if the average count is set to 0, a moving average over 10 measurements is performed.

Range: 0 to 200000
*RST: 0

Manual operation: See "Sweep/Average Count" on page 92

[SENSe:]SWEep:COUNt <SweepCount>

Defines the number of measurements that the application uses to average traces.

In continuous measurement mode, the application calculates the moving average over the average count.

In single measurement mode, the application stops the measurement and calculates the average after the average count has been reached.

Parameters:

<SweepCount> When you set a sweep count of 0 or 1, the FSW performs one single measurement in single measurement mode.
In continuous measurement mode, if the sweep count is set to 0, a moving average over 10 measurements is performed.

Range: 0 to 200000
*RST: 0

Example:
`SWE:COUN 64`
Sets the number of measurements to 64.
`INIT:CONT OFF`
Switches to single measurement mode.
`INIT;*WAI`
Starts a measurement and waits for its end.

Manual operation: See "Sweep/Average Count" on page 92

11.5.8 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>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE` on page 168

Remote commands exclusive to adjusting settings automatically:

[SENSe:]ADJust:ALL......191
[SENSe:]ADJust:CONFigure:LEVel:DURation......192
[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE......192
[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer......193
[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer......193
[SENSe:]ADJust:LEVel......193

[SENSe:]ADJust:ALL

Initiates a measurement to determine and set the ideal settings for the current task automatically (only once for the current measurement).

This includes:

- Reference level
- Scaling

Example: `ADJ:ALL`

Manual operation: See "Adjusting all Determinable Settings Automatically (Auto All)" on page 93

[SENSe:]ADJust:CONFigure:LEVel:DURation <Duration>

To determine the ideal reference level, the FSW performs a measurement on the current input data. This command defines the length of the measurement if `[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE` is set to `MANual`.

Parameters:

<Duration> Numeric value in seconds

Range: 0.001 to 16000.0
*RST: 0.001
Default unit: s

Example: `ADJ:CONF:DUR:MODE MAN`
Selects manual definition of the measurement length.
`ADJ:CONF:LEV:DUR 5ms`
Length of the measurement is 5 ms.

Manual operation: See "Changing the Automatic Measurement Time (Meas Time Manual)" on page 94

[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE <Mode>

To determine the ideal reference level, the FSW performs a measurement on the current input data. This command selects the way the FSW determines the length of the measurement .

Parameters:

<Mode>

AUTO
The FSW determines the measurement length automatically according to the current input data.

MANual
The FSW uses the measurement length defined by `[SENSe:]ADJust:CONFigure:LEVel:DURation` on page 192.

*RST: AUTO

Manual operation: See "Resetting the Automatic Measurement Time (Meas Time Auto)" on page 94
See "Changing the Automatic Measurement Time (Meas Time Manual)" on page 94

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

When the reference level is adjusted automatically using the [SENSe:]ADJust:LEVel on page 193 command, the internal attenuators and the preamplifier are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines a lower threshold the signal must fall below (compared to the last measurement) before the reference level is adapted automatically.

Parameters:

<Threshold>	Range:	0 dB to 200 dB
	*RST:	+1 dB
	Default unit:	dB

Example: `SENS:ADJ:CONF:HYST:LOW 2`
For an input signal level of currently 20 dBm, the reference level is only adjusted when the signal level falls below 18 dBm.

Manual operation: See "Lower Level Hysteresis" on page 95

[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer <Threshold>

When the reference level is adjusted automatically using the [SENSe:]ADJust:LEVel on page 193 command, the internal attenuators and the preamplifier are also adjusted. To avoid frequent adaptation due to small changes in the input signal, you can define a hysteresis. This setting defines an upper threshold the signal must exceed (compared to the last measurement) before the reference level is adapted automatically.

Parameters:

<Threshold>	Range:	0 dB to 200 dB
	*RST:	+1 dB
	Default unit:	dB

Example: `SENS:ADJ:CONF:HYST:UPP 2`

Example: For an input signal level of currently 20 dBm, the reference level is only adjusted when the signal level rises above 22 dBm.

Manual operation: See "Upper Level Hysteresis" on page 95

[SENSe:]ADJust:LEVel

Initiates a single (internal) measurement that evaluates and sets the ideal reference level for the current input data and measurement settings. Thus, the settings of the RF attenuation and the reference level are optimized for the signal level. The FSW is not overloaded and the dynamic range is not limited by an S/N ratio that is too small.

Example: `ADJ:LEV`

Manual operation: See "Setting the Reference Level Automatically (Auto Level)" on page 71

11.5.9 Evaluation range

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

[SENSe:]CDPower:CODE....................194
[SENSe:]CDPower:MAPPing....................194
[SENSe:]CDPower:SET[:VALue]....................194
[SENSe:]CDPower:SLOT....................195

[SENSe:]CDPower:CODE <CodeNo>

Selects the code number.

For further details refer to "Code Number" on page 103.

Parameters:

<CodeNo> Range: 0 to base spreading factor - 1
Increment: 1
*RST: 0

Example: `CDP:CODE 8`
Selects the eighth channel.

Manual operation: See "Code Number" on page 103

[SENSe:]CDPower:MAPPing <SignalComponent>

Switches between the I and Q branch of the signal.

Parameters:

<SignalComponent> I | Q
*RST: Q

Example: `CDP:MAPP Q`

Manual operation: See "Mapping" on page 91
See "Branch (MS application only)" on page 104

[SENSe:]CDPower:SET[:VALue] <SetNo>

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 20
CDP:SET 10
```

Selects the 11th set (out of 20) for further analysis (counting starts with 0).

Manual operation: See "Set to Analyze" on page 82

[SENSe:]CDPower:SLOT <numericvalue>

Selects the slot (PCG) to be analyzed.

Parameters:

<numericvalue>	Range:	0 to 63
	Increment:	1
	*RST:	0

Example: `CDP:SLOT 7`
Selects slot number 7 for analysis.

Manual operation: See "Power Control Group" on page 104

11.5.10 Code domain analysis settings

Some evaluations provide further settings for the results. The commands for Code Domain Analysis are described here.

[SENSe:]CDPower:NORMalize....195
[SENSe:]CDPower:ORDer....195
[SENSe:]CDPower:PDISplay....196
[SENSe:]CDPower:PPReference....196
[SENSe:]CDPower:PREFerence....197
[SENSe:]CDPower:SFACtor....197
[SENSe:]CDPower:TPMeas....197

[SENSe:]CDPower:NORMalize <State>

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

Parameters:

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

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

Manual operation: See "Compensate IQ Offset" on page 101

[SENSe:]CDPower:ORDer <SortOrder>

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 39.

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 operation: See "Code Display Order" on page 102

[SENSe:]CDPower:PDISplay <Mode>

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: REL

Example:
`CDP:PDIS REL`
Pilot channel power is displayed in relation to the total power.

Manual operation: See "Code Power Display" on page 102

[SENSe:]CDPower:PPReference <Mode>

Is only available for "Code Domain Power" evaluation in MS mode.

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 operation: See "Pilot Power Display (MS application only)" on page 102

[SENSe:]CDPower:PREFerence <Power>

Specifies the reference power for the relative power result displays (e.g. Code Domain Power, "Power vs PCG").

Parameters:

<Power> TOTal | PICH

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 141 command).

TOTal
The reference power is the total power of the signal.

*RST: PICH

For further information refer to "Power Reference" on page 102.

Example: `CDP:PREF TOT`
Sets total power as reference power.

Manual operation: See "Power Reference" on page 102

[SENSe:]CDPower:SFACtor <SpreadingFactor>

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 39.

Parameters:

<SpreadingFactor> 64 | 128

*RST: 64

Example: `CDP:SFAC 128`
Selects base spreading factor 128.

Manual operation: See "Base Spreading Factor" on page 101

[SENSe:]CDPower:TPMeas <State>

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 | 1 | 0

*RST: 0

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 operation: See "Timing and phase offset calculation" on page 102

11.6 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 29.

For details on configuring these RF measurements in a remote environment, see the Remote Commands chapter of the FSW User Manual.

The cdma2000 RF measurements must be activated in a CDMA2000 application, see Chapter 11.3, "Activating the measurement channel", on page 132.

The individiual measurements are activated using the `CONFigure:CDPower[:BTS]:MEASurement` on page 137 command (see Chapter 11.4, "Selecting a measurement", on page 137).

- Special RF configuration commands 198
- Analysis for RF measurements 199

11.6.1 Special RF configuration commands

In addition to the common RF measurement configuration commands described for the base unit, the following special commands are available in cdma2000 applications:

CONFigure:CDPower[:BTS]:BCLass 198
CONFigure:CDPower[:BTS]:BANDclass 199

CONFigure:CDPower[:BTS]:BCLass <Bandclass>

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 bandclasses", on page 261.

*RST: 0

Example: `CONF:CDP:BCL 1`
Selects band class 1, 1900 MHz

CONFigure:CDPower[:BTS]:BANDclass <Bandclass>

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 bandclasses", on page 261.

*RST: 0

Example: `CONF:CDP:BCL 1`
Selects band class 1, 1900 MHz

Manual operation: See "Bandclass" on page 97

11.6.2 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 the CDMA2000 applications.

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

11.7 Configuring the result display

The following commands are required to configure the screen display in a remote environment. The tasks for manual operation are described in Chapter 3, "Measurements and result displays", on page 14.

- General window commands....199
- Working with windows in the display....200

11.7.1 General window commands

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

Note that the suffix <n> always refers to the window *in the currently selected channel* (see `INSTrument[:SELect]` on page 136).

DISPlay:FORMat....200
DISPlay[:WINDow<n>]:SIZE....200

DISPlay:FORMat <Format>

Determines which tab is displayed.

Parameters:

<Format>

SPLit
Displays the MultiView tab with an overview of all active channels

SINGle
Displays the measurement channel that was previously focused.

*RST: SING

Example: `DISP:FORM SPL`

DISPlay[:WINDow<n>]:SIZE <Size>

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 205).

Suffix:

<n> Window

Parameters:

<Size>

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

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

*RST: SMALl

Example: `DISP:WIND2:SIZE LARG`

11.7.2 Working with windows in the display

The following commands are required to change the evaluation type and rearrange the screen layout for a channel as you do using the SmartGrid in manual operation. Since the available evaluation types depend on the selected application, some parameters for the following commands also depend on the selected channel.

Note that the suffix <n> always refers to the window *in the currently selected channel*.

(See `INSTrument[:SELect]` on page 136).

LAYout:ADD[:WINDow]? 201
LAYout:CATalog[:WINDow]? 203
LAYout:IDENtify[:WINDow]? 203
LAYout:MOVE[:WINDow] 203
LAYout:REMove[:WINDow] 204

LAYout:REPLace[:WINDow]....204
LAYout:SPLitter....205
LAYout:WINDow<n>:ADD?....206
LAYout:WINDow<n>:IDENtify?....206
LAYout:WINDow<n>:REMove....207
LAYout:WINDow<n>:REPLace....207

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

Adds a window to the display in the active channel.

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

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

Query parameters:

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

Return values:

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

Example: `LAY:ADD? '1',BEL,'XPOW:CDP:ABSolute'`
Adds a "Code Domain Power" display below window 1.

Usage: Query only

Manual operation: See "Bitstream" on page 17
See "Channel Table" on page 18
See "Code Domain Power / Code Domain Error Power" on page 20
See "Composite Constellation" on page 21
See "Composite EVM" on page 22
See "Magnitude Error vs Chip" on page 23
See "Peak Code Domain Error" on page 24
See "Phase Error vs Chip" on page 24
See "Power vs PCG" on page 26
See "Power vs Symbol" on page 26
See "Result Summary" on page 27
See "Symbol Constellation" on page 27
See "Symbol EVM" on page 28
See "Symbol Magnitude Error" on page 28
See "Symbol Phase Error" on page 29
See "Diagram" on page 34
See "Result Summary" on page 35
See "Marker Table" on page 35
See "Marker Peak List" on page 36

Table 11-6: <WindowType> parameter values for CDMA2000/1xEV-DO applications

Parameter value	Window type
BITStream	"Bitstream"
CCONst	"Composite Constellation"
CDEPower	"Code Domain Error Power"
CDPower	"Code Domain Power"
CEVM	"Composite EVM"
CTABle	"Channel Table"
LEValuation	List evaluation (SEM, Power vs. Time)
MECHip	"Magnitude Error vs. Chip"
MTABle	"Marker table"
PCDerror	"Peak Code Domain Error"
PECHip	"Phase Error vs. Chip"
PPCG	"Power vs. PCG"
PSYMbol	"Power vs. Symbol"
RSUMmary	"Result Summary"
SCONst	"Symbol Constellation"
SEVM	"Symbol EVM"
SMERror	"Symbol Magnitude Error"
SPERror	"Symbol Phase Error"

LAYout:CATalog[:WINDow]?

Queries the name and index of all active windows in the active channel from top left to bottom right. The result is a comma-separated list of values for each window, with the syntax:

<WindowName_1>,<WindowIndex_1>..<WindowName_n>,<WindowIndex_n>

Return values:

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

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

Example: `LAY:CAT?`
Result:
`'2',2,'1',1`
Two windows are displayed, named '2' (at the top or left), and '1' (at the bottom or right).

Usage: Query only

LAYout:IDENtify[:WINDow]? <WindowName>

Queries the **index** of a particular display window in the active channel.

Note: to query the **name** of a particular window, use the `LAYout:WINDow<n>:IDENtify?` query.

Query parameters:

<WindowName> String containing the name of a window.

Return values:

<WindowIndex> Index number of the window.

Example: `LAY:IDEN:WIND? '2'`
Queries the index of the result display named '2'.
Response:
`2`

Usage: Query only

LAYout:MOVE[:WINDow] <WindowName>, <WindowName>, <Direction>

Setting parameters:

<WindowName> String containing the name of an existing window that is to be moved.
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.

<WindowName> String containing the name of an existing window the selected window is placed next to or replaces.
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.

<Direction> LEFT | RIGHt | ABOVe | BELow | REPLace
Destination the selected window is moved to, relative to the reference window.

Example: `LAY:MOVE '4','1',LEFT`
Moves the window named '4' to the left of window 1.

Example: `LAY:MOVE '1','3',REPL`
Replaces the window named '3' by window 1. Window 3 is deleted.

Usage: Setting only

LAYout:REMove[:WINDow] <WindowName>

Removes a window from the display in the active channel.

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

Example: `LAY:REM '2'`
Removes the result display in the window named '2'.

Usage: Setting only

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

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

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

Setting parameters:
<WindowName> String containing the name of the existing window.
By default, the name of a window is the same as its index. To determine the name and index of all active windows in the active channel, use the `LAYout:CATalog[:WINDow]?` query.

<WindowType> Type of result display you want to use in the existing window.
See `LAYout:ADD[:WINDow]?` on page 201 for a list of available window types.

Example: `LAY:REPL:WIND '1',MTAB`
Replaces the result display in window 1 with a marker table.

Usage: Setting only

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

Changes the position of a splitter and thus controls the size of the windows on each side of the splitter.

Compared to the `DISPlay[:WINDow<n>]:SIZE` on page 200 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 does not work, but does not return an error.

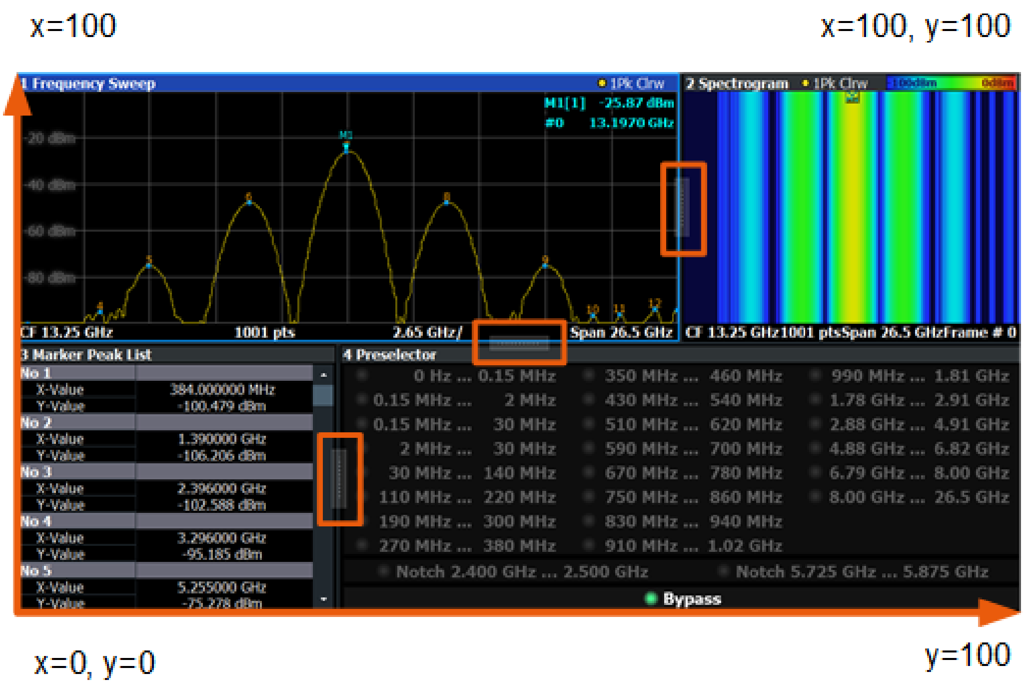


Figure 11-1: SmartGrid coordinates for remote control of the splitters

Setting parameters:

<Index1>	The index of one window the splitter controls.
<Index2>	The index of a window on the other side of the splitter.
<Position>	New vertical or horizontal position of the splitter as a fraction of the screen area (without channel and status bar and softkey menu). The point of origin (x = 0, y = 0) is in the lower left corner of the screen. The end point (x = 100, y = 100) is in the upper right corner of the screen. (See Figure 11-1.) The direction in which the splitter is moved depends on the screen layout. If the windows are positioned horizontally, the splitter also moves horizontally. If the windows are positioned vertically, the splitter also moves vertically. Range: 0 to 100

Example: `LAY:SPL 1,3,50`
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('"Marker Table"') to the center (50%) of the screen, i.e. in the figure above, to the left.

Example: `LAY:SPL 1,4,70`
Moves the splitter between window 1 ('Frequency Sweep') and 3 ('"Marker Peak List"') towards the top (70%) of the screen.
The following commands have the exact same effect, as any combination of windows above and below the splitter moves the splitter vertically.
`LAY:SPL 3,2,70`
`LAY:SPL 4,1,70`
`LAY:SPL 2,1,70`

Usage: Setting only

LAYout:WINDow<n>:ADD? <Direction>,<WindowType>

Adds a measurement window to the display. Note that with this command, the suffix <n> determines the existing window next to which the new window is added. Unlike `LAYout:ADD[:WINDow]?`, for which the existing window is defined by a parameter.

To replace an existing window, use the `LAYout:WINDow<n>:REPLace` command.

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

Suffix:
<n> Window

Query parameters:
<Direction> LEFT | RIGHt | ABOVe | BELow

<WindowType> Type of measurement window you want to add.
See `LAYout:ADD[:WINDow]?` on page 201 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?

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

Note: to query the **index** of a particular window, use the LAYout:IDENtify[:WINDow]? command.

Suffix:
<n> Window

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

Example: LAY:WIND2:IDEN?
Queries the name of the result display in window 2.
Response:
'2'

Usage: Query only

LAYout:WINDow<n>:REMove

Removes the window specified by the suffix <n> from the display in the active channel.

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

Suffix:
<n> Window

Example: LAY:WIND2:REM
Removes the result display in window 2.

Usage: Event

LAYout:WINDow<n>:REPLace <WindowType>

Changes the window type of an existing window (specified by the suffix <n>) in the active channel.

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

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

Suffix:
<n> Window

Setting parameters:
<WindowType> Type of measurement window you want to replace another one with.
See LAYout:ADD[:WINDow]? on page 201 for a list of available window types.

Example: LAY:WIND2:REPL MTAB
Replaces the result display in window 2 with a marker table.

Usage: Setting only

11.8 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 ... 208
INITiate<n>:CONMeas ... 209
INITiate<n>:CONTinuous ... 209
INITiate<n>[:IMMediate] ... 210
INITiate:SEQuencer:ABORt ... 210
INITiate:SEQuencer:IMMediate ... 210
INITiate:SEQuencer:MODE ... 210
INITiate:SEQuencer:REFResh[:ALL] ... 211
SYSTem:SEQuencer ... 211

ABORt

Aborts the measurement in the current channel and resets the trigger system.

To prevent overlapping execution of the subsequent command before the measurement has been aborted successfully, use the `*OPC?` or `*WAI` command after `ABOR` and before the next command.

For details on overlapping execution see Remote control via SCPI.

To abort a sequence of measurements by the Sequencer, use the `INITiate:SEQuencer:ABORt` command.

Note on blocked remote control programs:

If a sequential command cannot be completed, for example because a triggered sweep never receives a trigger, the remote control program will never finish and the remote channel to the FSW is blocked for further commands. In this case, you must interrupt processing on the remote channel first in order to abort the measurement.

To do so, send a "Device Clear" command from the control instrument to the FSW on a parallel channel to clear all currently active remote channels. Depending on the used interface and protocol, send the following commands:

- **Visa**: `viClear()`
- **GPIB**: `ibclr()`
- **RSIB**: `RSDLLibclr()`

Now you can send the `ABORt` command on the remote channel performing the measurement.

Example: `ABOR;:INIT:IMM`
Aborts the current measurement and immediately starts a new one.

Example: `ABOR;*WAI`
`INIT:IMM`
Aborts the current measurement and starts a new one once abortion has been completed.

Usage: Event

INITiate<n>:CONMeas

Restarts a (single) measurement that has been stopped (using ABORt) or finished in single measurement mode.

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

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

Suffix:
<n> irrelevant

Usage: Asynchronous command

Manual operation: See "Continue Single Sweep" on page 93

INITiate<n>:CONTinuous <State>

Controls the measurement mode for an individual channel.

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

For details on synchronization see Remote control via SCPI.

If the measurement mode is changed for a channel while the Sequencer is active (see INITiate:SEQuencer:IMMediate on page 210), the mode is only considered the next time the measurement in that channel is activated by the Sequencer.

Suffix:
<n> irrelevant

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

ON | 1
Continuous measurement

OFF | 0
Single measurement

*RST: 1 (some applications can differ)

Example:
```
INIT:CONT OFF
```
Switches the measurement mode to single measurement.
```
INIT:CONT ON
```
Switches the measurement mode to continuous measurement.

Manual operation: See "Continuous Sweep / Run Cont" on page 92

INITiate<n>[:IMMediate]

Starts a (single) new measurement.

With measurement count or average count > 0, this means a restart of the corresponding number of measurements. With trace mode MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

You can synchronize to the end of the measurement with *OPC, *OPC? or *WAI.

For details on synchronization see Remote control via SCPI.

Suffix:
<n> irrelevant

Usage: Asynchronous command

Manual operation: See "Single Sweep / Run Single" on page 92

INITiate:SEQuencer:ABORt

Stops the currently active sequence of measurements.

You can start a new sequence any time using `INITiate:SEQuencer:IMMediate` on page 210.

Usage: Event

INITiate:SEQuencer:IMMediate

Starts a new sequence of measurements by the Sequencer.

Its effect is similar to the `INITiate<n>[:IMMediate]` command used for a single measurement.

Before this command can be executed, the Sequencer must be activated (see `SYSTem:SEQuencer` on page 211).

Example:
`SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single sequence mode so each active measurement is performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.

INITiate:SEQuencer:MODE <Mode>

Defines the capture mode for the entire measurement sequence and all measurement groups and channels it contains.

Note: To synchronize to the end of a measurement sequence using `*OPC`, `*OPC?` or `*WAI`, use `SINGle` Sequencer mode.

Parameters:

<Mode>

SINGle
Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence is finished.

CONTinuous
Each measurement group is started one after the other in the order of definition. All measurement channels in a group are started simultaneously and performed once. After *all* measurements are completed, the next group is started. After the last group, the measurement sequence restarts with the first one and continues until it is stopped explicitly.

*RST: CONTinuous

INITiate:SEQuencer:REFResh[:ALL]

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 secondary 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 channels.

SYSTem:SEQuencer <State>

Turns the Sequencer on and off. The Sequencer must be active before any other Sequencer commands (`INIT:SEQ...`) are executed, otherwise an error occurs.

A detailed programming example is provided in the "Operating Modes" chapter in the FSW User Manual.

Parameters:

<State> ON | OFF | 0 | 1

ON | 1
The Sequencer is activated and a sequential measurement is started immediately.

OFF | 0
The Sequencer is deactivated. Any running sequential measurements are stopped. Further Sequencer commands (`INIT:SEQ...`) are not available.

*RST: 0

Example:
`SYST:SEQ ON`
Activates the Sequencer.
`INIT:SEQ:MODE SING`
Sets single Sequencer mode so each active measurement is performed once.
`INIT:SEQ:IMM`
Starts the sequential measurements.
`SYST:SEQ OFF`

11.9 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 11.5.6, "Channel detection", on page 183.

Specific commands:

- Retrieving calculated CDA results.....212
- Retrieving CDA trace results.....214
- Measurement results for TRACe<n>[:DATA]? TRACE<n>.....216
- Exporting trace results.....229
- Retrieving RF results.....230

11.9.1 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?.....212
CALCulate<n>:MARKer<m>:Y?.....214

CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult? <Measurement>

Queries individual values of the measured and calculated results of the CDMA2000 code domain power measurement.

Suffix:
<n> 1..n
Window

<m> 1..n
Marker

Query parameters:
<Measurement> SLOT | PTOTal | PPICh | RHO | MACCuracy | PCDerror | ACTive | FERRor | FERPpm | CERRor | TFRame | IQOFfset | IQIMbalance | SRATe | CHANnel | SFACtor | TOFFset | POFFset | CDPabsolute | CDPRelative | EVMRms | EVMPeak | DMTYpe

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 operation: See "Code Domain Power / Code Domain Error Power" on page 20
See "Composite Constellation" on page 21
See "Composite EVM" on page 22
See "Peak Code Domain Error" on page 24
See "Power vs Symbol" on page 26
See "Result Summary" on page 27
See "Symbol Constellation" on page 27
See "Symbol EVM" on page 28

CALCulate<n>:MARKer<m>:Y?

Queries the result at the position of the specified marker.

Suffix:
<n> 1..n

<m> 1..n

Return values:
<Result> Default unit: DBM

Usage: Query only

Manual operation: See "CCDF" on page 33
See "Marker Table" on page 35
See "Marker Peak List" on page 36

11.9.2 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>[, <BitLength>]

Selects the data format that is used for transmission of trace data from the FSW to the controlling computer.

Note that the command has no effect for data that you send to the FSW. The 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 can be.

: **REAL**
Floating-point numbers (according to IEEE 754) in the "definite length block format".
In the Spectrum application, the format setting `REAL` is used for the binary transmission of trace data.

<BitLength>
: Length in bits for floating-point results

: **16**
16-bit floating-point numbers.
Compared to `REAL,32` format, half as many numbers are returned.

: **32**
32-bit floating-point numbers
For I/Q data, 8 bytes per sample are returned for this format setting.

: **64**
64-bit floating-point numbers
Compared to `REAL,32` format, twice as many numbers are returned.

Example: `FORM REAL,32`

TRACe<n>[:DATA] <ResultType>

Reads trace data from the FSW.

For details on reading trace data for other than code domain measurements refer to the `TRACe:DATA` command in the base unit description.

Suffix:

<n>
: Window

Parameters:

<ResultType>
: TRACe1 | TRACe2 | TRACe3 | TRACe4 | CTABle | LIST

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 11.9.3, "Measurement results for TRACe<n>[:DATA]? TRACE<n>", on page 216.

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.

Manual operation: See "Magnitude Error vs Chip" on page 23
See "Phase Error vs Chip" on page 24
See "Symbol Magnitude Error" on page 28
See "Symbol Phase Error" on page 29

11.9.3 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 14.

- Bitstream....................217
- Channel table....................217
- Code domain error power....................221
- Code domain power....................221
- Composite constellation....................225
- Composite EVM (RMS)....................226
- EVM vs chip....................226
- Frequency error vs PCG....................226
- Mag error vs chip....................226

- Power vs PCG.....226
- Peak code domain error.....226
- Phase discontinuity vs PCG.....227
- Phase error vs chip.....227
- Power vs symbol.....227
- Result summary.....227
- Symbol constellation.....228
- Symbol EVM.....229
- Symbol magnitude error.....229
- Symbol phase error.....229

11.9.3.1 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".

11.9.3.2 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 11-3 and Table 11-5)	{0..13} (BTS) {0..9} (MS)
<code class>	code class of the channel (see Chapter 4.2, "Channels, codes and symbols", on page 37)	{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 42)	

Value	Description	Range/Unit
<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 measurements**, 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 measurements**, 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 BTS channel table values

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 MS channel table values

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)
<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
```

11.9.3.3 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 37)	{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 215.

11.9.3.4 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 37)	{2...7} (BTS) {1..6} (MS)
<code number>	code number within the channel	{0..127} (BTS) {0..63}(MS)
<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 215.

Measurement example: retrieving the code domain power in the BTS application

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
```

11.9.3.5 Composite constellation

When the trace data for this evaluation is queried, the real and the imaginary branches of each chip are transferred:

<Re $chip_0$>, <Im $chip_0$>, <Re $chip_1$>, <Im $chip_1$>, ..., <Re $chip_n$>, <Im $chip_n$>

The number of value pairs corresponds to the chip number of 1536 chips in a power control group.

11.9.3.6 Composite EVM (RMS)

When the trace data for this evaluation is queried, one pair of PCG and level value is transferred for each PCG:

<PCG number>, <level value in %>

The number of value pairs corresponds to the number of captured PCGs.

11.9.3.7 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.

11.9.3.8 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>

11.9.3.9 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 slot is returned (=2560 values). The values are calculated as the magnitude difference between the received signal and the reference signal for each chip in %, and are normalized to the square root of the average power at the selected slot.

11.9.3.10 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.

11.9.3.11 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.

11.9.3.12 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>

11.9.3.13 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 slot is returned (=2560 values). The values are calculated as the phase difference between the received signal and the reference signal for each chip in degrees, and are normalized to the square root of the average power at the selected slot.

11.9.3.14 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 39.

11.9.3.15 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>, <FERRor>, <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	

Value	Description	Range / Unit
<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	
<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	{-∞...∞} dBm
<CDPabsolute>	Absolute channel power	{-∞...∞} 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 212

11.9.3.16 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 39.

11.9.3.17 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 39.

11.9.3.18 Symbol magnitude error

When the trace data for this evaluation is queried, the magnitude error in % of each symbol at the selected slot is transferred. The number of the symbols depends on the spreading factor of the selected channel:

NOFSymbols=10*2$^{(8\text{-CodeClass})}$

11.9.3.19 Symbol phase error

When the trace data for this evaluation is queried, the phase error in degrees of each symbol at the selected slot is transferred. The number of the symbols depends on the spreading factor of the selected channel:

NOFSymbols=10*2$^{(8\text{-CodeClass})}$

11.9.4 Exporting trace results

Trace results can be exported to a file.

For more commands concerning data and results storage see the FSW User Manual.

MMEMory:STORe<n>:TRACe..229
FORMat:DEXPort:DSEParator..230

MMEMory:STORe<n>:TRACe <Trace>, <FileName>

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 FSW base unit user manual.

Secure User Mode

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

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

For details, see "Protecting Data Using the Secure User Mode" in the "Data Management" section of the FSW base unit user manual.

Suffix:
<n> Window

Parameters:
<Trace> Number of the trace to be stored

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

Example: `MMEM:STOR1:TRAC 1,'C:\TEST.ASC'`
Stores trace 1 from window 1 in the file `TEST.ASC`.

FORMat:DEXPort:DSEParator <Separator>

Selects the decimal separator for data exported in ASCII format.

Parameters:
<Separator> POINt | COMMa

COMMa
Uses a comma as decimal separator, e.g. *4,05*.

POINt
Uses a point as decimal separator, e.g. *4.05*.

*RST: *RST has no effect on the decimal separator. Default is POINt.

Example: `FORM:DEXP:DSEP POIN`
Sets the decimal point as separator.

11.9.5 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 214

Remote commands exclusive to retrieving RF results:

CALCulate<n>:LIMit<li>:FAIL?.. 230
CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?..231
CALCulate<n>:STATistics:RESult<res>?...233

CALCulate<n>:LIMit<li>:FAIL?

Queries the result of a limit check in the specified window.

Note that for SEM measurements, the limit line suffix <li> is irrelevant, as only one specific SEM limit line is checked for the currently relevant power class.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also `INITiate<n>:CONTinuous` on page 209.

Suffix:

<n> Window

 Limit line

Return values:

<Result> **0**
PASS

1
FAIL

Example: `INIT;*WAI`
Starts a new sweep and waits for its end.
`CALC2:LIM3:FAIL?`
Queries the result of the check for limit line 3 in window 2.

Usage: Query only

Manual operation: See "Spectrum Emission Mask" on page 31

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

Queries the results of power measurements.

To get a valid result, you have to perform a complete measurement with synchronization to the end of the measurement before reading out the result. This is only possible for single measurement mode.

See also `INITiate<n>:CONTinuous` on page 209.

Suffix:

<n> irrelevant

<m> irrelevant

<sb>
Sub block in a Multi-standard radio measurement;
MSR ACLR: 1 to 8
Multi-SEM: 1 to 8
for all other measurements: irrelevant

Parameters:

<Measurement>

ACPower | MCACpower
ACLR measurements (also known as adjacent channel power or multicarrier adjacent channel measurements).
Returns the power for every active transmission and adjacent channel. The order is:
- power of the transmission channels
- power of adjacent channel (lower,upper)
- power of alternate channels (lower,upper)

MSR ACLR results:
For MSR ACLR measurements, the order of the returned results is slightly different:
- power of the transmission channels
- total power of the transmission channels for each sub block
- power of adjacent channels (lower, upper)
- power of alternate channels (lower, upper)
- power of gap channels (lower1, upper1, lower2, upper2)

The unit of the return values depends on the scaling of the y-axis:
- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

GACLr
For MSR ACLR measurements only: returns a list of ACLR values for each gap channel (lower1, upper1, lower2, upper2)

MACM
For MSR ACLR measurements only: returns a list of CACLR values for each gap channel (lower1, upper1, lower2, upper2)

CN
Carrier-to-noise measurements.
Returns the C/N ratio in dB.

CN0
Carrier-to-noise measurements.
Returns the C/N ratio referenced to a 1 Hz bandwidth in dBm/Hz.

CPOWer
Channel power measurements.
Returns the channel power. The unit of the return values depends on the scaling of the y-axis:
- logarithmic scaling returns the power in the current unit
- linear scaling returns the power in W

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

PPOWer
Peak power measurements.
Returns the peak power. The unit of the return values depends on the scaling of the y-axis:
• logarithmic scaling returns the power in the current unit
• linear scaling returns the power in W
For SEM measurements, the return value is the peak power of the reference range (in the specified sub block).

OBANdwidth | OBWidth
Occupied bandwidth.
Returns the occupied bandwidth in Hz.

Manual operation: See "Power" on page 30
See "Channel Power ACLR" on page 30
See "Spectrum Emission Mask" on page 31
See "Occupied Bandwidth" on page 32
See "CCDF" on page 33

CALCulate<n>:STATistics:RESult<res>? <ResultType>

Queries the results of a measurement for a specific trace.

Suffix:

<n> Window

<res> Trace

Query parameters:

<ResultType>

MEAN
Average (=RMS) power in dBm measured during the measurement time.

PEAK
Peak power in dBm measured during the measurement time.

CFACtor
Determined crest factor (= ratio of peak power to average power) in dB.

ALL
Results of all three measurements mentioned before, separated by commas: <mean power>,<peak power>,<crest factor>

Example:

```
CALC:STAT:RES2? ALL
```

Reads out the three measurement results of trace 2. Example of answer string: 5.56,19.25,13.69 i.e. mean power: 5.56 dBm, peak power 19.25 dBm, crest factor 13.69 dB

Usage: Query only

Manual operation: See "CCDF" on page 33

11.10 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 FSW User Manual.

- Traces..234
- Markers..235

11.10.1 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>][:SUBWindow<w>]:TRACe<t>:MODE...234
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe]... 235

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE <Mode>

Selects the trace mode. If necessary, the selected trace is also activated.

For max hold, min hold or average trace mode, you can set the number of single measurements with `[SENSe:]SWEep:COUNt`. Note that synchronization to the end of the measurement is possible only in single sweep mode.

Suffix:

<n>	Window
<w>	subwindow Not supported by all applications
<t>	Trace

Parameters:

<Mode>

WRITe
(default:) Overwrite mode: the trace is overwritten by each sweep.

AVERage
The average is formed over several sweeps. The "Sweep/Average Count" determines the number of averaging procedures.

MAXHold
The maximum value is determined over several sweeps and displayed. The 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 FSW saves the sweep result in the trace memory only if the new value is lower than the previous one.

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

BLANk
Hides the selected trace.

*RST: Trace 1: WRITe, Trace 2-6: BLANk

Example:
`INIT:CONT OFF`
Switching to single sweep mode.
`SWE:COUN 16`
Sets the number of measurements to 16.
`DISP:TRAC3:MODE WRIT`
Selects clear/write mode for trace 3.
`INIT;*WAI`
Starts the measurement and waits for the end of the measurement.

Manual operation: See "Trace Mode" on page 105

DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe] <State>

Turns a trace on and off.

The measurement continues in the background.

Suffix:

<n> Window

<w> subwindow
Not supported by all applications

<t> Trace

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

Example: `DISP:TRAC3 ON`

11.10.2 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.

- Individual marker settings......236
- General marker settings......239
- Positioning the marker......239

11.10.2.1 Individual marker settings

CALCulate<n>:MARKer<m>:AOFF....236
CALCulate<n>:MARKer<m>[:STATe]....236
CALCulate<n>:MARKer<m>:X....236
CALCulate<n>:DELTamarker<m>:AOFF....237
CALCulate<n>:DELTamarker<m>[:STATe]....237
CALCulate<n>:DELTamarker<m>:X....238
CALCulate<n>:DELTamarker<m>:X:RELative?....238
CALCulate<n>:DELTamarker<m>:Y?....238

CALCulate<n>:MARKer<m>:AOFF

Turns off all markers.

Suffix:

<n> Window

<m> Marker

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

Manual operation: See "All Markers Off" on page 108

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

Turns markers on and off. If the corresponding marker number is currently active as a delta marker, it is turned into a normal marker.

Suffix:

<n> Window

<m> Marker

Parameters:

<State> ON | OFF | 0 | 1

OFF | 0
Switches the function off

ON | 1
Switches the function on

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

Manual operation: See "Marker State" on page 107
See "Marker Type" on page 108

CALCulate<n>:MARKer<m>:X <Position>

Moves a marker to a specific coordinate on the x-axis.

If necessary, the command activates the marker.

If the marker has been used as a delta marker, the command turns it into a normal marker.

Suffix:
<n> Window

<m> Marker

Parameters:
<Position> Numeric value that defines the marker position on the x-axis. The unit depends on the result display.

Range: The range depends on the current x-axis range.
Default unit: Hz

Example: `CALC:MARK2:X 1.7MHz`
Positions marker 2 to frequency 1.7 MHz.

Manual operation: See "Marker Table" on page 35
See "Marker Peak List" on page 36
See "X-value" on page 107

CALCulate<n>:DELTamarker<m>:AOFF

Turns off *all* delta markers.

Suffix:
<n> Window

<m> irrelevant

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

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

Turns delta markers on and off.

If necessary, the command activates the delta marker first.

No suffix at DELTamarker turns on delta marker 1.

Suffix:
<n> Window

<m> Marker

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

OFF | 0
Switches the function off

ON | 1
Switches the function on

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

Manual operation: See "Marker State" on page 107
See "Marker Type" on page 108

CALCulate<n>:DELTamarker<m>:X <Position>

Moves a delta marker to a particular coordinate on the x-axis.

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

Suffix:

<n> Window

<m> Marker

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

Manual operation: See "X-value" on page 107

CALCulate<n>:DELTamarker<m>:X:RELative?

Queries the relative position of a delta marker on the x-axis.

If necessary, the command activates the delta marker first.

Suffix:

<n> Window

<m> Marker

Return values:

<Position> Position of the delta marker in relation to the reference marker.

Example: `CALC:DELT3:X:REL?`
Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

Usage: Query only

CALCulate<n>:DELTamarker<m>:Y?

Queries the result at the position of the specified delta marker.

Suffix:

<n> 1..n

<m> 1..n

Return values:

<Result> Result at the position of the delta marker.
The unit is variable and depends on the one you have currently set.
Default unit: DBM

Usage: Query only

11.10.2.2 General marker settings

DISPlay[:WINDow<n>]:MTABle......239

DISPlay[:WINDow<n>]:MTABle <DisplayMode>

Turns the marker table on and off.

Suffix:
<n> irrelevant

Parameters:
<DisplayMode>

ON | 1
Turns on the marker table.

OFF | 0
Turns off the marker table.

AUTO
Turns on the marker table if 3 or more markers are active.

*RST: AUTO

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

Manual operation: See "Marker Table Display" on page 109

11.10.2.3 Positioning the marker

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

- Positioning normal markers......239
- Positioning delta markers......242

Positioning normal markers

The following commands position markers on the trace.

CALCulate<n>:MARKer<m>:FUNCtion:PICH......239
CALCulate<n>:MARKer<m>:FUNCtion:TDPich......240
CALCulate<n>:MARKer<m>:MAXimum:LEFT......240
CALCulate<n>:MARKer<m>:MAXimum:NEXT......240
CALCulate<n>:MARKer<m>:MAXimum[:PEAK]......241
CALCulate<n>:MARKer<m>:MAXimum:RIGHt......241
CALCulate<n>:MARKer<m>:MINimum:LEFT......241
CALCulate<n>:MARKer<m>:MINimum:NEXT......241
CALCulate<n>:MARKer<m>:MINimum[:PEAK]......242
CALCulate<n>:MARKer<m>:MINimum:RIGHt......242

CALCulate<n>:MARKer<m>:FUNCtion:PICH

Sets the marker to channel 0.64.

Suffix:

<n> 1..n
Window

<m> 1..n
Marker

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 application only

Manual operation: See "Marker To PICH" on page 112

CALCulate<n>:MARKer<m>:FUNCtion:TDPich

Suffix:

<n> 1..n
Window

<m> 1..n
Marker

Example: `CALC:MARK:FUNC:TDP`
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 application only

Manual operation: See "Marker To TDPICH" on page 112

CALCulate<n>:MARKer<m>:MAXimum:LEFT

Moves a marker to the next positive peak.

The search includes only measurement values to the left of the current marker position.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Next Peak" on page 111

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

Moves a marker to the next positive peak.

Suffix:
<n> Window

<m> Marker

Manual operation: See "Search Next Peak" on page 111

CALCulate<n>:MARKer<m>:MAXimum[:PEAK]

Moves a marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:
<n> Window

<m> Marker

Manual operation: See "Peak Search" on page 111

CALCulate<n>:MARKer<m>:MAXimum:RIGHt

Moves a marker to the next positive peak.

The search includes only measurement values to the right of the current marker position.

Suffix:
<n> Window

<m> Marker

Manual operation: See "Search Next Peak" on page 111

CALCulate<n>:MARKer<m>:MINimum:LEFT

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:
<n> Window

<m> Marker

Manual operation: See "Search Next Minimum" on page 111

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

Moves a marker to the next minimum peak value.

Suffix:
<n> Window

<m> Marker

Manual operation: See "Search Next Minimum" on page 111

CALCulate<n>:MARKer<m>:MINimum[:PEAK]

Moves a marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Minimum" on page 111

CALCulate<n>:MARKer<m>:MINimum:RIGHt

Moves a marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Next Minimum" on page 111

Positioning delta markers

The following commands position delta markers on the trace.

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT....... 242
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT....... 243
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]....... 243
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt....... 243
CALCulate<n>:DELTamarker<m>:MINimum:LEFT....... 243
CALCulate<n>:DELTamarker<m>:MINimum:NEXT....... 244
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]....... 244
CALCulate<n>:DELTamarker<m>:MINimum:RIGHt....... 244

CALCulate<n>:DELTamarker<m>:MAXimum:LEFT

Moves a delta marker to the next positive peak value.

The search includes only measurement values to the left of the current marker position.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Next Peak" on page 111

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

Moves a marker to the next positive peak value.

Suffix:

<n> 1..n
Window

<m> 1..n
Marker

Manual operation: See "Search Next Peak" on page 111

CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]

Moves a delta marker to the highest level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Peak Search" on page 111

CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt

Moves a delta marker to the next positive peak value on the trace.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Next Peak" on page 111

CALCulate<n>:DELTamarker<m>:MINimum:LEFT

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Next Minimum" on page 111

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

Moves a marker to the next minimum peak value.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Next Minimum" on page 111

CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]

Moves a delta marker to the minimum level.

If the marker is not yet active, the command first activates the marker.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Minimum" on page 111

CALCulate<n>:DELTamarker<m>:MINimum:RIGHt

Moves a delta marker to the next minimum peak value.

The search includes only measurement values to the right of the current marker position.

Suffix:

<n> Window

<m> Marker

Manual operation: See "Search Next Minimum" on page 111

11.11 Importing and exporting I/Q data and results

For details see Chapter 5, "I/Q data import and export", on page 50.

MMEMory:LOAD:IQ:STATe ... 244
MMEMory:STORe<n>:IQ:COMMent ... 245
MMEMory:STORe<n>:IQ:FORMat ... 245
MMEMory:STORe<n>:IQ:STATe ... 246

MMEMory:LOAD:IQ:STATe 1, <FileName>

Restores I/Q data from a file.

Setting parameters:

<FileName> string

String containing the path and name of the source file.
The file type is determined by the file extension. If no file extension is provided, the file type is assumed to be `.iq.tar`.
For `.mat` files, Matlab® v4 is assumed.

Example: `MMEM:LOAD:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`
Loads IQ data from the specified file.

Usage: Setting only

MMEMory:STORe<n>:IQ:COMMent <Comment>

Adds a comment to a file that contains I/Q data.

Suffix:

<n> irrelevant

Parameters:

<Comment> String containing the comment.

Example: `MMEM:STOR:IQ:COMM 'Device test 1b'`
Creates a description for the export file.
`MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iq.tar'`
Stores I/Q data and the comment to the specified file.

MMEMory:STORe<n>:IQ:FORMat <Format>,<DataFormat>

Sets or queries the format of the I/Q data to be stored.

Suffix:

<n> irrelevant

Parameters:

<Format>

FLOat32
32-bit floating point format.

INT32
32-bit integer format.

*RST: FLOat32

<DataFormat>

COMPlex
Exports complex data.

REAL
Exports real data.

*RST: COMPlex

Example: `MMEM:STOR:IQ:FORM INT32,REAL`

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

Writes the captured I/Q data to a file.

By default, the contents of the file are in 32-bit floating point format.

Suffix:

<n> 1..n

Parameters:

<1>

<FileName> String containing the path and name of the target file.
The file type is determined by the file extension. If no file extension is provided, the file type is assumed to be `.iq.tar`.
For `.mat` files, Matlab® v4 is assumed.

Example:

```
MMEM:STOR:IQ:STAT 1, 'C:
\R_S\Instr\user\data.iq.tar'
```

Stores the captured I/Q data to the specified file.

Usage: Asynchronous command

11.12 Configuring the secondary application data range (MSRA mode only)

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

For the CDMA2000 BTS secondary application, the secondary 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 182). 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 secondary application data for the 3GPP FDD BTS measurement.

The **analysis interval** used by the individual result displays cannot be edited, but is determined automatically. However, you can query the currently used analysis interval for a specific window.

The **analysis line** is displayed by default but can be hidden or re-positioned.

Remote commands exclusive to MSRA secondary applications

The following commands are only available for MSRA secondary application channels:

CALCulate<n>:MSRA:ALINe:SHOW.....247
CALCulate<n>:MSRA:ALINe[:VALue].....247
CALCulate<n>:MSRA:WINDow<n>:IVAL.....247
INITiate<n>:REFResh.....248
[SENSe:]MSRA:CAPTure:OFFSet.....248

CALCulate<n>:MSRA:ALINe:SHOW

Defines whether or not the analysis line is displayed in all time-based windows in all MSRA secondary applications and the MSRA primary application.

Note: even if the analysis line display is off, the indication whether or not the currently defined line position lies within the analysis interval of the active secondary application remains in the window title bars.

Suffix:

<n>	irrelevant

Parameters:

<State>	ON | OFF | 0 | 1 **OFF | 0** Switches the function off **ON | 1** Switches the function on

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

Defines the position of the analysis line for all time-based windows in all MSRA secondary applications and the MSRA primary application.

Suffix:

<n>	irrelevant

Parameters:

<Position>	Position of the analysis line in seconds. The position must lie within the measurement time of the MSRA measurement. Default unit: s

CALCulate<n>:MSRA:WINDow<n>:IVAL

Returns the current analysis interval for applications in MSRA operating mode.

Suffix:

<n>	irrelevant
<n>	1..n Window

Return values:

<IntStart>	Analysis start = Capture offset time Default unit: s

<IntStop>	Analysis end = capture offset + capture time Default unit: s

INITiate<n>:REFResh

Updates the current measurement results to reflect the current measurement settings.

No new I/Q data is captured. Thus, measurement settings apply to the I/Q data currently in the capture buffer.

The command applies exclusively to I/Q measurements. It requires I/Q data.

Suffix:
<n> irrelevant

Example: `INIT:REFR`
Updates the IQ measurement results.

Usage: Asynchronous command

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

This setting is only available for secondary applications in MSRA mode, not for the MSRA primary application. 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 secondary application data. The offset must be a positive value, as the secondary application can only analyze data that is contained in the capture buffer.

Range: 0 to <Record length>
*RST: 0
Default unit: S

Manual operation: See "Capture Offset" on page 78

11.13 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 FSW.

For details on the common FSW status registers refer to the description of remote commands basics in the FSW User Manual.

*RST does not influence the status registers.

The STATus:QUEStionable:DIQ register is described in "STATus:QUEStionable:DIQ register" on page 153.

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 249 and STATus:QUEStionable:SYNC[:EVENt]? on page 249.

Table 11-7: 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]?....249
STATus:QUEStionable:SYNC:CONDition?....249
STATus:QUEStionable:SYNC:ENABle....250
STATus:QUEStionable:SYNC:NTRansition....250
STATus:QUEStionable:SYNC:PTRansition....250

STATus:QUEStionable:SYNC[:EVENt]? <ChannelName>

Reads out the EVENt section of the status register.

The command also deletes the contents of the EVENt section.

Query parameters:

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Usage: Query only

STATus:QUEStionable:SYNC:CONDition? <ChannelName>

Reads out the CONDition section of the status register.

The command does not delete the contents of the EVENt section.

Query parameters:

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

Usage: Query only

STATus:QUEStionable:SYNC:ENABle <BitDefinition>, <ChannelName>

Controls the ENABle part of a register.

The ENABle part allows true conditions in the EVENt part of the status register to be reported in the summary bit. If a bit is 1 in the enable register and its associated event bit transitions to true, a positive transition will occur in the summary bit reported to the next higher level.

Parameters:

<BitDefinition> Range: 0 to 65535

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

STATus:QUEStionable:SYNC:NTRansition <BitDefinition>[,<ChannelName>]

Controls the Negative TRansition part of a register.

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

Parameters:

<BitDefinition> Range: 0 to 65535

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

STATus:QUEStionable:SYNC:PTRansition <BitDefinition>[,<ChannelName>]

These commands control the Positive TRansition part of a register.

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

Parameters:

<BitDefinition> Range: 0 to 65535

<ChannelName> String containing the name of the channel.
The parameter is optional. If you omit it, the command works for the currently active channel.

11.14 Deprecated commands

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..251
[SENSe:]CDPower:LEVel:ADJust..252
[SENSe:]CDPower:PRESet..252

CALCulate<n>:FEED <Evaluation>

Selects the evaluation method of the measured data that is to be displayed in the specified window.

Note that this command is maintained for compatibility reasons only. Use the `LAYout` commands for new remote control programs (see Chapter 11.7.2, "Working with windows in the display", on page 200).

Suffix:
<n> 1..n
Window

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 11-8: <Evaluation> parameter values

String Parameter	Text Parameter	Evaluation
'XTIM:CDP:BSTRream'	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: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 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 FSW programs use `[SENSe:]ADJust:LEVel` on page 193.

[SENSe:]CDPower:PRESet

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[:EXEC]` command.

11.15 Programming examples for CDMA2000 BTS measurements

The following programming example demonstrates how to perform Code Domain Analysis on a CDMA2000 signal in a remote environment. It assumes the network has been set up for remote control.

Note that some commands may not be necessary as they reflect the default instrument settings; however, they are included to demonstrate their use.

```
//--------------Preparing the instrument -----------
//Reset the instrument
*RST
//Activate a CDMA2000 BTS measurement channel named "BTSMeasurement"
INST:CRE:NEW BC2K,'BTSMeasurement'
//Select the code domain analysis measurement
CONF:CDP:BTS:MEAS CDP
//Stop continuous sweep
INIT:CONT OFF

//---------------- Configuring the Measurement-----
//Set the reference level to 0 dBm
DISP:TRAC:Y:SCAL:RLEV 0
//Set the center frequency to 878.49 MHz
FREQ:CENT 878.49 MHz

//---------- Trigger settings --------------------
// Use these settings only if an external trigger is connected
// to the TRIGGER INPUT connector of the analyzer.
// Otherwise ignore these commands.
// Define the use of an external trigger.
```

```
TRIGger:SOURce EXT

//------------ Signal Description -------------------
//IF KNOWN, define the pseudo noise offset of the base station from the external
//trigger of 2 (*64 chips) to accelerate calculation
//SENS:CDP:PNOF 2

//Capture data only from signal at antenna 1.
SENS:CDP:ANT 1
//Switch to multi-carrier signal detection and disable enhanced signal detection
//algorithm to accelerate calculation
CONF:CDP:BTS:MCAR ON
CONF:CDP:BTS:MCAR:MALG OFF
//Activate multicarrier RRC filter with rolloff 0.02 and cutoff at 1.25 MHz
CONF:CDP:BTS:MCAR:FILT ON
CONF:CDP:BTS:MCAR:FILT:TYPE RRC
CONF:CDP:BTS:MCAR:FILT:ROFF 0.02
CONF:CDP:BTS:MCAR:FILT:COFR 1.25MHZ

//----------- Channel detection --------------------------
//Configure an inactive threshold of -60.0 dB
SENS:CDP:ICTR -60

//---------- Configuring the result display ------------
// Activate the following result displays:
// 1: Code Domain Power (default, upper left)
// 2: Result Summary (default, below CDP)
// 3: Code Domain Error Power (next to CDP)
// 4: Bitstream Table (next to Result Summary)
LAYout:ADD:WINDow? '1',RIGH,PCD
LAYout:ADD:WINDow? '2',RIGH,BITS

//----------- Code domain settings ---------------------------
//Use a base spreading factor of 128
SENS:CDP:SFAC 128
//Configure compensation for I/Q offset
SENS:CDP:NORM ON
//Calculate timing and phase offset
SENS:CDP:TPM ON
//Define relative code power results, referred to total power of the signal
SENS:CDP:PDIS REL
SENS:CDP:PREF TOT
//Use bit-reverse sort order for code display
SENS:CDP:ORD BITR

//------------- Data acquisition -------------------------
//Configure data capture for 3 PCGs, analyze set 0, code number 3
SENS:CDP:IQL 3
SENS:CDP:SET 0
SENS:CDP:CODE 3
```

```
//--------------Performing the Measurement-----
//Select single sweep mode.
INIT:CONT OFF
//Initiate a new measurement and waits until the sweep has finished.
INIT;*WAI

//---------------Retrieving Results-------------
//Retrieve the composite EVM
CALC:MARK:FUNC:CDP:BTS:RES? MACC
//Retrieve the channel power, relative to total power
CALC:MARK:FUNC:CDP:BTS:RES? CDPR
//Retrieve the total power
CALC:MARK:FUNC:CDP:BTS:RES? PTOT
//Retrieve the peak error vector magnitude in percent
CALC:MARK:FUNC:CDP:BTS:RES? EVMP
//Retrieve the trace data of the Code Domain Error Power display
TRAC3:DATA? TRACE1
```

Annex

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.

- BTS channel tables..255
- MS channel tables...257

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 A-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	-
F-PCH	1	1.64	-
F-CHAN	6	9.64 10.64 11.64 15.64 17.64 25.64	1 1 1 1 1 1

Table A-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 10.128 11.128 15.128 17.128 25.128	4 4 4 4 4 4

Table A-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 10.128 11.128 15.128 17.128 25.128	4 4 4 4 4 4

Table A-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	-
F-PCH	1	1.64	-
F-CHAN	6	9.128 10.128 11.128 15.128 17.128 25.128	4 4 4 4 4 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 84).
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 A-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 A-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 A-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 A-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

Figure A-1: Codetable for base spreading factor 64

HADAMARD									BITREVERSE								
0	0000000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0000000	0
1	0000001	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1000000	64
2	0000010	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0100000	32
3	0000011	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1100000	96
4	0000100	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0010000	16
5	0000101	0	0	0	0	1	0	1	1	0	1	0	0	0	0	1010000	80
6	0000110	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0110000	48
7	0000111	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1110000	112
8	000 1000	0	0	0	1	0	0	0	0	0	0	1	0	0	0	000 1000	8
9	0001001	0	0	0	1	0	0	1	1	0	0	1	0	0	0	100 1000	72
10	0001010	0	0	0	1	0	1	0	0	1	0	1	0	0	0	010 1000	40
11	0001011	0	0	0	1	0	1	1	1	1	0	1	0	0	0	110 1000	104
12	0001100	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0011000	24
13	0001101	0	0	0	1	1	0	1	1	0	1	1	0	0	0	1011000	88
14	0001110	0	0	0	1	1	1	0	0	1	1	1	0	0	0	0111000	56
15	0001111	0	0	0	1	1	1	1	1	1	1	1	0	0	0	1111000	120
16	0010000	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0000100	4
17	0010001	0	0	1	0	0	0	1	1	0	0	0	1	0	0	1000100	68
18	0010010	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0100100	36
19	0010011	0	0	1	0	0	1	1	1	1	0	0	1	0	0	1100100	100
20	0010100	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0010100	20
21	0010101	0	0	1	0	1	0	1	1	0	1	0	1	0	0	1010100	84
22	0010110	0	0	1	0	1	1	0	0	1	1	0	1	0	0	0110100	52
23	0010111	0	0	1	0	1	1	1	1	1	1	0	1	0	0	1110100	116
24	0011000	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0001100	12
25	0011001	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1001100	76
26	0011010	0	0	1	1	0	1	0	0	1	0	1	1	0	0	0101100	44
27	0011011	0	0	1	1	0	1	1	1	1	0	1	1	0	0	1101100	108
28	0011100	0	0	1	1	1	0	0	0	0	1	1	1	0	0	0011100	28
29	0011101	0	0	1	1	1	0	1	1	0	1	1	1	0	0	1011100	92
30	0011110	0	0	1	1	1	1	0	0	1	1	1	1	0	0	0111100	60
31	0011111	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1111100	124
32	0100000	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0000010	2
33	0100001	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1000010	66
34	0100010	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0100010	34
35	0100011	0	1	0	0	0	1	1	1	1	0	0	0	1	0	1100010	98
36	0100100	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0010010	18
37	0100101	0	1	0	0	1	0	1	1	0	1	0	0	1	0	1010010	82
38	0100110	0	1	0	0	1	1	0	0	1	1	0	0	1	0	0110010	50
39	0100111	0	1	0	0	1	1	1	1	1	1	0	0	1	0	1110010	114
40	010 1000	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0001010	10
41	0101001	0	1	0	1	0	0	1	1	0	0	1	0	1	0	1001010	74
42	0101010	0	1	0	1	0	1	0	0	1	0	1	0	1	0	0101010	42
43	0101011	0	1	0	1	0	1	1	1	1	0	1	0	1	0	1101010	106
44	0101100	0	1	0	1	1	0	0	0	0	1	1	0	1	0	0011010	26
45	0101101	0	1	0	1	1	0	1	1	0	1	1	0	1	0	1011010	90
46	0101110	0	1	0	1	1	1	0	0	1	1	1	0	1	0	0111010	58
47	0101111	0	1	0	1	1	1	1	1	1	1	1	0	1	0	1111010	122
48	0110000	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0000110	6
49	0110001	0	1	1	0	0	0	1	1	0	0	0	1	1	0	1000110	70
50	0110010	0	1	1	0	0	1	0	0	1	0	0	1	1	0	0100110	38
51	0110011	0	1	1	0	0	1	1	1	1	0	0	1	1	0	1100110	102
52	0110100	0	1	1	0	1	0	0	0	0	1	0	1	1	0	0010110	22
53	0110101	0	1	1	0	1	0	1	1	0	1	0	1	1	0	1010110	86
54	0110110	0	1	1	0	1	1	0	0	1	1	0	1	1	0	0110110	54
55	0110111	0	1	1	0	1	1	1	1	1	1	0	1	1	0	1110110	118
56	0111000	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0001110	14
57	0111001	0	1	1	1	0	0	1	1	0	0	1	1	1	0	1001110	78
58	0111010	0	1	1	1	0	1	0	0	1	0	1	1	1	0	0101110	46
59	0111011	0	1	1	1	0	1	1	1	1	0	1	1	1	0	1101110	110
60	0111100	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0011110	30
61	0111101	0	1	1	1	1	0	1	1	0	1	1	1	1	0	1011110	94
62	0111110	0	1	1	1	1	1	0	0	1	1	1	1	1	0	0111110	62
63	0111111	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1111110	126

Figure A-2: Code table for base spreading factor 128 (part1)

HADAMARD									BITREVERSE								
64	1000000	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0000001	1
65	1000001	1	0	0	0	0	0	1	1	0	0	0	0	0	1	1000001	65
66	1000010	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0100001	33
67	1000011	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1100001	97
68	1000100	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0010001	17
69	1000101	1	0	0	0	1	0	1	1	0	1	0	0	0	1	1010001	81
70	1000110	1	0	0	0	1	1	0	0	1	1	0	0	0	1	0110001	49
71	1000111	1	0	0	0	1	1	1	1	1	1	0	0	0	1	1110001	113
72	100 1000	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0001001	9
73	1001001	1	0	0	1	0	0	1	1	0	0	1	0	0	1	1001001	73
74	1001010	1	0	0	1	0	1	0	0	1	0	1	0	0	1	0101001	41
75	1001011	1	0	0	1	0	1	1	1	1	0	1	0	0	1	1101001	105
76	1001100	1	0	0	1	1	0	0	0	0	1	1	0	0	1	0011001	25
77	1001101	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1011001	89
78	1001110	1	0	0	1	1	1	0	0	1	1	1	0	0	1	0111001	57
79	1001111	1	0	0	1	1	1	1	1	1	1	1	0	0	1	1111001	121
80	1010000	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0000101	5
81	1010001	1	0	1	0	0	0	1	1	0	0	0	1	0	1	1000101	69
82	1010010	1	0	1	0	0	1	0	0	1	0	0	1	0	1	0100101	37
83	1010011	1	0	1	0	0	1	1	1	1	0	0	1	0	1	1100101	101
84	1010100	1	0	1	0	1	0	0	0	0	1	0	1	0	1	0010101	21
85	1010101	1	0	1	0	1	0	1	1	0	1	0	1	0	1	1010101	85
86	1010110	1	0	1	0	1	1	0	0	1	1	0	1	0	1	0110101	53
87	1010111	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1110101	117
88	1011000	1	0	1	1	0	0	0	0	0	0	1	1	0	1	0001101	13
89	1011001	1	0	1	1	0	0	1	1	0	0	1	1	0	1	1001101	77
90	1011010	1	0	1	1	0	1	0	0	1	0	1	1	0	1	0101101	45
91	1011011	1	0	1	1	0	1	1	1	1	0	1	1	0	1	1101101	109
92	1011100	1	0	1	1	1	0	0	0	0	1	1	1	0	1	0011101	29
93	1011101	1	0	1	1	1	0	1	1	0	1	1	1	0	1	1011101	93
94	1011110	1	0	1	1	1	1	0	0	1	1	1	1	0	1	0111101	61
95	1011111	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1111101	125
96	1100000	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0000011	3
97	1100001	1	1	0	0	0	0	1	1	0	0	0	0	1	1	1000011	67
98	1100010	1	1	0	0	0	1	0	0	1	0	0	0	1	1	0100011	35
99	1100011	1	1	0	0	0	1	1	1	1	0	0	0	1	1	1100011	99
100	1100100	1	1	0	0	1	0	0	0	0	1	0	0	1	1	0010011	19
101	1100101	1	1	0	0	1	0	1	1	0	1	0	0	1	1	1010011	83
102	1100110	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0110011	51
103	1100111	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1110011	115
104	110 1000	1	1	0	1	0	0	0	0	0	0	1	0	1	1	0001011	11
105	1101001	1	1	0	1	0	0	1	1	0	0	1	0	1	1	1001011	75
106	1101010	1	1	0	1	0	1	0	0	1	0	1	0	1	1	0101011	43
107	1101011	1	1	0	1	0	1	1	1	1	0	1	0	1	1	1101011	107
108	1101100	1	1	0	1	1	0	0	0	0	1	1	0	1	1	0011011	27
109	1101101	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1011011	91
110	1101110	1	1	0	1	1	1	0	0	1	1	1	0	1	1	0111011	59
111	1101111	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1111011	123
112	1110000	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0000111	7
113	1110001	1	1	1	0	0	0	1	1	0	0	0	1	1	1	1000111	71
114	1110010	1	1	1	0	0	1	0	0	1	0	0	1	1	1	0100111	39
115	1110011	1	1	1	0	0	1	1	1	1	0	0	1	1	1	1100111	103
116	1110100	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0010111	23
117	1110101	1	1	1	0	1	0	1	1	0	1	0	1	1	1	1010111	87
118	1110110	1	1	1	0	1	1	0	0	1	1	0	1	1	1	0110111	55
119	1110111	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1110111	119
120	1111000	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0001111	15
121	1111001	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1001111	79
122	1111010	1	1	1	1	0	1	0	0	1	0	1	1	1	1	0101111	47
123	1111011	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1101111	111
124	1111100	1	1	1	1	1	0	0	0	0	1	1	1	1	1	0011111	31
125	1111101	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1011111	95
126	1111110	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0111111	63
127	1111111	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1111111	127

Figure A-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 97).

Table A-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 sample 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 commands (CDMA2000)

[SENSe:]ADJust:ALL 191
[SENSe:]ADJust:CONFigure:HYSTeresis:LOWer 193
[SENSe:]ADJust:CONFigure:HYSTeresis:UPPer 193
[SENSe:]ADJust:CONFigure:LEVel:DURation 192
[SENSe:]ADJust:CONFigure:LEVel:DURation:MODE 192
[SENSe:]ADJust:LEVel 193
[SENSe:]AVERage<n>:COUNt 190
[SENSe:]CDPower:ANTenna 141
[SENSe:]CDPower:CODE 194
[SENSe:]CDPower:ICTReshold 184
[SENSe:]CDPower:IQLength 182
[SENSe:]CDPower:LCODe:MASK 142
[SENSe:]CDPower:LCODe:MODE 142
[SENSe:]CDPower:LCODe:OFFSet 142
[SENSe:]CDPower:LEVel:ADJust 252
[SENSe:]CDPower:MAPPing 194
[SENSe:]CDPower:NORMalize 195
[SENSe:]CDPower:ORDer 195
[SENSe:]CDPower:PDISplay 196
[SENSe:]CDPower:PNOFfset 141
[SENSe:]CDPower:PPReference 196
[SENSe:]CDPower:PREFerence 197
[SENSe:]CDPower:PRESet 252
[SENSe:]CDPower:QINVert 182
[SENSe:]CDPower:SET:COUNt 182
[SENSe:]CDPower:SET[:VALue] 194
[SENSe:]CDPower:SFACtor 197
[SENSe:]CDPower:SLOT 195
[SENSe:]CDPower:TPMeas 197
[SENSe:]FREQuency:CENTer 165
[SENSe:]FREQuency:CENTer:STEP 165
[SENSe:]FREQuency:CENTer:STEP:AUTO 166
[SENSe:]FREQuency:CENTer:STEP:LINK 166
[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor 166
[SENSe:]FREQuency:OFFSet 167
[SENSe:]MSRA:CAPTure:OFFSet 248
[SENSe:]PROBe<pb>:ID:PARTnumber? 158
[SENSe:]PROBe<pb>:ID:SRNumber? 159
[SENSe:]PROBe<pb>:SETup:ATTRatio 159
[SENSe:]PROBe<pb>:SETup:CMOFfset 160
[SENSe:]PROBe<pb>:SETup:DMOFfset 160
[SENSe:]PROBe<pb>:SETup:MODE 161
[SENSe:]PROBe<pb>:SETup:NAME? 161
[SENSe:]PROBe<pb>:SETup:NMOFfset 161
[SENSe:]PROBe<pb>:SETup:PMODe 162
[SENSe:]PROBe<pb>:SETup:PMOFfset 162
[SENSe:]PROBe<pb>:SETup:STATe? 163

[SENSe:]PROBe<pb>:SETup:TYPE?....163
[SENSe:]SWEep:COUNt....190
ABORt....208
CALCulate<n>:DELTamarker<m>:AOFF....237
CALCulate<n>:DELTamarker<m>:MAXimum:LEFT....242
CALCulate<n>:DELTamarker<m>:MAXimum:NEXT....243
CALCulate<n>:DELTamarker<m>:MAXimum:RIGHt....243
CALCulate<n>:DELTamarker<m>:MAXimum[:PEAK]....243
CALCulate<n>:DELTamarker<m>:MINimum:LEFT....243
CALCulate<n>:DELTamarker<m>:MINimum:NEXT....244
CALCulate<n>:DELTamarker<m>:MINimum:RIGHt....244
CALCulate<n>:DELTamarker<m>:MINimum[:PEAK]....244
CALCulate<n>:DELTamarker<m>:X....238
CALCulate<n>:DELTamarker<m>:X:RELative?....238
CALCulate<n>:DELTamarker<m>:Y?....238
CALCulate<n>:DELTamarker<m>[:STATe]....237
CALCulate<n>:FEED....251
CALCulate<n>:LIMit<li>:FAIL?....230
CALCulate<n>:MARKer<m>:AOFF....236
CALCulate<n>:MARKer<m>:FUNCtion:CDPower[:BTS]:RESult?....212
CALCulate<n>:MARKer<m>:FUNCtion:PICH....239
CALCulate<n>:MARKer<m>:FUNCtion:POWer<sb>:RESult?....231
CALCulate<n>:MARKer<m>:FUNCtion:TDPich....240
CALCulate<n>:MARKer<m>:MAXimum:LEFT....240
CALCulate<n>:MARKer<m>:MAXimum:NEXT....240
CALCulate<n>:MARKer<m>:MAXimum:RIGHt....241
CALCulate<n>:MARKer<m>:MAXimum[:PEAK]....241
CALCulate<n>:MARKer<m>:MINimum:LEFT....241
CALCulate<n>:MARKer<m>:MINimum:NEXT....241
CALCulate<n>:MARKer<m>:MINimum:RIGHt....242
CALCulate<n>:MARKer<m>:MINimum[:PEAK]....242
CALCulate<n>:MARKer<m>:X....236
CALCulate<n>:MARKer<m>:Y?....214
CALCulate<n>:MARKer<m>[:STATe]....236
CALCulate<n>:MSRA:ALINe:SHOW....247
CALCulate<n>:MSRA:ALINe[:VALue]....247
CALCulate<n>:MSRA:WINDow<n>:IVAL....247
CALCulate<n>:STATistics:RESult<res>?....233
CALCulate<n>:UNIT:POWer....167
CALibration:AIQ:HATiming[:STATe]....158
CONFigure:CDPower:MS:CTABle:DATA....189
CONFigure:CDPower[:BTS]:BANDclass....199
CONFigure:CDPower[:BTS]:BCLass....198
CONFigure:CDPower[:BTS]:CTABle:CATalog....185
CONFigure:CDPower[:BTS]:CTABle:COMMent....187
CONFigure:CDPower[:BTS]:CTABle:COPY....185
CONFigure:CDPower[:BTS]:CTABle:DATA....187
CONFigure:CDPower[:BTS]:CTABle:DELete....186
CONFigure:CDPower[:BTS]:CTABle:NAME....189
CONFigure:CDPower[:BTS]:CTABle:RESTore....186

CONFigure:CDPower[:BTS]:CTABle:SELect....186
CONFigure:CDPower[:BTS]:CTABle[:STATe]....186
CONFigure:CDPower[:BTS]:MCARrier:FILTer:COFRequency....138
CONFigure:CDPower[:BTS]:MCARrier:FILTer:ROFF....139
CONFigure:CDPower[:BTS]:MCARrier:FILTer:TYPE....140
CONFigure:CDPower[:BTS]:MCARrier:FILTer[:STATe]....139
CONFigure:CDPower[:BTS]:MCARrier:MALGo....140
CONFigure:CDPower[:BTS]:MCARrier[:STATe]....140
CONFigure:CDPower[:BTS]:MEASurement....137
DIAGnostic:SERVice:NSOurce....164
DISPlay:FORMat....200
DISPlay[:WINDow<n>]:MTABle....239
DISPlay[:WINDow<n>]:SIZE....200
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MAXimum....169
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:MINimum....170
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:MODE....234
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:AUTO ONCE....168
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:PDIVision....168
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel....169
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet....169
DISPlay[:WINDow<n>][:SUBWindow<w>]:TRACe<t>[:STATe]....235
FORMat:DEXPort:DSEParator....230
FORMat[:DATA]....215
INITiate:SEQuencer:ABORt....210
INITiate:SEQuencer:IMMediate....210
INITiate:SEQuencer:MODE....210
INITiate:SEQuencer:REFResh[:ALL]....211
INITiate<n>:CONMeas....209
INITiate<n>:CONTinuous....209
INITiate<n>:REFResh....248
INITiate<n>[:IMMediate]....210
INPut:ATTenuation....172
INPut:ATTenuation:AUTO....172
INPut:ATTenuation:PROTection:RESet....144
INPut:CONNector....144
INPut:COUPling....144
INPut:DIQ:CDEVice....150
INPut:DIQ:RANGe:COUPling....150
INPut:DIQ:RANGe[:UPPer]....150
INPut:DIQ:RANGe[:UPPer]:AUTO....150
INPut:DIQ:RANGe[:UPPer]:UNIT....151
INPut:DIQ:SRATe....151
INPut:DIQ:SRATe:AUTO....151
INPut:DPATh....145
INPut:EATT....173
INPut:EATT:AUTO....173
INPut:EATT:STATe....173
INPut:EGAin[:STATe]....170
INPut:FILE:PATH....147
INPut:FILTer:HPASs[:STATe]....145

INPut:FILTer:YIG[:STATe]....145
INPut:GAIN:STATe....171
INPut:GAIN[:VALue]....171
INPut:IMPedance....146
INPut:IQ:BALanced[:STATe]....156
INPut:IQ:FULLscale:AUTO....157
INPut:IQ:FULLscale[:LEVel]....157
INPut:IQ:TYPE....157
INPut:SELect....146
INPut:TYPE....147
INSTrument:CREate:DUPLicate....133
INSTrument:CREate:REPLace....133
INSTrument:CREate[:NEW]....133
INSTrument:DELete....134
INSTrument:LIST?....134
INSTrument:REName....136
INSTrument[:SELect]....136
LAYout:ADD[:WINDow]?....201
LAYout:CATalog[:WINDow]?....203
LAYout:IDENtify[:WINDow]?....203
LAYout:MOVE[:WINDow]....203
LAYout:REMove[:WINDow]....204
LAYout:REPLace[:WINDow]....204
LAYout:SPLitter....205
LAYout:WINDow<n>:ADD?....206
LAYout:WINDow<n>:IDENtify?....206
LAYout:WINDow<n>:REMove....207
LAYout:WINDow<n>:REPLace....207
MMEMory:LOAD:IQ:STATe....244
MMEMory:LOAD:IQ:STReam....148
MMEMory:LOAD:IQ:STReam:AUTO....148
MMEMory:LOAD:IQ:STReam:LIST?....149
MMEMory:STORe<n>:IQ:COMMent....245
MMEMory:STORe<n>:IQ:FORMat....245
MMEMory:STORe<n>:IQ:STATe....246
MMEMory:STORe<n>:TRACe....229
OUTPut:DIQ[:STATe]....151
OUTPut:TRIGger<tp>:DIRection....179
OUTPut:TRIGger<tp>:LEVel....180
OUTPut:TRIGger<tp>:OTYPe....180
OUTPut:TRIGger<tp>:PULSe:IMMediate....181
OUTPut:TRIGger<tp>:PULSe:LENGth....181
OUTPut<up>:DIQ:CDEVice?....152
STATus:QUEStionable:DIQ:CONDition?....154
STATus:QUEStionable:DIQ:ENABle....154
STATus:QUEStionable:DIQ:NTRansition....155
STATus:QUEStionable:DIQ:PTRansition....155
STATus:QUEStionable:DIQ[:EVENt]?....155
STATus:QUEStionable:SYNC:CONDition?....249
STATus:QUEStionable:SYNC:ENABle....250

STATus:QUEStionable:SYNC:NTRansition....250
STATus:QUEStionable:SYNC:PTRansition....250
STATus:QUEStionable:SYNC[:EVENt]?....249
SYSTem:PRESet:CHANnel[:EXEC]....136
SYSTem:SEQuencer....211
SYSTem:SPEaker:VOLume....164
TRACe:IQ:FILE:REPetition:COUNt....149
TRACe<n>[:DATA]....215
TRIGger[:SEQuence]:DTIMe....175
TRIGger[:SEQuence]:HOLDoff[:TIME]....175
TRIGger[:SEQuence]:IFPower:HOLDoff....175
TRIGger[:SEQuence]:IFPower:HYSTeresis....175
TRIGger[:SEQuence]:LEVel:BBPower....176
TRIGger[:SEQuence]:LEVel:IFPower....177
TRIGger[:SEQuence]:LEVel:RFPower....177
TRIGger[:SEQuence]:LEVel:VIDeo....177
TRIGger[:SEQuence]:LEVel[:EXTernal<port>]....176
TRIGger[:SEQuence]:SLOPe....178
TRIGger[:SEQuence]:SOURce....178
TRIGger[:SEQuence]:TIME:RINTerval....179

Index

A

Abbreviations ... 262
Aborting
    Sweep ... 92, 93
AC/DC coupling ... 62
ACKCH ... 46
ACLR
    Bandclasses ... 97, 98, 261
    cdma2000 results ... 30
    Configuring (cdma2000) ... 96
    Results (remote) ... 231
Activating
    cdma2000 measurements (remote) ... 132
Active channels ... 15
    Quasi-inactive ... 44
Adjacent channel leakage ratio
    see ACLR ... 30
Agilent
    Long code generation mode ... 41
Alias power ... 21, 40, 101
Amplitude
    Configuration ... 69
    Configuring (remote) ... 167
    Settings ... 69
Analog Baseband
    Input ... 63
Analysis
    BTS Code Domain Settings ... 100
    Remote commands ... 234
    RF (remote) ... 199
    RF measurements ... 100
    Settings ... 100
Analysis interval
    MSRA ... 81, 82, 182
Analysis line ... 49
Antenna diversity ... 43
    Activating ... 56
    Special channels ... 44
Antenna number
    Selecting ... 56
Application cards ... 9
Application notes ... 9
Applications
    Adopted parameters ... 52
    Switching ... 52
Attenuation
    Auto ... 71
    Configuring (remote) ... 172
    Electronic ... 72
    External ... 47
    Manual ... 71
    Option ... 72
    Protective (remote) ... 144
Audio demodulation
    Volume (remote control) ... 164
Auto all ... 93
Auto level
    Hysteresis ... 95
    Reference level ... 71, 94
    Softkey ... 71, 94
Auto scaling ... 74
Auto settings ... 93
    Meastime Auto ... 94
    Meastime Manual ... 94
    Remote commands ... 191
Autosearch
    Channel detection ... 44
Average count ... 92

B

Bandclasses
    ACLR ... 261
    Defining ... 97, 98
    SEM ... 261
    Supported ... 261
Bandwidth
    Coverage, MSRA mode ... 48
    Menu ... 52
Base spreading factor ... 40, 101
Base station
    see BTS ... 10
Base transceiver station
    see BTS ... 10
Bit-Reverse
    Code table ... 258
    Sort order ... 39, 102
Bitstream
    Evaluation method ... 17
    Trace results ... 217
Branches ... 41
    Analysis ... 44
    Evaluation range ... 104
    Retrieving ... 217
    Selecting ... 104
Brochures ... 8
BTS ... 10

C

Capture Length ... 81
Capture offset
    MSRA applications ... 82
    MSRA secondary applications ... 78
    Remote ... 248
    Softkey ... 78
Carrier Frequency Error ... 15
CCCH ... 46
CCDF
    cdma2000 results ... 33
    Configuring (cdma2000) ... 99
CDA ... 14
    Analysis settings (BTS) ... 100
    Configuring ... 52
    Configuring (remote) ... 138
    Evaluation settings BTS (remote) ... 195
    Parameters ... 15
    Performing ... 114
    Results ... 15
CDE
    Peak ... 24
CDEP
    Color assignment ... 21
    Display ... 101

Evaluation method ... 20
Trace results ... 221
cdma2000
Basics ... 37
Introduction ... 10
Measurements ... 14
Remote commands ... 127
CDMA2000
Programming examples ... 252
cdma2000 mode
Error messages ... 113
Optimizing ... 113
Reference ... 255
RF measurements ... 29
Troubleshooting ... 113
CDP
Absolute/Relative ... 102
Channel table ... 89, 91, 189
Color assignment ... 21
Display ... 101, 102
Evaluation method ... 20
Measurement examples ... 120
Reference power ... 102
Retrieving ... 217
Trace results ... 221
Triggered (Measurement example) ... 122
Center frequency ... 68
Deviation (Measurement example) ... 121
Softkey ... 68
Step size ... 69
Channel
Creating (remote) ... 133
Deleting (remote) ... 134
Duplicating (remote) ... 133
Querying (remote) ... 134
Renaming (remote) ... 136
Replacing (remote) ... 133
Channel bandwidth
MSRA mode ... 48
Channel bar ... 12
Channel detection
Autosearch ... 44
Configuring ... 83
Methods ... 44
Predefined tables ... 44
Remote commands ... 183, 184
Search mode ... 84
Softkey ... 82
Channel number ... 16, 19
Configuring in table ... 88, 90, 189
Retrieving ... 217
Channel power
ACLR, see ACLR ... 30
Channel tables
Adding channels ... 87
CDP ... 89, 91, 189
Channel number ... 88, 90, 189
Channel status ... 89, 91, 189
Channel type ... 88, 90, 189
Comment ... 86
Comparison ... 44
Configuring ... 19, 115, 189
Configuring (remote) ... 187
Copying ... 86
Creating ... 85
Creating from measurement ... 87
Deleting ... 86
Deleting channels ... 87
Details (BTS) ... 87
Details (MS) ... 89
Domain conflict ... 89, 91
Editing ... 86
Evaluation method ... 18
Managing ... 85
Managing (remote) ... 185
Mapping ... 91, 189
Name ... 86
Parameters ... 19
Predefined ... 255
RC ... 89
RECENT ... 85
Selected ... 85
Selecting ... 85
Settings ... 86
Sorting ... 87
Trace results ... 217
Channel types
BTS ... 44
Configuring in table ... 88, 90, 189
Detected ... 19, 45
Detected (BTS) ... 45
Detected (MS) ... 46
MS ... 46
Parameter values (remote) ... 183, 184
Retrieving ... 217
Special (BTS) ... 45
Special (MS) ... 46
Channels ... 37
Active ... 15, 84, 89, 91, 189
Bandwidth ... 37
Bitstream ... 17
Evaluation range ... 103
Inactive, showing ... 19
Number ... 37
Results ... 16
Selected (Display) ... 12
Status ... 19, 21, 22, 89, 91, 189
Threshold ... 22
Chip Rate Error ... 15
Chips ... 38
Closing
Channels (remote) ... 134
Windows (remote) ... 207
Code class
Relationship to spreading factor ... 38
Relationship to symbol rate ... 38
Code Display Order ... 102
Code domain ... 37
Code Domain Analysis
see CDA ... 14
Code Domain Error Power
see CDEP ... 20
Code Domain Power
see CDP ... 20
Code domain settings
Softkey ... 100
Code number
see Channel number ... 37
Selecting ... 103
Code tables ... 258
Codes ... 37
Long ... 41
Mapping ... 41
Number per channel ... 38

Power display ... 102
Quasi-inactive ... 44
Short ... 41
Sorting ... 20, 39, 102
Sorting order ... 20
Complementary cumulative distribution function
see CCDF ... 33
Composite Constellation
Evaluation method ... 21
Trace results ... 225
Composite EVM ... 16
Evaluation method ... 22
Measurement examples ... 123
Trace results ... 226
Continue single sweep
Softkey ... 93
Continuous sweep
Softkey ... 92
Conventions
SCPI commands ... 128
Copying
Channel (remote) ... 133
CQICH ... 46
Cut-off frequency
RRC filter ... 57, 60

D

Data acquisition
MSRA ... 81, 82, 182
see Signal capturing ... 80
Data input ... 60
Data output ... 60
Data sheets ... 8
DC offset
Analog Baseband (B71, remote control) ... 158
see IQ offset ... 101
DCCH ... 46
Delta markers
Defining ... 108
Diagram footer information ... 13
Diagrams
Evaluation method ... 34
Digital Baseband interface ... 67
Connected instrument ... 67
Output connection status (remote) ... 152
Output settings ... 66, 67
Status registers ... 153
Digital I/Q
Connection information ... 67
Enhanced mode ... 76
Output settings ... 66
Output settings information ... 67
Triggering ... 76
Digital output
Enabling ... 67
Direct path
Input configuration ... 62
Display
Information ... 11
Display configuration
Softkey ... 14, 51
Domain conflict
Channel table ... 89, 91
Duplicating
Channel (remote) ... 133

E

EACH ... 46
Electronic input attenuation ... 71, 72
Eliminating
IQ offset ... 101, 195
Enhanced algorithm
Multicarrier signals ... 56, 59
Enhanced mode
Digital I/Q ... 76
Error messages ... 113
Error vector magnitude
see EVM ... 22
Errors
Device connections ... 153
IF OVLD ... 71
Evaluation methods
Remote ... 201
Evaluation range
Branch ... 104
Channel ... 103
PCG ... 104
Remote commands ... 194
Sets ... 82, 104
Settings ... 100
Softkey ... 103
Evaluations
CDA ... 17
RF ... 34
see also Result Displays ... 14
Selecting ... 14
EVM
Composite ... 22
vs Chip ... 226
vs symbol ... 16, 19, 28
Exporting
I/Q data ... 50, 52
I/Q data (remote) ... 244
Trace results (remote) ... 229
External trigger ... 76
Level (remote) ... 176

F

F-CHAN ... 45
F-PDCCH ... 45
F-PDCH ... 45
F-PICH ... 45, 46
F-SYNC ... 45
F-TDPICH ... 45, 46
FCH ... 46
Files
I/Q data input ... 64
Filter types
Multicarrier ... 56, 59
Filters
Cut-off frequency ... 57, 60
High-pass (RF input) ... 63
Multicarrier signals ... 43, 56, 59
Roll-off factor ... 57, 60
YIG (remote) ... 145
Free Run
Trigger ... 76
Frequency
Configuration ... 68
Configuration (remote) ... 165
Offset ... 69

Frequency error
Measurement examples ... 120
vs PCG ... 226
Frontend
Configuring ... 68
Configuring (remote) ... 165

G

Getting started ... 7

H

Hadamard
Code table ... 258
Sort order ... 39, 102
Hardware settings
Displayed ... 12
High-pass filter
RF input ... 63
Hysteresis
Lower (Auto level) ... 95
Upper (Auto level) ... 95

I

I/Q data
Exporting ... 52
Exporting (remote) ... 244
Importing ... 52
Importing (remote) ... 244
Importing/Exporting ... 50
Input file ... 65
Input files ... 64
IF Power
Trigger ... 77
Trigger level (remote) ... 177
Impedance
Setting ... 62
Importing
I/Q data ... 50, 52
I/Q data (remote) ... 244
Inactive Channel Threshold ... 84
Input
Coupling ... 62
I/Q data files ... 64
Overload (remote) ... 144
RF ... 62
Settings ... 60, 73
Source Configuration (softkey) ... 60
Source, connection errors ... 153
Source, Radio frequency (RF) ... 61
Input sources
I/Q data file ... 65
I/Q data files ... 64
Installation ... 10
Instrument security procedures ... 8
Invert Q ... 81
IQ imbalance ... 16
IQ offset
Eliminating ... 101, 195

K

Keys
BW ... 52
LINES ... 52
MKR -> ... 110
MKR FUNCT ... 52
Peak Search ... 111
RUN CONT ... 92
RUN SINGLE ... 92, 93
SPAN ... 52

L

Lines
Menu ... 52
LO feedthrough ... 62
Long codes ... 41
Agilent signals ... 41
Generation ... 41, 59
Mask ... 58
Offset ... 58
Scrambling ... 41
Low-pass filter
Multicarrier ... 56, 59
Lower Level Hysteresis ... 95

M

Mag Error vs Chip
Evaluation ... 23
Trace results ... 226
Mapping ... 16, 19, 41
Channel table ... 91, 189
I/Q branches ... 91, 189
Retrieving ... 217
Selecting ... 104
Marker Functions
Menu ... 52
Marker table
Configuring ... 108
Evaluation method ... 35
Markers
Configuring ... 106
Configuring (remote) ... 235, 239
Configuring (softkey) ... 106
Deactivating ... 108
Delta markers ... 108
Minimum ... 111
Minimum (remote control) ... 239
Next minimum ... 111
Next minimum (remote control) ... 239
Next peak ... 111
Next peak (remote control) ... 239
Peak ... 111
Peak (remote control) ... 239
Positioning ... 110
Search settings ... 109
Setting to PICH ... 112
Setting to TDPICH ... 112
Settings (remote) ... 236
State ... 107
Table ... 109
Table (evaluation method) ... 35
Type ... 108
Maximizing
Windows (remote) ... 200
Maximum
Y-axis ... 74
Measurement channel
Activating (remote) ... 132

Measurement examples ... 118
CDP ... 120
Center frequency deviation ... 121
Composite EVM ... 123
Frequency error ... 120
PCDE ... 125
RHO factor ... 125
SEM ... 119
Signal channel power ... 118
Synchronization ... 121
Trigger offset ... 123
Triggered CDP ... 122
Wrong PN offset ... 123
Measurement time
Auto settings ... 94
Measurements
RF ... 29
Selecting ... 51, 54
Selecting (remote) ... 137
Starting (remote) ... 208
Types ... 14
Minimum ... 111
Marker positioning ... 111
Next ... 111
Y-axis ... 74
MKR ->
Key ... 110
Modulation
Accuracy ... 22
Bits per symbol ... 39
Symbol constellation ... 39
Type ... 16
MS (Mobile station) ... 10
MSR ACLR
Results (remote) ... 231
MSRA
Analysis interval ... 81, 82, 182
Operating mode ... 48
MSRA applications
Capture offset ... 82
MSRA primary
Data coverage ... 48
MSRA secondary applications
Capture offset (remote) ... 248
Multicarrier
Algorithm ... 56, 59
Carrier detection ... 56, 59
Filter ... 56, 59
Filter types ... 56, 59
Filters ... 43
Mode ... 43, 56, 59
Multiple
Measurement channels ... 11, 51

N

Next Minimum ... 111
Marker positioning ... 111
Next Peak ... 111
Marker positioning ... 111
Noise
Source ... 66

O

OBW
cdma2000 results ... 32
Configuring (cdma2000) ... 98
Occupied bandwidth
see OBW ... 32
Offset ... 16
Analysis interval ... 78
Frequency ... 69
Reference level ... 71
Optimizing
Test setup ... 113
Options
Electronic attenuation ... 72
High-pass filter ... 63
Preamplifier ... 73
Output
Configuration ... 65
Configuration (remote) ... 164
Digital Baseband interface settings ... 66, 67
Digital Baseband interface status ... 152
Digital I/Q (remote) ... 151
Noise source ... 66
Power measurement, Configuring ... 95
Settings ... 65
Trigger ... 79
Overload
RF input (remote) ... 144
Overview
Configuring cdma2000 ... 53

P

Parameters
CDA ... 15
Channel table ... 19
Channels ... 16
PCDE
Evaluation method ... 24
Measurement examples ... 125
Trace results ... 226
PCG ... 14
Display ... 12
Evaluation range ... 104
Number of symbols ... 37
Power ... 26
Results ... 15
Selecting ... 104
PCGs ... 37
Captured ... 81
Peak Code Domain Error
see PCDE ... 24
Peak list
Evaluation method ... 36
Peak search
Key ... 111
Mode ... 110
Peaks
Marker positioning ... 111
Next ... 111
Softkey ... 111
Performing
cdma2000 measurement ... 114
Phase Discontinuity vs PCG
Trace results ... 227

Phase Error vs Chip
Evaluation ... 24
Trace results ... 227
Phase offset ... 16, 19
Calculating ... 102
Retrieving ... 217
PICH ... 46
Power reference ... 102
Softkey ... 112
Pilot
Power ... 16
Pilot Power
K83 ... 102
PN offset ... 41, 56
False (Measurement example) ... 123
Power
Absolute ... 16, 19
Alias ... 21, 40
Channels ... 16, 19, 30, 95
Pilot ... 16
Reference ... 102
Reference (Display) ... 12
Relative ... 16, 19
Threshold ... 84
Total ... 16
vs PCG ... 26
vs symbol ... 26
Power control groups
see PCG ... 14, 37
Power vs PCG
Evaluation method ... 26
Trace results ... 226
Power vs Symbol
Evaluation method ... 26
Trace results ... 227
Preamplifier
Setting ... 73
Softkey ... 73
Predefined channel tables
Antenna diversity ... 44
BTS ... 255, 257
BTS application ... 85
Channel detection ... 44
MS application ... 85
Provided ... 85
Restoring ... 86
Using ... 84
Presetting
Channels ... 54
Pretrigger ... 78
Programming examples
CDMA2000 ... 252
Protection
RF input (remote) ... 144

Q

Quasi-inactive codes ... 44

R

Radio configuration
see RC ... 19, 42
Range
Scaling ... 74
RC ... 19, 42
BTS application ... 42
Channel table ... 89
Channel tables ... 255
Retrieving ... 217
Reference level ... 71
Auto level ... 71, 94
Offset ... 71
Unit ... 71
Value ... 71
Reference power ... 102
Release notes ... 8
Remote commands
Basics on syntax ... 127
Boolean values ... 131
Capitalization ... 129
Character data ... 131
Data blocks ... 132
Deprecated ... 251
Numeric values ... 130
Optional keywords ... 129
Parameters ... 130
Strings ... 132
Suffixes ... 129
Resetting
RF input protection ... 144
Restoring
Channel settings ... 54
Predefined channel tables ... 86
Result displays
CDA ... 17
Channel Bitstream ... 17
Code Domain Error Power ... 20
Code Domain Power ... 20
Composite Constellation ... 21
Composite EVM ... 22
Configuring ... 51
Configuring (remote) ... 199
Diagram ... 34
Marker table ... 35
Peak Code Domain Error ... 24
Peak list ... 36
Power vs PCG ... 26
Power vs Symbol ... 26
Result Summary ... 27, 35
see also Evaluations ... 14
Symbol Constellation ... 27
Symbol EVM ... 28
Result Summary
Channel results ... 16
Evaluation method ... 27, 35
General Results ... 15
PCG results ... 15
Result display ... 35
Trace results ... 227
Results
Calculated (remote) ... 212
Evaluating ... 100
Exporting (remote) ... 229
Retrieving (remote) ... 212
RF (remote) ... 230
Trace (remote) ... 214
Trace data query (remote) ... 216, 217
Retrieving
Calculated results (remote) ... 212
Results (remote) ... 212

RF Results (remote) ... 230
Trace results (remote) ... 214
RF attenuation
Auto ... 71
Manual ... 71
RF input ... 61
Overload protection (remote) ... 144
Remote ... 143
RF measurements
Analysis ... 100
Analysis (remote) ... 199
cdma2000 ... 29
Configuring ... 95
Configuring (remote) ... 198
Performing ... 116
Results ... 29
Results (remote) ... 230
Types ... 29
RF Power
Trigger level (remote) ... 177
RF signal power ... 30, 95
RHO factor ... 16
Measurement examples ... 125
Roll-off factor
RRC filter ... 57, 60
RRC Filter
Cut-off frequency ... 57, 60
Multicarrier ... 56, 59
Roll-off factor ... 57, 60
RUN CONT
Key ... 92
RUN SINGLE
Key ... 92, 93

S

S1CH ... 46
Safety instructions ... 8
Sample rate ... 81
Configuring in channel table ... 89, 91
Scaling
Amplitude range, automatically ... 74
Configuration, softkey ... 74
Y-axis ... 74
Scrambling ... 41
Security procedures ... 8
Select meas ... 51
SEM
Bandclasses ... 97, 98, 261
cdma2000 results ... 31
Configuring (cdma2000) ... 97
Measurement examples ... 119
Sequencer ... 11, 51
Activating (remote) ... 210
Remote ... 209
Sequences
Aborting (remote) ... 210
Mode (remote) ... 210
Service manual ... 7
Sets
Captured ... 82
Definition ... 37
Evaluation range ... 82, 104
Selecting ... 82, 104
Stored ... 82
Settings
Overview ... 53
Show inactive channels ... 19
Signal capturing
Remote commands ... 182
Softkey ... 80
Signal channel power
Measurement examples ... 118
Signal description
BTS (remote) ... 138
BTS Configuration ... 55
Configuring ... 55
MS (remote) ... 141
MS Configuration ... 57
Remote commands ... 138
Softkey ... 55
Single sweep
Softkey ... 92
Slope
Trigger ... 78, 178
Softkeys
Amplitude Config ... 69
Auto All ... 93
Auto Level ... 71, 94
Bandclasses ... 97, 98
Capture Offset ... 78
Center ... 68
Channel Detection ... 82
Code Domain Settings ... 100
Continue Single Sweep ... 93
Continuous Sweep ... 92
Digital I/Q ... 76
Display Config ... 14, 51
Evaluation Range ... 103
External ... 76
Free Run ... 76
Frequency Config ... 68
IF Power ... 77
Input Source Config ... 60
Lower Level Hysteresis ... 95
Marker Config ... 106
Meastime Auto ... 94
Meastime Manual ... 94
Min ... 111
Next Min ... 111
Next Peak ... 111
Norm/Delta ... 108
Outputs Config ... 65
Peak ... 111
PICH ... 112
Preamp ... 73
Ref Level ... 71
Ref Level Offset ... 71
RF Atten Auto ... 71
RF Atten Manual ... 71
Scale Config ... 74
Signal Capture ... 80
Signal Description ... 55
Single Sweep ... 92
Sweep Config ... 91
Sweep Count ... 92
TDPICH ... 112
Trace Config ... 104
Trigger Config ... 75
Trigger Offset ... 78
Upper Level Hysteresis ... 95

Sort order
  Bit-Reverse ... 39
  Codes ... 20, 102
  Hadamard ... 39
Span
  Menu ... 52
Speaker
  Remote control ... 164
Special channels
  ACKCH ... 46
  BTS ... 45
  CCCH ... 46
  CQICH ... 46
  DCCH ... 46
  EACH ... 46
  F-CHAN ... 45
  F-PDCCH ... 45
  F-PDCH ... 45
  F-PICH ... 45
  F-SYNC ... 45, 46
  F-TDPICH ... 45, 46
  FCH ... 46
  MS ... 46
  PICH ... 46
  S1CH ... 46
  Transmit diversity ... 46
Specifications ... 8
Specifics for
  Configuration ... 54
Spectrum Emission Mask
  see SEM ... 31
Spreading factor ... 19, 37, 38
  Base ... 24
  Display ... 101
  Relationship to code class ... 38
  Relationship to symbol rate ... 38
Status
  Bar ... 13
  Channels ... 19, 89, 91, 189
Status registers
  Contents ... 248
  Querying ... 248
  STAT:QUES:POW ... 144
  STATus:QUEStionable:DIQ ... 153
Suffixes
  Common ... 132
  Remote commands ... 129
Sweep
  Aborting ... 92, 93
  Configuration (softkey) ... 91
  Configuring (remote) ... 190
Sweep Count ... 92
Symbol Constellation ... 27
  Evaluation method ... 27
  Trace results ... 228
Symbol EVM ... 16, 19
  Evaluation method ... 28
  Trace results ... 229
Symbol Magnitude Error
  Evaluation ... 28
  Trace results ... 229
Symbol Phase Error
  Evaluation ... 29
  Trace results ... 229
Symbol rate ... 19, 37
  Display ... 12
  Relationship to code class ... 38
  Relationship to spreading factor ... 38
Symbols
  Constellation ... 27
  Number per PCG ... 37
  Power ... 26
Synchronization
  Reference frequencies ... 121

T

TDPICH
  Softkey ... 112
Test setup ... 47
  Connections ... 47
  Equipment ... 47
  Presettings ... 48
Threshold
  Active channels ... 84
Timing offset ... 16, 19
  Calculating ... 102
  Retrieving ... 217
Title bar
  Window ... 13
Traces
  Configuration (softkey) ... 104
  Configuring (remote) ... 234
  Exporting (remote) ... 229
  Mode ... 105
  Mode (remote) ... 234
  Results (remote) ... 214, 216, 217
Transmit diversity ... 43
  Number of symbols ... 37
  Required channels ... 46
Trigger
  Adjusting (Measurement example) ... 123
  CDP (Measurement example) ... 122
  Configuration (remote) ... 174
  Configuration (softkey) ... 75
  External (remote) ... 178
  Offset ... 78
  Output ... 79
  Slope ... 78, 178
Trigger level ... 77
  External trigger (remote) ... 176
  IF Power (remote) ... 177
  RF Power (remote) ... 177
Trigger source ... 76
  Digital I/Q ... 76
  External ... 76
  Free Run ... 76
  IF Power ... 77
Trigger to frame ... 15
Troubleshooting ... 113
  Input overload ... 144

U

UE (User equipment)
  see MS (Mobile station) ... 10
Units
  Reference level ... 71
Upper Level Hysteresis ... 95

V

Videos ... 9
Volume
    Remote control ... 164

W

Walsh code ... 19
White papers ... 9
Windows
    Adding (remote) ... 201
    Closing (remote) ... 207
    Configuring ... 54
    Layout (remote) ... 205
    Maximizing (remote) ... 200
    Querying (remote) ... 203
    Replacing (remote) ... 204
    Splitting (remote) ... 200
    Title bar ... 13
    Types (remote) ... 201

X

X-value
    Marker ... 107

Y

Y-maximum, Y-minimum
    Scaling ... 74
YIG-preselector
    Activating/Deactivating ... 63
    Activating/Deactivating (remote) ... 145