Software Manual

cdma2000/1xEV-DV Mobile Station Test

Application Firmware R&S FS-K83

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Contents of the Software Manual for Application Firmware R&S FS-K83

This software manual contains information on operation of the R&S FSU and R&S FSP spectrum analyzers and the R&S FSQ signal analyzer configured with Application Firmware R&S FS-K83. It includes a description of the menus and the remote-control commands for the cdma2000 mobile station test application firmware.
All other aspects of analyzer operation can be taken from the operating manual of the analyzer.

The software description of the application firmware consists of the data sheet and 10 chapters:

The **data sheet**   provides information on the typical specifications and the firmware characteristics.

Chapter 1   describes how you enable the application firmware.

Chapter 2   describes typical examples of measurements by means of tests.

Chapter 3   describes the test setup for mobile station tests.

Chapter 4   describes the predefined channel tables.

Chapter 5   provides a schematic overview of the control menus.

Chapter 6   contains a detailed description of all functions for mobile station tests as a reference for manual operation. The chapter also lists the corresponding IEC-bus command for each function.

Chapter 7   describes all the remote-control commands that have been defined for the application firmware. At the end of the chapter there is a table showing the assignment of the IEC-bus commands to the softkeys.

Chapter 8   describes testing of the rated specifications.

Chapter 9   contains code tables in Hadamard and BitReverse order.

Chapter 10   explains the expressions used for the measured variables in code domain measurement.

Chapter 11   contains the index for this software manual.

cdma2000 Mobile Station Test Application Firmware R&S FS-K83

When configured with Application Firmware R&S FS-K83, the analyzer performs code domain power measurements on reverse link signals (mobile station) on the basis of the 3GPP2 Standard (Third Generation Partnership Project 2).

"**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 form the basis.
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 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 at least active in one of captured power control groups (pilot gating). In addition to the code domain measurements described in the cdma2000 Standard, the application features measurements in the spectral range such as channel power, adjacent channel power, occupied bandwidth and spectrum emission mask with predefined settings.

1 Installing and Enabling the Application Firmware

Installation

If Application Firmware R&S FS-K83 has not been installed on the device, a firmware update will have to be performed. This will have been done already if the application software was installed at the factory.

Before the application firmware can be installed, a corresponding basic firmware of the basic device has to be installed on the analyzer. Refer to the release notes of the current Application Firmware R&S FS-K83 for the compatible versions.
If the basic firmware has to be updated, start the firmware update from the current floppy disks of the basic firmware by successively pressing *SETUP → NEXT → FIRMWARE UPDATE*.

If the correct basic firmware is installed, the firmware update for the application firmware is started from the floppy disks for the firmware of the R&S FS-K83 application using the same key sequence - *SETUP → NEXT → FIRMWARE UPDATE*.
Following installation, the application firmware has to be enabled as described below.

Enabling

Application Firmware R&S FS-K83 is enabled in the *SETUP → GENERAL SETUP* menu by entering a keyword. The keyword is supplied with the application firmware. When the application software is installed before the device leaves the factory, the application firmware will already have been enabled.

GENERAL SETUP menu:
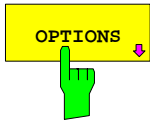
OPTIONS

The OPTIONS softkey opens a submenu in which the keywords can be entered for the application firmware. The available applications are displayed in a table, which is opened when you enter the submenu.
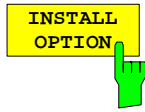
INSTALL OPTION

The *INSTALL OPTION* softkey activates input of the keyword for an application firmware.

One or several keywords can be entered in the input field. If the keyword is valid, the message *OPTION KEY OK* is displayed and the application firmware is entered in the *FIRMWARE OPTIONS* table.

If a keyword is invalid, the message *OPTION KEY INVALID* is displayed.

If the version of the application firmware and the version of the basic firmware are not compatible, an appropriate message is issued. In this instance, follow the instructions contained in the previous section, "Installation".

2 Getting Started

The following chapter explains basic cdma2000 mobile station tests using a test setup with the Signal Generator SMIQ as the device under test. It describes how operating and measuring errors can be avoided by means of correct default settings.
The measurement screen is presented in Chapter 6 for the different measurements.

Attention is drawn to important settings exemplifying how to avoid measurement errors during measurements. The correct setting is followed by the effect of an incorrect setting. The following measurements are performed:

- Measurement 1: Measurement of the signal spectrum

- Measurement 2: Measurement of the spectrum emission mask

- Measurement 3: Measurement of the relative code domain power and the frequency error
  - Setting: Center frequency

- Measurement 4: Triggered measurement of the relative code domain power
  - Setting: Trigger offset

- Measurement 5: Measurement of the composite EVM

- Measurement 6: Measurement of the peak code domain error

- Measurement 7: Measurement of the RHO factor

The cdma2000 raw data are created with the R&S WinIQSIM software and loaded into the arbitrary waveform generator of the SMIQ.

The measurements are performed with the following instruments and aids:

- Spectrum Analyzers R&S FSU, R&S FSP or Signal Analyzer R&S FSQ with Application Firmware R&S FS-K83 (mobile station test for cdma2000).
- Vector Signal Generator SMIQ with hardware options B11 (data generator) / B20 (modulation coder) and B60 (arbitrary waveform generator) together with firmware version 5.20 or higher with enabled option K12 cdma2000 and SMIQ-Z5 PARDATA BNC ADAPTER for external trigger signal.
- PC that is either connected by means of a serial cable to the SMIQ, or has an IEC-bus card and connected by means of an IEC-bus cable to the SMIQ. R&S WinIQSIM Software V3.20 or higher is installed on that PC. The software can be downloaded from the Rohde & Schwarz web site on the Internet at http://www.rohde-schwarz.com.
- 1 coaxial cable, 50 Ω, approximately 1 m, N connector
- 2 coaxial cables, 50 Ω, approximately 1 m, BNC connector

Generating a cdma2000 reverse link signal with WinIQSIM

The WinIQSIM software can be downloaded at http://www.rohde-schwarz.com and is installed on a PC. The WinIQSIM software can be used to generate cdma2000 reverse link signals, which are then transferred on an SMIQ or AMIQ. An explanation is given below of how the test signal described in the cdma2000 standard is generated. WinIQSIM version 3.20 or higher is assumed.

Selecting Start and Standard:

Start **WinIQSIM.exe**.
In the **File** menu, select the **New** option and select **CDMA2000** from the list that follows. The CDMA2000 dialog box appears.
Under General Settings, first select **Reverse Link** to switch to the mobile station signals. Activate **MS1** by clicking **ON** and then click **MS1** to configure mobile station 1.

Set RC 3 for Radio Configuration. The dialog box looks like the one below:
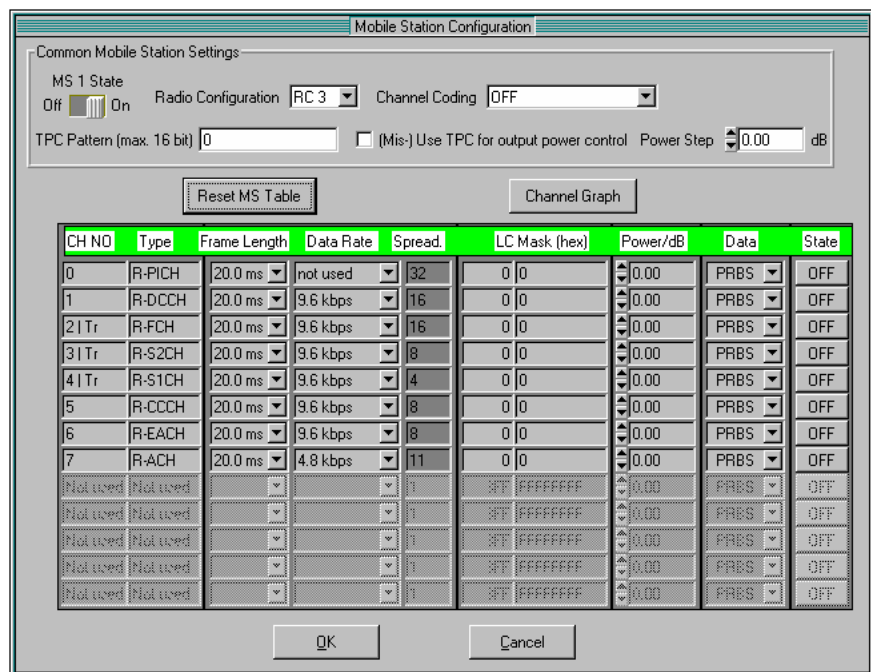
Fig. 2-1   WinIQSIM mobile station configuration for RC 3 prior to defining the active channels

Activate channels:

In this **mobile station configuration**, the following settings are performed so that a reverse link signal with pilot channel (PICH), fundamental channel (FCH) and supplemental channel 1 (S1CH) is generated.
Set **PICH State, FCH State** and **S1CH State** to **ON**. Set the data rate for the FCH to 19.2 kbps and the data rate for the S1CH to 76.8 kbps; these are the highest data rates at which the FCH is sent with code number 4 at spreading factor 16 (Q branch) and the S1CH is sent with code number 2 at spreading factor 4 (Q branch). The data rate cannot be modified at the pilot; is always sent with code number 0 at spreading factor 32 (I branch).
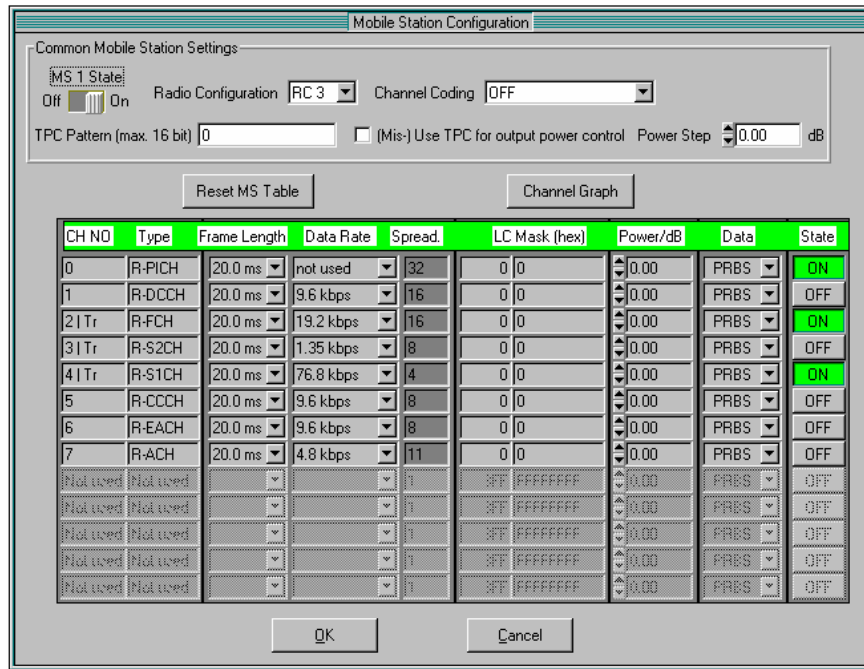
Fig. 2-2   WinIQSIM configuration with active channels

Define trigger settings: Then, set the trigger settings on the **SMIQ** menu by choosing the option
                             Trigger Output Settings. For the **Current Mode**: **Mode 1** the **Restart
                             Clock (SEQUENCE)** is defined. This means that the trigger at the slot
                             limit is available every 80 ms at TRIG1 of the SMIQ Z5 BNC adapters.
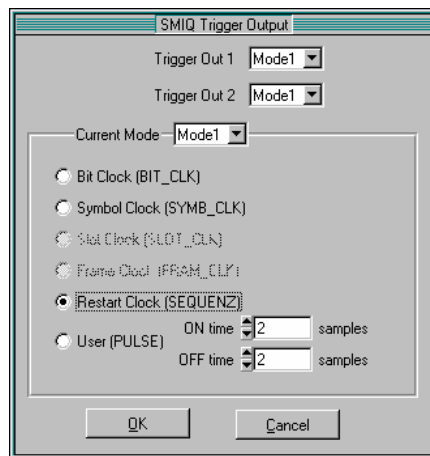
Fig. 2-3   WinIQSIM base station configuration of the finished model

Save and download to   Save this cdma2000 configuration with **File|Save** as file 'C2KMS.IQS'.
SMIQ: Connect the SMIQ either serially or by means of an IEC-bus card and
                             IEC-bus cable to the SMIQ and, in the **SMIQ|TRANSMISSION** menu,
                             load the generated signal under the name 'C2KMS' onto the SMIQ.

Default settings in cdma2000 MS operating mode

At the default setting after PRESET, the analyzer is in SPECTRUM mode. The following basic settings of the code domain measurement are not activated until the cdma2000 MS operating mode is selected by operating the CDMA2k MS hotkey.

Table 2-1   Default setting of code domain measurement after preset

Parameter	Setting
Digital standard	CDMA 2000 MC1 (MC1 stands for Multi-Carrier 1 and thus describes cdma2000 1X, i.e. a carrier)
Band class	Band class 0 (800 MHz band)
Sweep	CONTINUOUS
CDP mode	CODE CHAN AUTOSEARCH
Trigger setting	FREE RUN
Trigger offset	0 s
Long code mask	0
Long code offset	0 chips
Threshold value	-40 dB
Code number	0
PCG number	0
Capture length	3 PCGs (PCG stands for Power Control Group)
Code order	Hadamard
Analysis	Screen A: CODE PWR RELATIVE
	Screen B: RESULT SUMMARY

The following conventions apply for displaying settings on the analyzer:

[***<Key>***]   Press a key on the front panel, e.g. ***[SPAN]***

[<SOFTKEY>]   Press a softkey, e.g. *[MARKER -> PEAK]*

[<nn unit>]   Enter a value and terminate by entering the unit, e.g. *[12 kHz]*

The following conventions apply for displaying settings on the SMIQ:

[***<Key>***]   Press a key on the front panel, e.g. ***[FREQ]***

<MENU>   Choose a menu, parameter or setting, e.g. *DIGITAL STD.*The menu level is identified by indenting.

<nn unit>   Enter a value and terminate by entering the unit, e.g. *12 kHz*

Measurement 1: Measurement of the signal power

Measurement of the spectrum provides an overview of the cdma2000 signal and the carrier-oriented spurious emissions.

Test setup   ➢ Connect the RF output of the SMIQ to the RF input of the analyzer
                                (coaxial cable with N connectors).

Settings on SMIQ: *[PRESET]*
                              [LEVEL: *0 dBm]*
                              [FREQ: *833.49 MHz]*
                              ARB MOD
                                  SET SMIQ ACCORDING TO WAVEFORM ...
                                      SET SMIQ ACCORDING TO WAVEFORM   ON
                                          IQ SWAP (VECTOR MODE)   ON
                                          TRIGGER OUT MODE   ON
                              (These three settings are only required once after generator preset and are used to apply, in VECTOR MODE, the IQ SWAP and, in ARB MOD, the trigger setting automatically from the waveform file generated by WinIQSIM. This is particularly convenient when a switch is made between different waveforms.)

                                      SELECT WAVEFORM... select name C2KMS'
                                      STATE: ON

Setting on analyzer: *[PRESET]*
                              [FREQUENCY: *833.49 MHz]*
                              [AMPT: *0 dBm]*
                              [CDMA2k MS]
                              [MEAS: *POWER]*

Measurement on analyzer: The following are displayed:

                              • The spectrum of the cdma2000 signal

                              • The channel power of the signal within the 1.2288 MHz channel
                                bandwidth

Measurement 2: Measurement of the spectrum emission mask

The cdma2000 specification calls for a measurement which monitors compliance with a spectral mask in a range of at least ±4.0 MHz around the cdma2000 carrier. To assess the power emissions within the specified range, signal power is measured with a 30 kHz filter. The ensuing trace is compared with the limit line, defined in the cdma2000 specification, according to the selected band class.

Test setup	➢ Connect the RF output of the SMIQ to the RF input of the analyzer (coaxial cable with N connectors).
Settings on SMIQ:	*SMIQ settings as for measurement 1*
Setting on analyzer:	***[PRESET]*** *Band class 0 is thus selected* ***[FREQUENCY:*** *833.49 MHz**]*** ***[AMPT:*** *0 dBm**]*** *[CDMA2k MS]* ***[MEAS:*** *SPECTRUM EM MASK**]***

Measurement on analyzer: The following are displayed:

- The spectrum of the cdma2000 signal

- The limit line defined in the standard

- Information on limit line overranging (passed/failed)

- If available, the largest overrange with frequency and level value

Measurement 3: Measurement of the relative code domain power and the frequency error

Measurement of the code domain power on a test model (with 3 channels) is shown below. In this case the basic parameters of the CDP measurements, which allow analysis of the signal, reset successively from values adjusted to the test signal to those that have not been adjusted in order to demonstrate the resulting effects.

Settings on SMIQ:	➢ Connect the RF output of the SMIQ to the RF input of the analyzer.
	➢ Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)
Settings on SMIQ:	*SMIQ settings as for measurement 1*
Setting on analyzer:	*[PRESET]*
	[FREQUENCY: *833.49 MHz]*
	[AMPT: *10 dBm]*
	[CDMA2k MS]
Measurement on analyzer:	The following are displayed:

Screen A:	Code domain power of signal (model with 3 channels)
Screen B:	Numerical results of CDP measurement including the frequency error

Setting: Synchronizing the reference frequencies

Synchronization of the transmitter and receiver to the same reference frequency reduces the frequency error.

Test setup
> Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)

Settings on SMIQ:
As for measurement 1

Setting on analyzer:
As for measurement 3, plus
[SETUP: *REFERENCE EXT]*

Measurement on analyzer: Screen B: Frequency error: The displayed frequency error should be < 10 Hz.

The reference frequencies of the analyzer and the device under test should be synchronized.

Setting: Behaviour with deviating center frequency setting

In the following setting, the behaviour of the device under test and analyzer on a deviating center frequency setting is shown.

Settings on SMIQ:
> Tune the center frequency of the signal generator in 0.1 kHz steps and watch the analyzer screen:

Measurement on analyzer:
- Up to about 2.0 kHz frequency error, a CDP measurement is still possible on the analyzer. A difference in the measurement accuracy of the CDP measurement is not discernible up to this frequency error.

- From a frequency offset of 2.3 kHz and higher, the probability of an impaired synchronization increases. The 'SYNC FAILED' message appears.

Settings on SMIQ:
> Set the signal generator center frequency again to 833.49 MHz:
[FREQ: *833.49 MHz]*

The center frequency of the analyzer must agree with the frequency of the device under test to within a 2.0 kHz offset.

Measurement 4: Triggered measurement of the relative code domain power

If the code domain power measurement is performed without external triggering, an extract is recorded from the test signal at a random point in time and attempts to detect the start of power control group (PCG) in it. To detect this start, all possibilities of the PN sequence location have to be tested in Free Run mode. This requires computing time. This computing time can be reduced by creating an external (frame) trigger. The search range for the start of the power control group are known and fewer options have to be tested.

Test setup	➢ Connect the RF output of the SMIQ to the RF input of the analyzer
	➢ Connect the reference frequencies (refer to measurement 2)
	➢ Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).
Settings on SMIQ:	As for measurement 1
Setting on analyzer:	As for measurement 3, plus **[TRIG: EXTERN]**
Measurement on analyzer:	The following are displayed:

Screen A: Code domain power of signal
Screen B: Numerical results of CDP measurement

Trg to Frame: Time offset between trigger event and start of the PCG

The repetition rate of the measurement increases compared with measurement without an external trigger.

Setting: Trigger offset

Any delay of the trigger event compared to the start of the PCG can be compensated by changing the trigger offset.

Setting on analyzer:	As for measurement 3, plus **[TRIG:]** *[TRIG OFFSET 100 µs]*
Measurement on analyzer:	The parameter "Trg to Frame" in the numerical results table (Screen B) changes: *Trg to Frame -100 µs*

A trigger offset compensates analog delays of the trigger event.

Measurement 5: Measurement of the composite EVM

Composite EVM is the measurement of the mean square error of the total signal, as defined in the cdma2000 specification.
An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other; the square deviation produces the Composite EVM measurement.

Test setup	➢ Connect the RF output of the SMIQ to the RF input of the analyzer (coaxial cable with N connectors)
	➢ Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)
	➢ Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer: **[PRESET]**
[FREQUENCY: *833.49 MHz***]**
[AMPT: *10 dBm***]**
[CDMA2k MS]
[TRIG *EXTERNAL***]**
[RESULTS *COMPOSITE EVM*]

Measurement on analyzer: The following are displayed:

Screen A: Code domain power of signal

Screen B: Composite EVM (EVM for total signal)

Measurement 6: Measurement of the peak code domain error

With the peak code domain error measurement, an ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other; the difference between the two signals is projected to the class of the base spreading factor. The peak code domain error measurement is obtained by summing the symbols of each difference signal PCG and searching for the maximum error code.

Test setup	➢ Connect the RF output of the SMIQ to the RF input of the analyzer (coaxial cable with N connectors)
	➢ Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer:
[PRESET]
[FREQUENCY: *833.49 MHz***]**
[AMPT: *0 dBm***]**
[CDMA2k MS]
[RESULTS   PEAK CODE DOMAIN ERR]

Measurement on analyzer: The following are displayed:

Screen A: Code domain power of signal

Screen B: Peak code domain error (for base spreading factor with default value 64)

Measurement 7: Measurement of the RHO factor

A measurement of the RHO factor is shown in the following. The RHO quality parameter should be measured using a signal which only contains the pilot channel. Accordingly, only the pilot has to be activated in a WinIQSIM model.

Settings on SMIQ:	➢ Connect the RF output of the SMIQ to the RF input of the analyzer.
	➢ Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)
Settings on SMIQ:	*SMIQ settings as for measurement 1, but only the pilot has to be activated in the WinIQSIM model.*
Setting on analyzer:	*[PRESET]*
	[FREQUENCY: *833.49 MHz]*
	[AMPT: *10 dBm]*
	[CDMA2k MS]

Measurement on analyzer: The following are displayed:

Screen A: Code domain power of signal (only pilot from 0.32)

Screen B: Numerical results of CDP measurement including the RHO factor

3 Test Setup for Mobile Station Tests

> ⚠️ ***Note:***
>
> *Before putting the device into operation, make sure that*
>
> - *The housing covers are in place and their screws have been tightened*
> - *The ventilation slits are free*
> - *No signal voltage levels above the permissible limits are applied to the inputs*
> - *The outputs of the device are not overloaded or wrongly connected*
>
> ***Failure to comply with the above points may result in damage to the device.***

This chapter describes the default settings of the analyzer for operation as a cdma2000 mobile station tester. A condition that has to be met before measurements can start is that the analyzer is correctly configured and supplied with power, as described in Chapter 1 of the operating manual for the basic device. Furthermore, Application Firmware R&S FS-K83 must be enabled. Installation and enabling of the application firmware are explained in Chapter 1 of this software manual.

Standard test setup
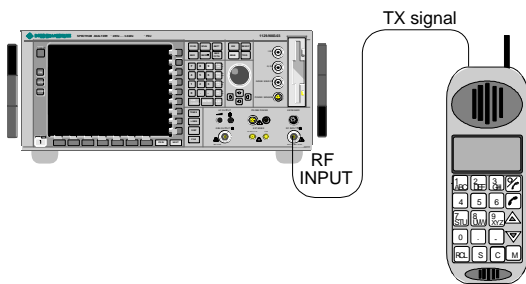
Fig. 3-1   MS test setup

➢ Connect the antenna output (or TX output) of the mobile station by means of a power attenuator exhibiting suitable attenuation to the RF input of the analyzer.
The following level values for external attenuation are recommended to ensure that the RF input of the analyzer is protected and the sensitivity of the device is not impaired too much:

Maximum power	Recommended external attenuation
$\geq$ 55 to 60 dBm	35 to 40 dB
$\geq$ 50 to 55 dBm	30 to 35 dB
$\geq$ 45 to 50 dBm	25 to 30 dB
$\geq$ 40 to 45 dBm	20 to 25 dB
$\geq$ 35 to 40 dBm	15 to 20 dB
$\geq$ 30 to 35 dBm	10 to 15 dB
$\geq$ 25 to 30 dBm	5 to 10 dB
$\geq$ 20 to 25 dBm	0 to 5 dB
20 dBm	0 dB

➢ For signal measurements at the output of two-port networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (*EXT REF IN/OUT*).

➢ To maintain the error limits called for in the cdma2000 specification during frequency measurement on mobile stations, the analyzer has to be operated on an external reference. The reference source might be a rubidium frequency standard, for example.

➢ If the mobile station has a trigger output, connect the trigger output of the mobile station to the rear trigger input of the analyzer (*EXT TRIG GATE*).

Default settings

➢ Enter the external attenuation.	**[AMPT] [NEXT]** *[REF LVL OFFSET]*.
➢ Enter the reference level.	**[AMPT]**
➢ Enter the center frequency.	**[FREQUENCY]**
➢ Set the trigger.	**[TRIG]**
➢ During use, switch on external reference.	**[SETUP]** *[REF: EXT]*
➢ Select the standard and the desired measurement.	*[CDMA2k MS] [RESULTS]*

4 Predefined Channel Tables

By default, the application firmware works in automatic Channel Search mode (softkey *CODE CHAN AUTOSEARCH*). However, there is also the option of using predefined channel tables and taking the code domain analysis as a basis. To do this, select the channel table and enable the predefined search mode (softkey *CODE CHAN PREDEFINED*). In accordance with the cdma2000 specification, different channel tables are defined for the various operating modes. They are listed below. Should channels other than those that appear in the predefined channel tables of the firmware application be used, the original tables should be copied and the channels adapted in the copy. (Refer to the *CHAN CONF* hotkey on page 73.) With supplemental channels, it is also possible to adapt the code number and spreading factor.

Channel table for ***E***NHANCED ***A***CCESS ***CH***ANNEL ***OP***ERATION with PICH and EACH with the name **EACHOP**.

Table 4-1   Channel table for enhanced access channel operation

Channel type	Code channel (Walsh Code.SF)	Mapping
PICH	0.32	I
EACH	2.8	Q

Channel table for ***R***EVERSE ***C***OMMOM ***C***ONTROL ***CH***ANNEL ***OP***ERATION with PICH and CCCH with the name **RCCCHOP**.

Table 4-2   Channel table for reverse commom control channel operation

Channel type	Code channel (Walsh Code.SF)	Mapping
PICH	0.32	I
CCCH	2.8	Q

Channel table for ***R***EVERSE ***T***RAFFIC ***CH***ANNEL ***OP***ERATION *with the following **3** channels:* PICH/DCCH/FCH with the name **RTCHOP3**.

Table 4-3   Channel table for ***R***EVERSE ***T***RAFFIC ***CH***ANNEL ***OP***ERATION 3

Channel type	Code channel (Walsh Code.SF)	Mapping
PICH	0.32	I
FCH	4.16	Q
S1CH	2.4	Q

Channel table for *REVERSE TRAFFIC CHANNEL OPERATION with the following 5 channels:* *PICH/DCCH/FCH/S1CH/S2CH* with the name **RTCHOP5**.

Table 4-4   Channel table for **R**EVERSE **T**RAFFIC **CH**ANNEL **OP**ERATION 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

For further information on the channel table defaults, refer to hotkey *CHAN CONF*.

The channel abbreviations are defined in Chapter 10 "Glossary".

5 Menu Overview

Application Firmware R&S FS-K83 (cdma2000 mobile station tests) adds RF measurements and code domain power measurements for the cdma2000 Forward Link mobile radio standard to the analyzer.
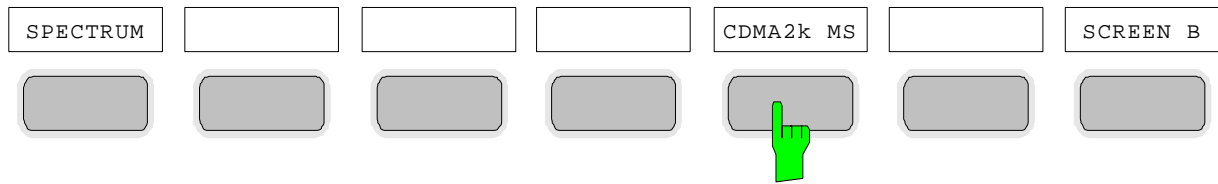
Fig. 5-1   Hotkey bar with enabled Application Firmware R&S FS-K83

After the application firmware has been called by operating hotkey *CDMA2k MS* (2k stands for 2 thousand, i.e. cdma2000), a new hotkey bar is displayed at the bottom edge of the screen and the code domain analyzer is selected and started.

EXIT CDMA	MEAS		CHAN CONF	SETTINGS	RESULTS	SCREEN B

POWER	CODE CHAN AUTOSEARCH		BAND CLASS	LONG CODE MASK		CODE DOM POWER	CHANNEL TABLE	SYMBOL CONST
ACLR	CODE CHAN PREDEFINED		BASE SF	LONG CODE OFFSET		CODE DOM ERROR	PEAK CODE DOMAIN ERR	SYMBOL EVM
SPECTRUM EM MASK			CAPTURE LENGTH			COMPOSITE EVM	POWER VS PCG	
OCCUPIED BANDWITH	EDIT CHAN CONF TABLE		ORDER HADAM BITRE	INACT CHAN THRESHOLD		RESULT SUMMARY	POWER VS SYMBOL	
CODE DOM ANALYZER	NEW CHAN CONF TABLE		CODE DOM OVERVIEW			COMPOSITE CONST	BITSTREAM	
SIGNAL STATISTIC	DEL CHAN CONF TABLE		SELECT I Q			SELECT I Q	SELECT I Q	SELECT I Q
	COPY CHAN CONF TABLE		CODE PWR ABS REL	INVERT Q ON OFF		SELECT CHANNEL	SELECT CHANNEL	SELECT CHANNEL
			POWER REF TOT PICH	SIDE BAND NORM INV		SELECT PCG	SELECT PCG	SELECT PCG
	RESTORE STD TABLES		TIME/PHASE ON OFF	NORMALIZE ON OFF		ADJUST REF LVL	ADJUST REF LVL	ADJUST REF LVL

HEADERS VALUES	16
INSERT LINE	32
	64
DELETE LINE	
MEAS CHAN CONF TABLE	
SAVE TABLE	
SORT TABLE	
PAGE UP	
PAGE DOWN	

Fig. 5-2   Overview of the menus in Application Firmware R&S FS-K83

There are different analyses for the code domain analyzer. They can be selected by means of the *RESULTS* hotkey. The *SETTINGS* hotkey allows the application firmware to be parameterized. The base spreading factor or the band class can be set in this menu, for example. The *CHAN CONF* hotkey is used to set Channel Search mode for the code domain analyzer. Furthermore, the customer can also define his own channel tables.

The MEAS hotkey is identical to the MEAS key (on the right of the front panel) and is used to select the different RF measurements or the code domain analyzer.

Clicking the *CHAN CONF* or *RESULTS* hotkey automatically switches to the code domain analyzer.

Pressing the *EXIT CDMA* hotkey once exits R&S FS-K83. The hotkey bar of the basic device is displayed again and the analyzer goes to SPECTRUM, the default mode.

Transition from the SPECTRUM operating mode to the application firmware:

The following user-specific settings are not modified so that the adaptation to the device under test is retained:

Reference Level + Rev Level Offset

Center Frequency + Frequency Offset

Input Attenuation + Mixer Level

The following user-specific settings are transferred as follows:

External trigger sources are retained, while all other trigger sources result in Free Run mode.   Additional trigger settings are retained.

Transition from the application firmware to the SPECTRUM operating mode:

The following user-specific settings are not modified so that the adaptation to the device under test is retained:

Reference Level + Rev Level Offset

Center Frequency + Frequency Offset

Input Attenuation + Mixer Level

The following user-specific settings are transferred as follows:

The trigger source is switched to FREE RUN and an analyzer frequency sweep is set with the   SPAN equal to the double the center frequency, or the maximum possible span, so that the   center frequency remains unchanged at any event.

The measurements available in R&S FS-K83 can be selected by means of the *MEAS* hotkey or the *MEAS* key:
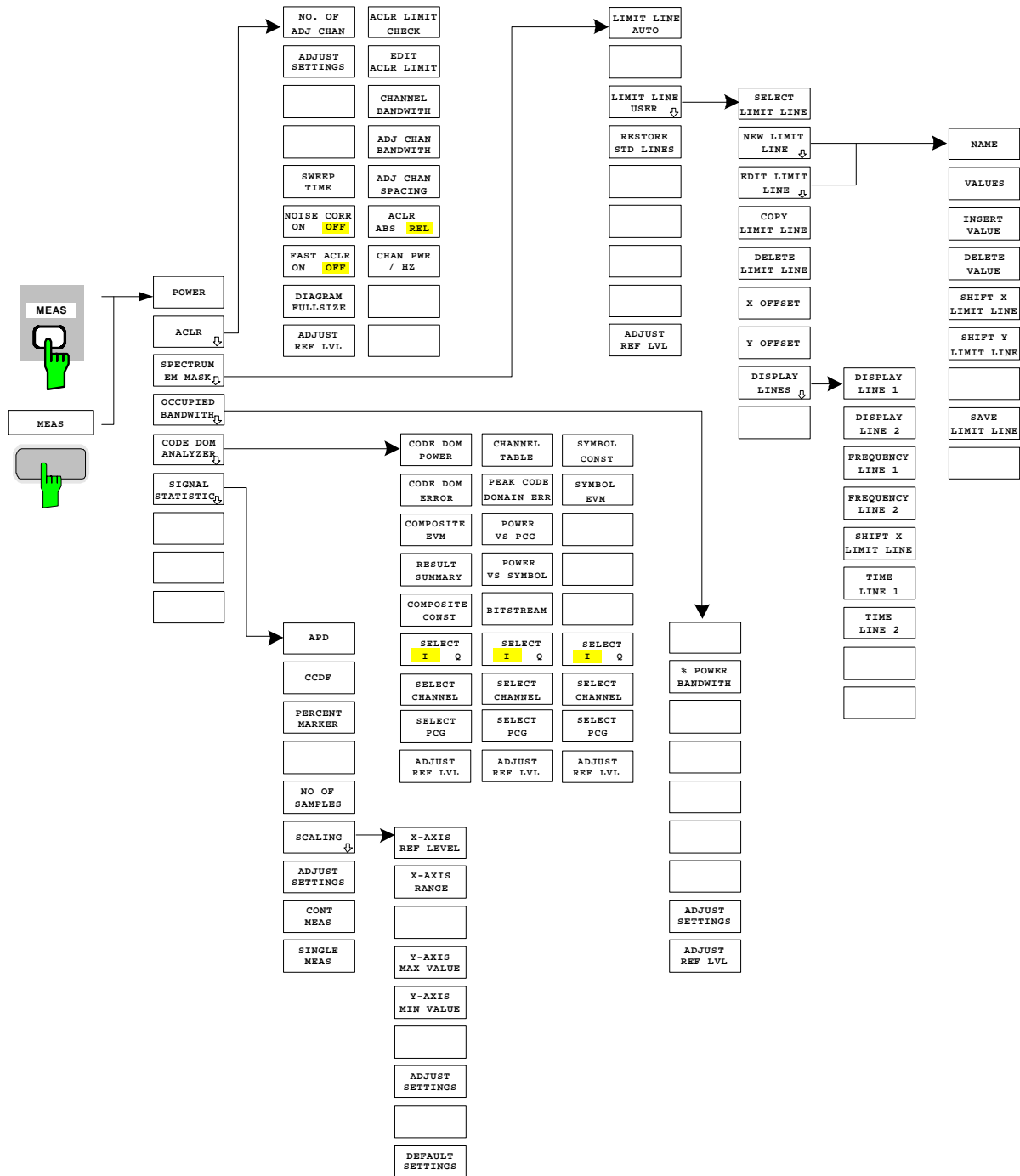
Fig. 5-3   Overview of menus

6 Configuration of cdma2000 Measurements

The most important measurements of the cdma2000 specification for mobile stations can be selected by means of the *MEAS* hotkey and *MEAS* key. They will be explained below on the basis of the softkey functions.

The *CODE DOM ANALYZER* softkey activates the code domain analyzer and guides the user to the submenus for selection of the analysis. Changing the assignment of the hotkey bar during transition to the application ensures that the most important parameters of the code domain analyzer can be directly accessed on the hotkey bar.

The *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH*, and *STATISTICS* softkeys activate mobile station measurements with predefined settings, which are performed in SPECTRUM mode of the basic device. The measurements are performed with the parameters contained in the cdma2000 specification. The settings can be modified later.

MEAS key or *MEAS* hotkeys
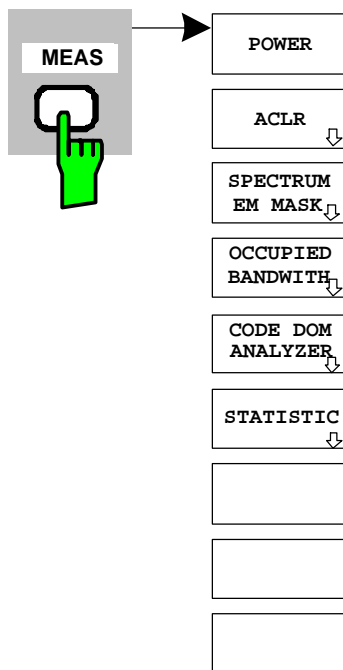
The *MEAS* hotkey or the *MEAS* key opens a submenu for selecting the measurements:

- *POWER* enables the channel power measurement with defined default values in SPECTRUM mode.

- *ACLR* enables the adjacent channel power measurement with defined default values in SPECTRUM mode.

- *SPECTRUM EM MASK* compares the signal power in different offset ranges of the carrier with the maximum values laid down in the cdma2000 specification.

- *OCCUPIED BANDWIDTH* enables measurement of the bandwidth assigned to the signal.

- *CODE DOM ANALYZER* enables the code domain analyzer and opens another menu for choosing the analysis type. All other menus of the analyzer are adapted to the functions of the code domain analyzer mode. The code domain analyzer is described in a separate chapter starting on page 53.

- *STATISTICS* analyzes the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).

Measuring channel power

MEAS key or *MEAS* hotkey
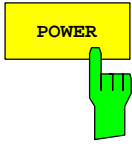
POWER

The *POWER* softkey enables measurement of the channel power of the cdma2000 signal.

The analyzer measures the RF signal power in the 1.2288 MHz bandwidth. The power is calculated by summation of the values at the trace points. The bandwidth and the associated channel power are displayed beneath the measurement screen.
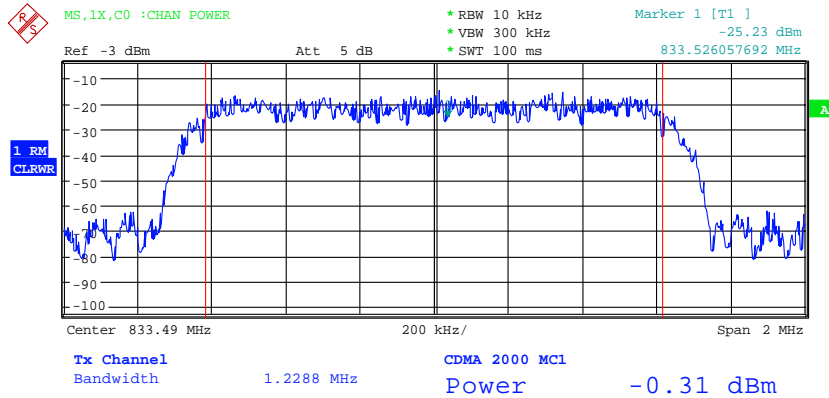
Fig. 6-1   Power measurement in the 1.2288 MHz transmission channel

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting: Level parameters / Center Frequency + Frequency Offset / All trigger settings	
ADJACENT CHAN POWER	ON
ACP STANDARD	cdma2000 MC1 (MC1 simply stands for multi carrier, i.e. a carrier)
NO OF ADJ CHANNELS	0 (main channel only)
FREQUENCY SPAN	2 MHz

Departing from these settings, the analyzer can be operated in all functions featured in SPECTRUM mode, i.e. all measurement parameters can be adapted to the requirements of the specific measurement.

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement: Level parameters / RBW, VBW / Sweep time

IEC-bus command: :CONFigure:CDPower:MEASurement POWer

Query of results: :CALCulate:MARKer:FUNCtion:POWer:RESult? CPOWer

Measuring adjacent channel power - ACLR

MEAS key or *MEAS* hotkey

ACLR ⇩ →	**NO. OF ADJ CHAN**	**ACLR LIMIT CHECK**
	ADJUST SETTINGS	**EDIT ACLR LIMIT**
		CHANNEL BANDWITH
		ADJ CHAN BANDWITH
	SWEEP TIME	**ADJ CHAN SPACING**
	NOISE CORR ON OFF	**ACLR ABS REL**
	FAST ACLR ON OFF	**CHAN PWR / HZ**
	DIAGRAM FULL SIZE	
	ADJUST REF LVL	

The *ACLR* (Adjacent Channel Leakage Power Ratio) softkey enables measurement of the adjacent channel power. The settings and limit values are taken from the spurious measurement defined in the cdma2000 specification.

The analyzer measures the power of the useful channel and of the adjacent channels on the left and right sides. At the default setting, only two adjacent channels are taken into account. Measurement results are displayed beneath the measurement screen.

The limits depend on the band class setting (*BAND CLASS* softkey).

The ACLR limit check can be enabled or disabled by means of the *ACLR LIMIT CHECK* softkey.
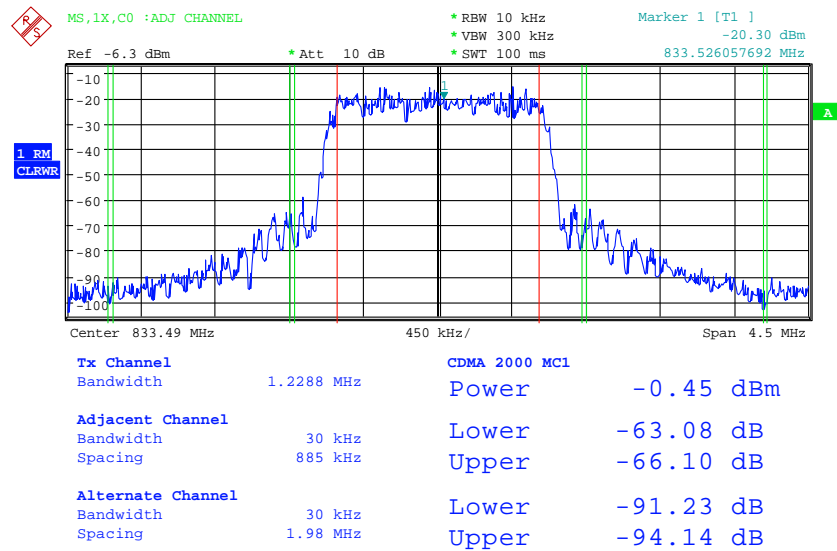
Fig. 6-2   Measuring adjacent channel power

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting: Level parameters Center Frequency + Frequency Offset All trigger settings	
ADJACENT CHAN POWER	ON
ACP STANDARD	cdma2000 MC1
NO OF ADJ. CHANNELS	2

Table 6-1   ACLR settings for band classes 0, 2, 5, 9, 11 and 12

Adjacent channel type	Spacing	RBW	Rel. limit	Abs. limit
Adjacent	885 kHz	30 kHz	-42 dBc	-70.2 dBm
Alternate	1.98 MHz	30 kHz	-54 dBc	-70.2 dBm
Alternate2	4.00 MHz	30 kHz	-54 dBc	-70.2 dBm

Table 6-2   ACLR settings for band class 3

Adjacent channel type	Spacing	RBW	Rel. limit	Abs. limit
Adjacent	885 kHz	30 kHz	-42 dBc	-70.2 dBm
Alternate	1.98 MHz	30 kHz	-54 dBc	-70.2 dBm
Alternate2	4.00 MHz	30 kHz	-54 dBc	none

Table 6-3   ACLR settings for band class 7

Adjacent channel type	Spacing	RBW	Rel. limit	Abs. limit
Adjacent	885 kHz	30 kHz	-42 dBc	-70.2 dBm
Alternate	1.98 MHz	30 kHz	-42 dBc	-70.2 dBm
Alternate2	2.25 MHz	30 kHz	none	-28.2 dBm

Table 6-4   ACLR settings for band class 10

Adjacent channel type	Spacing	RBW	Rel. limit	Abs. limit
Adjacent	885 kHz	30 kHz	-42 dBc	-70.2 dBm
Alternate	1.25 MHz	30 kHz	none	-13 dBm
Alternate2	4.00 MHz	30 kHz	none	-13 dBm

Table 6-5   ACLR settings for band classes 1, 4 and 8

Adjacent channel type	Spacing	RBW	Rel. limit	Abs. limit
Adjacent	1.25 MHz	30 kHz	-42 dBc	-70.2 dBm
Alternate	1.98 MHz	30 kHz	-50 dBc	-70.2 dBm
Alternate2	4.00 MHz	30 kHz	-50 dBc	-70.2 dBm

Table 6-6   ACLR settings for band class 6

Adjacent channel type	Spacing	RBW	Rel. limit	Abs. limit
Adjacent	1.25 MHz	30 kHz	-42 dBc	-70.2 dBm
Alternate	1.98 MHz	30 kHz	-50 dBc	-70.2 dBm
Alternate2	2.25 MHz	30 kHz	none	-28.3 dBm

Note: *The limit is corrected by 0 log RBW – 10 log 30 kHz for limit values which are not specified for   30   kHz bandwidth in the standard.*

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

        Level parameters
        RBW, VBW
        Sweep time
        SPAN
        NO OF ADJ. CHANNELS
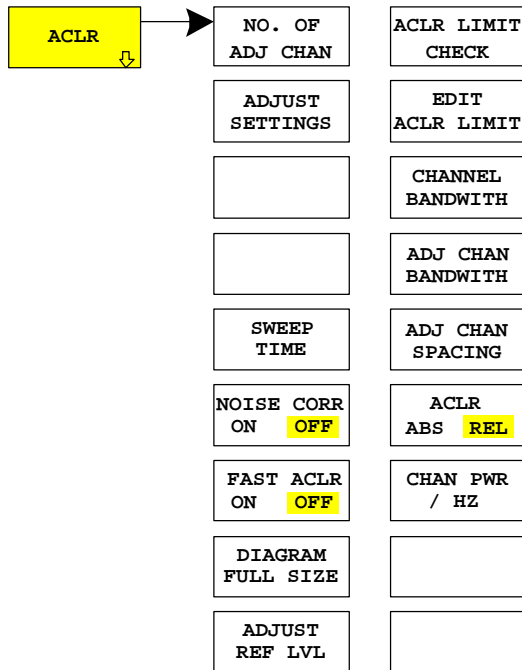   FAST ACLR MODUS

Departing from these settings, the analyzer can be operated in all functions featured in SPECTRUM mode, i.e. all measurement parameters can be adapted to the requirements of the specific measurement.

IEC-bus command: `:CONFigure:CDPower:MEASurement ACLR`

Query of results: `:CALCulate:MARKer:FUNCtion:POWer:RESult? ACPower`
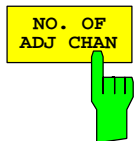
The *NO. OF ADJ CHAN* softkey enables input of the number ±n of adjacent channels which are taken into account for the adjacent channel power measurement.

0 to 3 can be entered.

The following measurements are performed depending on the number of channels.

0   Only the channel power is measured.

1   The channel power and the power of the upper and lower adjacent channel are measured.

2   The channel power, the power of the upper and lower adjacent channel and of the next upper and lower channel (alternate channel 1) are measured.

3   The channel power, the power of the upper and lower adjacent channel, the next higher and lower channel (alternate channel 1) and the next but one higher and lower channel (alternate channel 2) are measured.

IEC-bus command: `:SENS:POW:ACH:ACP 2`
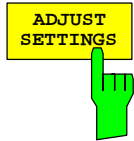
ADJUST SETTINGS

The *ADJUST SETTINGS* softkey automatically optimizes the settings of the analyzer for the selected power measurement.

All the analyzer settings relevant to power measurement within a specific frequency range (channel bandwidth) are then optimally set as a function of the channel configuration (channel bandwidth, channel spacing):

- Frequency span:

  The frequency span must include at least the channels to be analyzed.
  The double channel bandwidth is set as the span for measuring the channel power.
  The span setting depends for adjacent channel power measurement on the channel spacing and the channel bandwidth of the adjacent channel ADJ, ALT1 or ALT2 farthest away from the transmission channel.

- Resolution bandwidth RBW $\leq$ 1/40 of channel bandwidth

- Video bandwidth   VBW $\geq 3 \times$ RBW

- Detector   RMS detector

The trace mathematics and the trace averaging are disabled.
The reference level is not affected by *ADJUST SETTINGS*. It has to be set separately by means of *ADJUST REF LVL*.

Adjustment is performed once; if necessary, the device settings can be changed again later.

IEC-bus command: `:SENS:POW:ACH:PRES ACP|CPOW|OBW`

With manual setting of the measurement parameters deviating from that performed with *ADJUST SETTINGS*, the following must be borne in mind for the different parameters:

Frequency span	The frequency span must include at least all the channels needing to be measured. This is the channel bandwidth when channel power is measured. If the frequency span is large compared with the analyzed frequency section (or frequency sections), only a few pixels on the trace are available for the measurement.
Resolution bandwidth (RBW)	To ensure an acceptable measurement speed and also the necessary selection (for inhibiting spectral components outside the channel you want to measure, especially the adjacent channels), the resolution bandwidth must be selected so that it is neither too small nor too large. As a rule of thumb, the resolution bandwidth has to be set to values between 1% and 4% of the channel bandwidth. A larger resolution bandwidth can be set when the spectrum within and around the channel to be measured has an even characteristic.
Video bandwidth (VBW)	For a correct power measurement, the video signal must not be limited in terms of bandwidth. A band limitation of the logarithmic video signal would result in averaging and thus in a display of the power that would be too low (-2.51 dB at very small video bandwidth). The video bandwidth must therefore be at least three times higher than the resolution bandwidth. The *ADJUST SETTINGS* softkey sets the video bandwidth (VBW) as a function of the channel bandwidth as follows: $VBW \geq 3 \times RBW$.
Detector	The *ADJUST SETTINGS* softkey selects the RMS detector. The RMS detector is selected because it always indicates the power correctly, irrespective of the characteristics of the signal you want to measure. Generally speaking, the sample detector would also be possible. However, it results in unstable results on account of the limited number of trace pixels for calculation of the power in the channel. An averaging, which is often performed to stabilize the measurement results, produces a level display that is too low and must therefore be avoided. The lower level display depends on the number of averagings and the signal characteristic in the channel needing to be measured.

The *SWEEP TIME* softkey enables entry of the sweep time. A longer sweep time results in more stable measurement results with the RMS detector.
This setting is identical to the *SWEEP TIME MANUAL* setting in the *BW* menu.
IEC-bus command: :SWE:TIM <value>
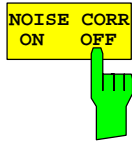
The *NOISE CORR ON/OFF* softkey enables correction of the measurement results by the background noise of the device, thus raising the dynamic range.

When the function is enabled, a reference measurement of the background noise on the device is performed first. The measured noise power is then subtracted from the power in the channel being analyzed. The background noise of the device depends on the selected center frequency, resolution bandwidth and level setting. The correction is therefore switched every time these settings are changed, and a corresponding message is displayed on the monitor.

To switch the background noise correction with the modified setting back on, the softkey must be pressed again. The reference measurement is then performed again.

IEC-bus command: `:SENS:POW:NCOR ON`

The *FAST ACLR* softkey toggles between measurement by the IBW method (FAST ACLR OFF) and the time domain method (FAST ACLR ON).

With *FAST ACLR ON*, the power measurement is performed in the different channels in the time domain. The analyzer adjusts its center frequency in succession to the different channel center frequencies and measures the power with the set measuring time (i.e. sweep time/number of measured channels). The suitable RBW filters for the selected standard and frequency offset are used automatically.

The RMS detector is used for correct power measurement. This means that software correction factors are not necessary.

Measured values are displayed in a table, the power in the useful channel being output in dBm and the power in the adjacent channels in dBm *(ACLR ABS)* or dB *(ACLR REL)*.

Selection of the sweep time (= measurement time) depends on the required reproducibility of the measurement results. The longer the selected sweep time, the more reproducible the measurement results will be, since the power measurement is then performed over a longer time.

As a rule of thumb, it can be assumed for a reproducibility of 0.5 dB (99% of the measurements are within 0.5 dB of the true measured value) that approximately 500 uncorrelated measured values are necessary (applies to white noise). The measured values are assumed to be uncorrelated when their spacing in time corresponds to the reciprocal value of the measurement bandwidth (= 1/BW).

With cdma2000 the measurement bandwidth is 10 kHz, i.e. measured values at an interval of 10 µs are assumed to be uncorrelated. Thus a measurement time (sweep time) of 50 ms per channel is required for 500 measured values. This is the default sweep time which the analyzer sets in coupled mode. Approximately 5000 measured values (i.e. the measurement time has to be extended to 500 ms) are required for a reproducibility of 0.1 dB (99% of all measurements are within 0.1 dB of the true measured values).

IEC-bus command: `:SENS:POW:HSP ON`
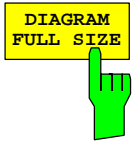
DIAGRAM FULL SIZE

The *DIAGRAM FULL SIZE* softkey switches the diagram to full screen size.

IEC-bus command: –
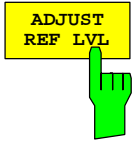
ADJUST REF LVL

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer 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 the analyzer being overloaded or the dynamic response being limited by too low a signal-to-noise ratio.
Since the measurement bandwidth is distinctly narrower for power channel measurements than the signal bandwidth, the signal branch can be overloaded, even though the trace is still well below the reference level.

IEC-bus command: `:SENS:POW:ACH:PRES:RLEV`

ACLR LIMIT CHECK

The *ACLR LIMIT CHECK* softkey enables and disables the limit check for the ACLR measurement.

IEC-bus command: `:CALC:LIM:ACP ON`
                                  `:CALC:LIM:ACP:ACH:RES?`
                                  `:CALC:LIM:ACP:ALT:RES?`

EDIT ACLR LIMIT

The default settings of limits are defined at the start of the adjacent channel power measurement as a function of the selected band class (refer to the BAND CLASS softkey), as in the tables on page 32. Similarly, the values in these tables are restored on a change of band class. After the band class has been selected, a table can be opened in the ACLR measurement, however, by means of the *EDIT ACLR LIMITS* softkey and the limits for the ACLR measurement can be modified in the table.

ACP LIMITS					
CHAN	RELATIVE LIMIT CHECK		ABSOLUTE LIMIT CHECK		
	VALUE	ON	VALUE	ON	
ADJ	-42 dBc	✗	-70.2 dBm	✗	
ALT1	-54 dBc	✗	-70.2 dBm	✗	
ALT2	-54 dBc	✗	-70.2 dBm	✗	

The following rules apply to limits:

- A separate limit can be defined for each of the adjacent channels. The limit applies simultaneously to the lower and upper adjacent channels.

- A relative limit and/or an absolute limit can be defined. Checks of both limits can be enabled independently of each other.

- Compliance with the active limits is checked independently of whether the limits are absolute or relative and whether the measurement itself is performed at absolute levels or at relative signal intervals. If both checks are active and if the higher of the two limits has been exceeded, the measured value concerned is identified.

Note: *Measured values which violate the limit are preceded by an asterisk and highlighted in red.*

IEC-bus command:
         `:CALC:LIM:ACP ON`

```
:CALC:LIM:ACP:ACH 0dB,0dB
:CALC:LIM:ACP:ACH:STAT ON
:CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ACH:ABS:STAT ON
:CALC:LIM:ACP:ALT1 0dB,0dB
:CALC:LIM:ACP:ALT1:STAT ON
:CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ALT1:ABS:STAT ON
:CALC:LIM:ACP:ALT2 0dB,0dB
:CALC:LIM:ACP:ALT2:STAT ON
:CALC:LIM:ACP:ALT2:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ALT2:ABS:STAT ON
```
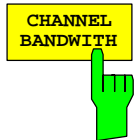

The *CHANNEL BANDWIDTH* softkey enables entry of the channel bandwidth for the transmission channel.

The useful channel bandwidth is normally determined by the transmission procedure. With cdma2000 measurements are performed at the default setting with a channel bandwidth of 1.2288 MHz.

When measuring by the IBW method (*FAST ACLR OFF)*, the channel bandwidth is represented on the screen by two vertical lines to the left and right of the center of the screen. This allows visual inspection of whether the whole power of the signal being measured is within the selected channel bandwidth.

With the time domain method (*FAST ACLR ON)*, the measurement is performed in zero span and the channel limits are not identified in this instance. The analyzer provides all available channel filters for selection of the channel bandwidth entry. Channel bandwidths that deviate from this cannot be set. Should deviating channel bandwidths be necessary, perform the measurement by the IBW method.

IEC-bus command: :SENS:POW:ACH:BWID 1.2288MHz
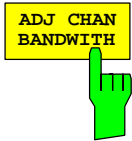
ADJ CHAN
BANDWITH

The *ADJ CHAN BANDWIDTH* softkey opens a table for defining the channel bandwidths for the adjacent channels.

ACP CHANNEL BW	
CHAN	BANDWIDTH
ADJ	30 kHz
ALT1	30 kHz
ALT2	30 kHz

When measuring by the IBW method (FAST ACLR OFF), the bandwidths of the different adjacent channels have to be entered numerically. Since it is common for all adjacent channels to have the same bandwidth, the other channels Alt1 and Alt2 are set to the bandwidth of the adjacent channel when the adjacent channel bandwidth (ADJ) is entered. Thus only one value needs to be entered in the case of equal adjacent channel bandwidths. The procedure is the same for the Alt2 channels (Alternate Channels 2) when the bandwidth of the Alt1 channel (Alternate Channel 1) is entered.

Note: *The bandwidths can be set independently of each other by overwriting the table from top to bottom.*

With the time domain method (FAST ACLR ON), the adjacent channel bandwidths are selected from the list of available channel filters. Use the IBW method for adjacent channel bandwidths that deviate from this.

IEC-bus command: :SENS:POW:ACH:BWID:ACH 30kHz
                       :SENS:POW:ACH:BWID:ALT1 30kHz
                       :SENS:POW:ACH:BWID:ALT2 30kHz

ADJ CHAN
SPACING

The *ADJ CHAN SPACING* softkey opens a table for defining the channel spacings.

CHANNEL SPACING	
CHAN	SPACING
ADJ	885 kHz
ALT1	1.98 MHz
ALT2	4.00 MHz

Since the adjacent channels frequently have the same spacing from each other, channel ALT1 and channel ALT2 are set to twice and three times the channel spacing of the adjacent channel, respectively, when the adjacent channel spacing (ADJ) is entered. Thus only one value needs to be entered in the case of identical channel spacings. The procedure for Alt2 channels is similar when the bandwidth of the Alt1 channel is entered.

Note: *The channel spacings can be set independently of each other by overwriting the table from top to bottom.*

IEC-bus command: :SENS:POW:ACH:SPAC:ACH 750kHz
                       :SENS:POW:ACH:SPAC:ALT1 1.98MHz
                       :SENS:POW:ACH:SPAC:ALT2 4MHz

The *ACLR ABS/REL* softkey (channel power absolute/relative) toggles between absolute and relative measurement of the power in the channel.

ACLR ABS   The absolute value of the power in the transmission channel and the adjacent channels is displayed in the unit of the Y-axis, e.g. dBm or dBμV.

ACLR REL   In the case of adjacent channel power measurement (*NO. OF ADJ CHAN* > 0), the level of the adjacent channels is displayed relative to the level of the transmission channel in dBc.

            With linear scaling of the Y-axis, the relative power (CP/CP_{ref}) of the new channel to the reference channel is displayed. With dB scaling, the logarithmic ratio $10*lg$ (CP/CP_{ref}) is displayed. This means that the relative channel power measurement can also be used for universal adjacent channel power measurements. In this instance each channel is measured separately.

IEC-bus command: :SENS:POW:ACH:MODE ABS
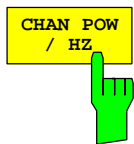
The *CHAN PWR / HZ* softkey toggles between measurement of the total power in the channel and measurement of the power in the channel referred to 1 Hz of bandwidth.

The conversion factor is $10 \cdot lg \dfrac{1}{Channel \cdot Bandwidth}$.

IEC-bus command: :CALC:MARK:FUNC:POW:RES:PHZ ON│OFF

Signal power check – SPECTRUM EM MASK

MEAS key or *MEAS* hotkey

SPECTRUM EM MASK

→

LIMIT LINE AUTO

LIMIT LINE USER

RESTORE STD LINES

ADJUST REF LVL
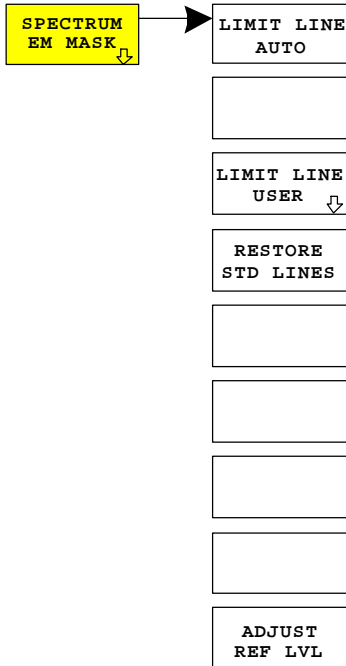
The *SPECTRUM EM MASK* (Spectrum Emission Mask) softkey starts determination of the cdma2000 signal power at defined offsets from the carrier and compares the power values with that of the spurious emission mask called for in the cdma2000 specification, in the carrier-oriented range between –4 MHz and 4 MHz.

The limits depend on the band class setting (*BAND CLASS* softkey).
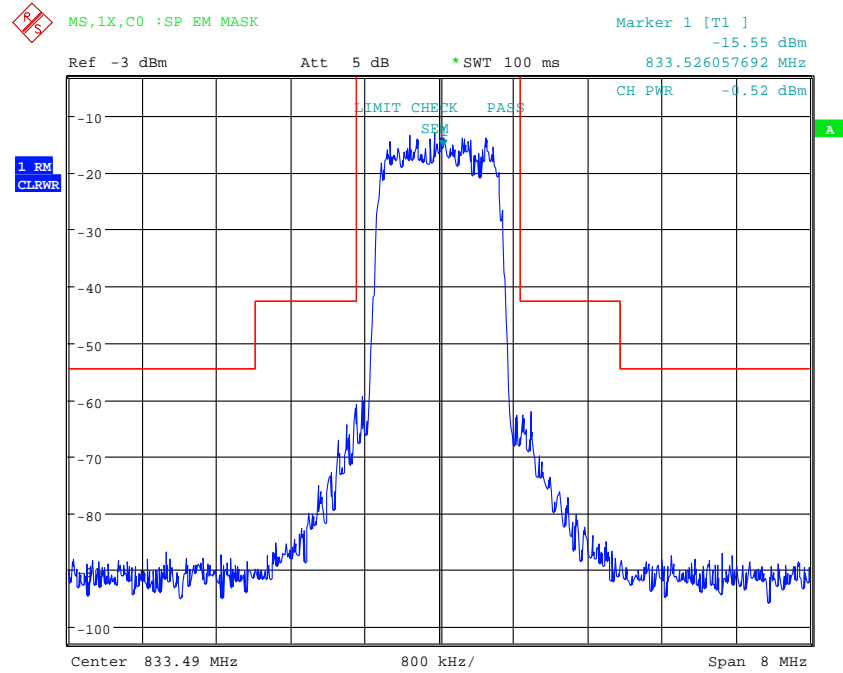
Fig. 6-3   Measuring the spectrum emission mask

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting: Level parameters Center Frequency + Frequency Offset All trigger settings	
ADJACENT CHAN POWER	ON
ACP STANDARD	cdma2000 MC1
NO OF ADJ. CHANNELS	0
FREQUENCY SPAN	8 MHz
SWEEP TIME	100 ms
DETECTOR	RMS

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement: Level parameters   RBW, VBW   Sweep time   SPAN

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode. Changes to the RBW and VBW are limited, because they are specified by definition of the limits. If the span is extended beyond 8 MHz, the analyzer automatically switches from the carrier to the 1 MHz channel filter for the frequency range from 4 MHz and higher.

IEC-bus command:	`:CONFigure:CDPower:MEASurement ESPectrum`
Query of results:	`:CALCulate:LIMit:FAIL?` and visual evaluation

<div style="background:yellow">**LIMIT LINE AUTO**</div>

The *LIMIT LINE AUTO* softkey automatically selects the limit line for checking after the power in the useful channel has been determined. If the measurement is performed in *CONTINUOUS SWEEP* and if the channel power varies from sweep to sweep, it can result in continuous replotting of the limit line.

The softkey is activated on entering the spectrum emission mask measurement.

IEC-bus command: `:CALC:LIM:ESP:MODE AUTO`

The definition of the limit line names is described at the *LIMIT LINE USER* softkey.

The relative limit lines are relative to the power in the channel (dBc). If both relative and absolute limits are defined for a frequency range, the resulting line is determined in the LIMIT LINE AUTO mode according to the "less stringent" criterion. Since these limit lines are of the 'upper limit line' type, this means that the higher limit in the level is used for comparison.

Note: *The limit is corrected by 10 log RBW – 10 log 30 kHz for limit values which are not specified for 30 kHz or 1 MHz bandwidth in the standard.*

The band classes 0, 2, 3, 5, 9, 10, 11 and 12 have the same frequency support points. Minor modifications exist for band classes 3, 7 and 10 which means that these band classes have to be defined separately.

Table 6-7   Band classes 0, 2, 5, 9, 11 and 12

Offset frequency	Relative limit C2KM0_R.LIM	Absolute limit C2KM0_A.LIM	RBW
-4.00 MHz	-54 dBc	-70.2 dBm	30 kHz
-1.98 MHz	-54 dBc	-70.2 dBm	30 kHz
-1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
-885 kHz	-42 dBc	-70.2 dBm	30 kHz
+885 kHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-54 dBc	-70.2 dBm	30 kHz
+4.00 MHz	-54 dBc	-70.2 dBm	30 kHz

Table 6-8   Band class 3

Offset frequency	Relative limit C2KM3_R.LIM	Absolute limit C2KM3_A.LIM	RBW
-4.00 MHz	-54 dBc		30 kHz
-1.98 MHz	-54 dBc	+200 dBm	30 kHz
-1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
-885 kHz	-42 dBc	-70.2 dBm	30 kHz
+885 kHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-54 dBc	+200 dBm	30 kHz
+4.00 MHz	-54 dBc		30 kHz

Table 6-9   Band class 7

Offset frequency	Relative limit C2KM7_R.LIM	Absolute limit C2KM7_A.LIM	RBW
-4.00 MHz		-28.2 dBm	30 kHz
-2.25 MHz	+200 dBc	-28.2 dBm	30 kHz
-2.25 MHz	-54 dBc	-70.2 dBm	30 kHz
-1.98 MHz	-54 dBc	-70.2 dBm	30 kHz
-1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
-885 kHz	-42 dBc	-70.2 dBm	30 kHz
+885 kHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-54 dBc	-70.2 dBm	30 kHz
+2.25 MHz	-54 dBc	-70.2 dBm	30 kHz
+2.25 MHz	+200 dBc	-28.2 dBm	30 kHz
+4.00 MHz		-28.2 dBm	30 kHz

Table 6-10   Band class 10

Offset frequency	Relative limit C2KMX_R.LIM	Absolute limit C2KMX_A.LIM	RBW
-4.00 MHz		-13 dBm	30 kHz
-1.25 MHz	+200 dBc	-13 dBm	30 kHz
-1.25 MHz	-42 dBc	-70.2 dBm	30 kHz
-885 kHz	-42 dBc	-70.2 dBm	30 kHz
+885 kHz	-42 dBc	-70.2 dBm	30 kHz
+1.25 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.25 MHz	+200 dBc	-13 dBm	30 kHz
+4.00 MHz		-13 dBm	30 kHz

The limits for band classes 1, 4, 6 and 8 are defined by separate limits. The frequency limit relative to the carrier in particular is not defined at 885 kHz but rather at 1.25 MHz.

Table 6-11   Band classes 1, 4 and 8

Offset frequency	Relative limit C2KM1_R.LIM	Absolute limit C2KM1_A.LIM	RBW
-4.00 MHz	-50 dBc	-70.2 dBm	30 kHz
-1.98 MHz	-50 dBc	-70.2 dBm	30 kHz
-1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
-1.25 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.25 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-50 dBc	-70.2 dBm	30 kHz
+4.00 MHz	-50 dBc	-70.2 dBm	30 kHz

The limits for band class 6 are derived from the limits of band classes 1, 4 and 8. The additional RBW switching within the ±4 MHz varies. The 1 MHz channel filter is used for the 1 MHz segments – highlighted in gray in the table. The frequency range is divided into three subsegments. The user's sweep time is distributed over the segments as follows (k = filter sweep rate factor):

Segment1: -4.00 ... -2.25 MHz   RBW = 1 MHz   k = 850 SWT1 = SWT * 1/10
Segment2: -2.25 ... +2.25 MHz RBW = 30 kHz k = 2.5 SWT2 = SWT * 8/10
Segment3: +2.25 ... 4.00 MHz   RBW = 1 MHz   k = 850 SWT3 = SWT * 1/10

For larger spans, the sweep time is adjusted so that the three areas are swept at a constant filter sweep rate factor k.

A further distinction in the case of band class 6 is the gradient between 2.25 MHz and 4.00 MHz.

Table 6-12   Band class 6

Offset frequency	Relative limit C2KM6_R.LIM	Absolute limit C2KM6_A.LIM	RBW
-4.00 MHz		-14.75 dBm	1 MHz
-2.25 MHz	+200 dBc	-13 dBm	1 MHz
-2.25 MHz	-50 dBc	-70.2 dBm	30 kHz
-1.98 MHz	-50 dBc	-70.2 dBm	30 kHz
-1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
-1.25 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.25 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-42 dBc	-70.2 dBm	30 kHz
+1.98 MHz	-50 dBc	-70.2 dBm	30 kHz
+2.25 MHz	-50 dBc	-70.2 dBm	30 kHz
+2.25 MHz	+200 dBc	-13 dBm	1 MHz
+4.00 MHz		-14.75 dBm	1 MHz
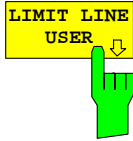
LIMIT LINE
USER

The *LIMIT LINE USER* softkey enables input of user-defined limit lines. The softkey opens the menus of the limit line editor, which are known from the basic device. The limit lines created by the user are included in the table for *LIMIT LINE MANUAL*.

The following limit line settings are sensible for mobile station tests:
Trace 1, Domain Frequency, X-Scaling Relative, Y-Scaling Absolute, Spacing linear, Unit dBm.

Unlike the default limit lines on the device when the analyzer is supplied from the factory that conform to the standard specifications, the user-specified limit line can be specified for the whole frequency range only either relatively (referred to the reference level) or absolutely.

The supplied limit lines of the AUTO mode can also be selected. The names are specified next to the type in the tables above and are defined as follows:

1) Standard in 3 characters
2) Link direction M for mobile station
3) Band class, the lowest digit being used in the case of more than one band class
4) Power classes A, B, C, where A is the highest power class and is not used for any power class dependency.
5) Type differentiation: A for absolute and R for relative

Example of cdma2000 band class 0, 2, 5, 9, 11-12:

```
C2K      : cdma2000
   M    : mobile station
    0: lowest of band classes 0,2,5,9,11-12
     _ : wildcard for power classes
      R : relative line =========
C2KM0_R
```

The limit line names are given in the tables next to the type.

IEC-bus command:

Refer to Table of softkeys with assignment of IEC-bus commands

RESTORE
STD LINES

The *RESTORE STD LINES* softkey restores the limit lines defined in the standard to the state they were in when the device was supplied. In this way unintended overwriting of the standard lines can be undone.

IEC-bus command: :CALC:LIM:ESP:RESTore
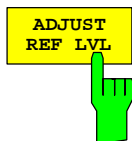
ADJUST
REF LVL

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured total signal power.

The softkey becomes active after the first sweep ends with measurement of the occupied bandwidth and thus the total power of the signal becomes known.

Adaptation of the reference level ensures that the signal path of the analyzer is not overloaded and the dynamic response is not restricted by a reference level that is too low.

IEC-bus command: :SENS:POW:ACH:PRES:RLEV

Measuring bandwidth occupied by the signal - OCCUPIED BANDWIDTH

MEAS key or *MEAS* hotkey
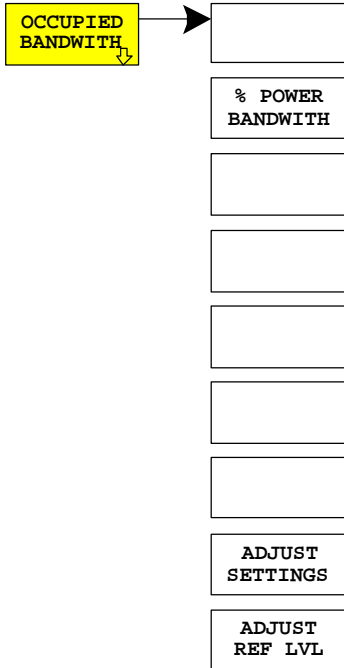
The *OCCUPIED BANDWIDTH* softkey enables measurement of the bandwidth occupied by the signal.

This measurement determines the bandwidth in which - in the initial state - 99% of the signal power is to be found. The percentage of the signal power that has to be included in the bandwidth measurement can be modified. The bandwidth and the frequency markers for the measurement are displayed in the Marker Info field at the top right corner of the display.

Fig.6-4   Measuring occupied bandwidth

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting:Level parameters	
Center Frequency + Frequency Offset	
All trigger settings	
OCCUPIED BANDWIDTH	ON
FREQUENCY SPAN	4.2 MHz
SWEEP TIME	100 ms
RBW	30 kHz
VBW	300 kHz
DETECTOR	RMS

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:
Level parameters
RBW, VBW
Sweep time
SPAN

IEC-bus command: `:CONFigure:CDPower:MEASurement OBANdwidth`

Query of results:`:CALCulate:MARKer:FUNCtion:POWer:RESult? OBANdwidth`
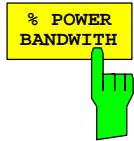
% POWER BANDWITH

The *% POWER BANDWIDTH* softkey opens a field for entering the percentage of power referred to the total power in the displayed frequency range, by means of which the occupied bandwidth is defined (percentage of total power).
The permissible range is 10% to 99.9%.

IEC-bus command: `:SENS:POW:BWID 99PCT`
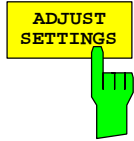
ADJUST SETTINGS

The *ADJUST SETTINGS* softkey adjusts the settings of the analyzer to the specified channel bandwidth for measurement of the occupied bandwidth.
All analyzer settings relevant for power measurement within a certain frequency range (channel bandwidth) such as:

- Frequency span   3 x channel width

- Resolution bandwidth   RBW $\leq$ 1/40 of channel bandwidth.

- Video bandwidth   VBW $\geq 3 \times$ RBW

- Detector   RMS

are optimized.

The reference level is not affected by *ADJUST SETTINGS*.It must be set for optimum measurement dynamics so that the maximum signal is close to the reference level.

Adjustment is performed once only but, if necessary, the device settings can again be changed afterwards.

IEC-bus command: `:SENS:POW:PRES OBW`
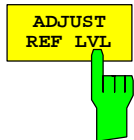
ADJUST REF LVL

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured total signal power.
The softkey becomes active after the first sweep ends with measurement of the occupied bandwidth and thus the total power of the signal becomes known.
Adaptation of the reference level ensures that the signal path of the analyzer is not overloaded and the dynamic response is not restricted by a reference level that is too low.
Since the measurement bandwidth is distinctly narrower for power channel measurements than the signal bandwidth, the signal branch can be overloaded, even though the trace is still well below the reference level. When the measured channel power is identical to the reference level, the signal path is not overloaded.

IEC-bus command: `:SENS:POW:ACH:PRES:RLEV`

Signal statistics

MEAS key or *MEAS* hotkey

SIGNAL STATISTIC →

APD

CCDF

PERCENT MARKER

NO OF SAMPLES

SCALING

ADJUST SETTINGS

CONT MEAS

SINGLE MEAS
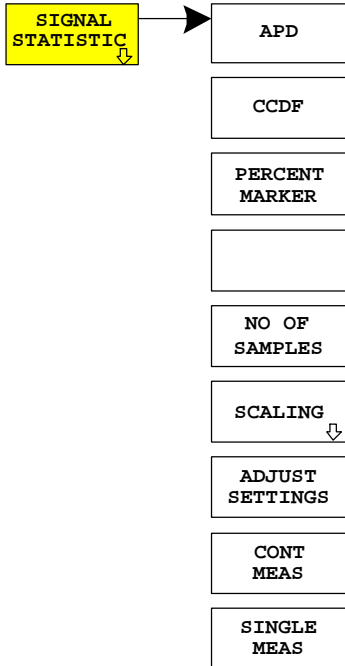
The *STATISTICS* softkey launches measurement of the distribution function of signal amplitudes (complementary cumulative distribution function). The measurement can be switched, using the menu softkey, to amplitude power distribution (APD).

For this measurement, a signal section of settable length is recorded continuously in the zero span and the distribution of the signal amplitudes is evaluated. The record length and the display range of the CCDF can be set using the softkeys of the menu. The amplitude distribution is plotted logarithmically as a percentage of the amount by which a certain level is exceeded, starting with the average value of the signal amplitudes.

In addition, the crest factor, i.e. the difference between the maximum value and the mean power, is output in dB.

MS,1X,C0 :SIGNAL STAT   RBW 10 MHz

Ref 9.3 dBm   Att 35 dB   AQT 3.125 ms

Center 833.49 MHz   1 dB/   Mean Pwr + 10 dB

Complementary Cumulative Distribution Function

Samples   100000

```
                 Trace 1
Mean    -0.35 dBm
Peak     4.33 dBm
Crest    4.68 dB
```
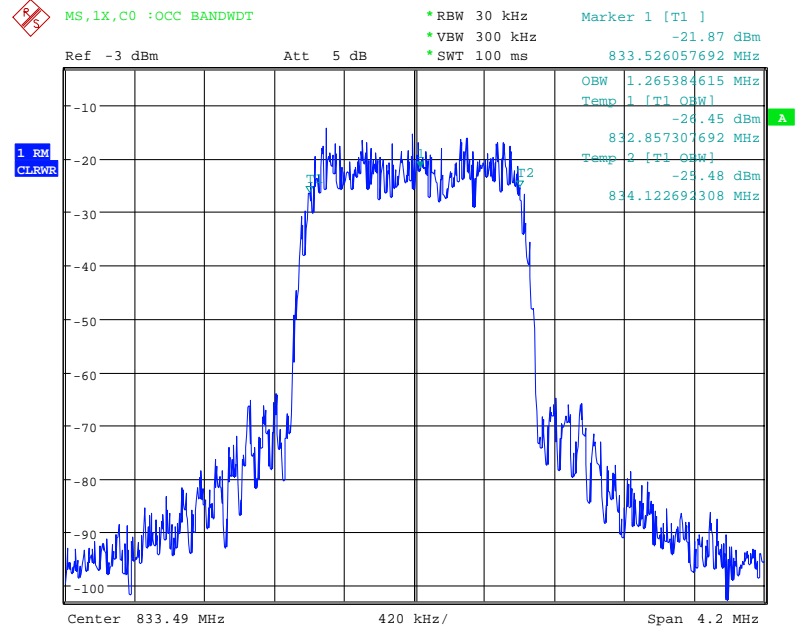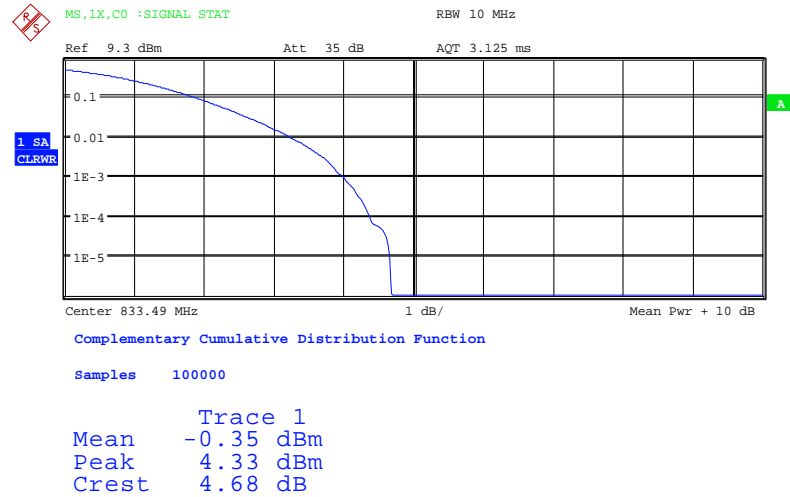
Fig. 6-5   CCDF of cdma2000 signal

The softkey enables SPECTRUM mode with predefined settings:

The following user-specific settings are not modified so that the adaptation to the device under test is retained:	
Reference Level + Rev Level Offset	
Center Frequency + Frequency Offset	
Input Attenuation + Mixer Level	
All trigger settings	
CCDF	ON
RBW	10 MHz
DETECTOR	SAMPLE

Departing from these settings, the analyzer can be operated in all functions featured in SPECTRUM mode, i.e. all measurement parameters can be adapted to the requirements of the specific measurement.

> To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on <u>re-entering</u> this measurement:
> Level parameters
> RBW
> NO OF SAMPLES

IEC-bus command: `:CONFigure:CDPower:MEASurement CCDF`
        or   `:CALCulate:STATistics:CCDF ON`

Query of results:

```
:CALCulate:MARKer:X?
:CALCulate:STATistics:RESults? MEAN |
                 PEAK |CFActor | ALL
```

MEAN   mean (RMS) measured power in dBm in the period of observation

PEAK   measured peak power in dBm in the period of observation

CFACtor Determined CREST factor (i.e. ratio of peak power to mean power) in dB

ALL   Results of all three named measurements, separated by a comma: <mean pow>, <peak pow>, <crest factor>
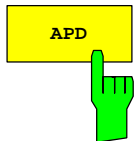
The *APD ON/OFF* softkey enables the amplitude probability distribution function.

IEC-bus command: `:CALC:STAT:APD ON`
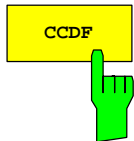
The *CCDF ON/OFF* softkey enables the complementary distribution function (complementary cumulative distribution function).

IEC-bus command: `:CALC:STAT:CCDF ON`

When the CCDF function is enabled, the *PERCENT MARKER* softkey supports positioning of marker 1 by entering a sought probability. This means that the power that will be exceeded with a given degree of probability can be determined in a simple manner.
If marker 1 is disabled, it is automatically enabled.

IEC-bus command: `:CALC:MARK:Y:PERC 0...100%`
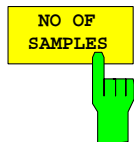
The *NO OF SAMPLES* softkey sets the number of power measurement values that have to be taken into account for the distribution measurement function.

Note: *The overall measurement time is influenced by the selected number of samples as well as by the resolution bandwidth selected for the measurement, since the resolution bandwidth directly affects the sampling rate.*

IEC-bus command: `:CALC:STAT:NSAM <value>`

SCALING → X-AXIS REF LEVEL

X-AXIS RANGE

Y-AXIS MAX VALUE

Y-AXIS MIN VALUE

ADJUST SETTINGS

DEFAULT SETTINGS
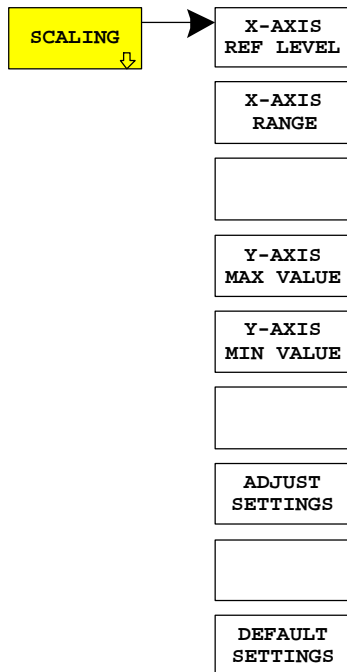
The *SCALING* softkey opens a menu in which the scaling parameters for the X and Y-axis can be modified.
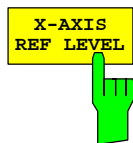
X-AXIS REF LEVEL

The *X-AXIS REF LEVEL* softkey changes the level settings of the device and sets the maximum measurable power.
The function is identical to that of the *REF LEVEL* softkey in the *AMPT* menu.
This value is mapped to the right diagram border for the *APD* function. For the CCDF function, this value is not directly represented in the diagram because the X-axis is scaled relative to the measured *MEAN POWER*.

IEC-bus command: :CALC:STAT:SCAL:X:RLEV <value>
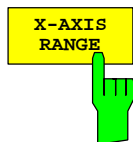
X-AXIS RANGE

The *X-AXIS RANGE* softkey changes the level range that has to be covered by the selected distribution sampling function.
The function is identical to that of the *RANGE LOG MANUAL* softkey in the *AMPT* menu.

IEC-bus command: :CALC:STAT:SCAL:X:RANG <value>
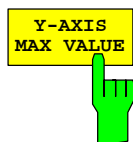
Y-AXIS MAX VALUE

The *Y-AXIS MAX VALUE* softkey sets the upper limit of the displayed probability range.
The values on the Y-axis are normalized, i.e. the maximum value is 1.0. Since the Y-axis is logarithmically scaled, the gap between the maximum and minimum values must be at least one decade.

IEC-bus command: :CALC:STAT:SCAL:Y:UPP <value>
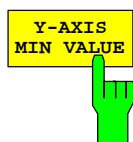
Y-AXIS MIN VALUE

The *Y-AXIS MIN VALUE* softkey sets the upper limit of the displayed probability range.
Since the Y-axis is logarithmically scaled, the gap between the maximum and minimum values must be at least one decade. Permissible range of values 0 < value < 1.

IEC-bus command: :CALC:STAT:SCAL:Y:LOW <value>
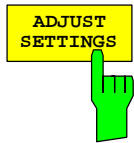
ADJUST SETTINGS

The *ADJUST SETTINGS* softkey optimizes the analyzer level settings according to the measured peak power in order to gain maximum sensitivity of the device.

The level area is set for the APD measurement according to the measured difference between the peak value and the minimum value of the power and, for the CCDF measurement, between the peak value and the mean value of the power in order to achieve maximum power resolution.

In addition, the probability scale of the selected number of measured values is adjusted.

IEC-bus command: :CALC:STAT:SCAL:AUTO ONCE
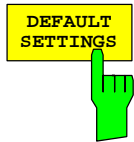
DEFAULT SETTINGS

The *DEFAULT SETTINGS* softkey resets the scaling on the X-axis and the Y-axis to the default (PRESET) settings.

X-axis reference level: -20 dBm
X-axis range for APD: 100 dB
X-axis range for CCDF: 20 dB

Y-axis for upper limit: 1.0
Y-axis for lower limit: 1E-6

IEC-bus command: :CALC:STAT:PRES
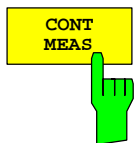
CONT MEAS

The *CONT MEAS* softkey starts the acquisition of new sequences of sample data and the calculation of the APD or CCDF trace, depending on the selected measurement. The next measurement is started automatically as soon as the indicated number of measured values has been reached ("CONTinuous MEASurement").

IEC-bus command: :INIT:CONT ON;:INIT:IMM
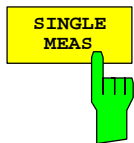
SINGLE MEAS

The *SINGLE MEAS* softkey starts the acquisition of one new sequence of sample data and the calculation of the APD or CCDF trace, depending on the selected measurement. The measurement finishes after the displayed number of measured values has been reached.

IEC-bus command: :INIT:CONT OFF;:INIT:IMM

Code domain measurements on cdma2000 signals

Application Firmware R&S FS-K83 provides a code domain analyzer. With its help, the measurements called for in the cdma2000 specification in respect of the power of the different codes and code channels (bunched codes) can be performed. In addition, the modulation quality (EVM and RHO factor), frequency error and trigger-to-frame time, and also peak code domain error are determined. Constellation analyses and bit stream analyses are similarly available. The calculation of the timing and phase offsets of the channels for the pilot can be enabled (refer to the *TIME/PHASE* softkey). The observation period can be adjusted in multiples of the power control group (PCG) by means of the *CAPTURE LENGTH* softkey.

Basically, there are the following results classes for the analyses:

- Results that take the total signal into account over the whole period of observation (all PCGs)
- Results that take the total signal into account over a power control group (PCG)
- Results that take one channel into account over the whole period of observation (all PCGs)
- Results that take one channel into account over a power control group (PCG)

The analyses of the code domain analyzer are performed on a split screen. The screen is divided into two halves for this.
The upper screen (Screen A) displays analyses which vary with respect to the codes. The lower screen (Screen B) displays all other analyses.

Table 6-13   Overview of the analyses

Analysis on Screen A	Code dimension		Time dimension		Mapping
	Total signal	One channel	All PCGs	One PCG	I or Q or overview
Code domain power	✓			✓	I/Q/Overview
Code domain error power	✓			✓	I/Q/Overview
Channel table	✓			✓	Not used

Analysis on Screen B	Code dimension		Time dimension		I or Q
	Total signal	One channel	All PCGs	One PCG	
Result summary	✓		✓	✓	Not used
Power versus PCG		✓	✓		I/Q
Power versus symbol		✓		✓	I/Q
Composite EVM (modulation accuracy)	✓		✓		Not used
Composite constellation	✓			✓	Not used
Peak code domain error	✓		✓		I/Q
Symbol constellation		✓		✓	I/Q
Symbol EVM		✓		✓	I/Q
Bit stream		✓		✓	I/Q

Depending on the symbol rate of a code channel, the code channel will have a different spreading factor and a different number of symbols per power control group. The relationship can be seen in the table below.

Table 6-14   Relationship between symbol rate, spreading factor and number of symbols

Data rate [ksps]	Spreading factor	Symbols per PCG
19.2	64	24
38.4	32	48
76.8	16	96
153.6	8	192
307.2	4	384
614.4	2	768

With analyses on the lower screen where symbols are entered along on the X-axis, the maximum number of symbols varies depending on the symbol rate of the selected code channel.

The code channel and power control group for which a result is to be displayed is selected using the *SELECT CHANNEL* and *SELECT PCG* softkeys. Let us assume that the code channel 1.32 (Walsh code number 1 for spreading factor 32) and PCG 2 have been selected. On screen A, the Code Domain Power analysis is relative and on Screen B the symbol EVM analysis is active. Screen A will thus display the Code Domain Power analysis of PCG 2. In this instance code channel 1.32 is shown selected in red. In the lower half of the screen, the EVM symbol for analysis of code channel 1.32 in PCG 2 with 48 values can be seen.

The code domain analyzer can be operated in two modes. In CODE CHAN AUTOSEARCH mode, it performs an automatic search for the following cdma2000 and 1xEV-DV channels:

Table 6-15   Channels in the cdma2000 and 1xEV-DV system

Channel	Abbreviation	Mapping	Channel number and spreading factor
Reverse Pilot Channel	PICH	I	0.32
Enhanced Access Channel[1]	EACH	Q	2.8
Reverse Common Control Channel	CCCH	Q	2.8
Reverse Dedicated Control Channel	DCCH	I	8.16
Reverse Acknowledgment Channel (1xEV-DV)	ACKCH	Q	16.64
Reverse Channel Quality Indicator Channel[2] (1xEV-DV)	CQICH	I/Q	12.16
Reverse Fundamental Channel	FCH	Q	4.16
Reverse Supplemental 1 Channel	S1CH	Q	1.2 or 2.4
Reverse Supplemental 2 Channel	S2CH	I	2.4 or 6.8

In the other mode, CODE CHAN PREDEFINED, the user has the option of determining the active code channels in the signal by means of selectable and editable tables. The automatic channel search is then replaced by this user input.

---

[1] Since the EACH has the same mapping as well as the same channel number and spreading factor as the CCCH, it is not possible to make a distinction between them in the CODE CHAN AUTOSEARCH. In this case, both the EACH and CCCH are output.

[2] The CQICH has mapping I if the FCH is available, otherwise it is output on the Q branch.

Presentation of analyses - RESULTS

The *RESULTS* hotkey or the *MEAS* hotkey and then the *CODE DOM ANALYZER*

| RESULTS | → | CODE DOM POWER | CHANNEL TABLE | SYMBOL CONST |
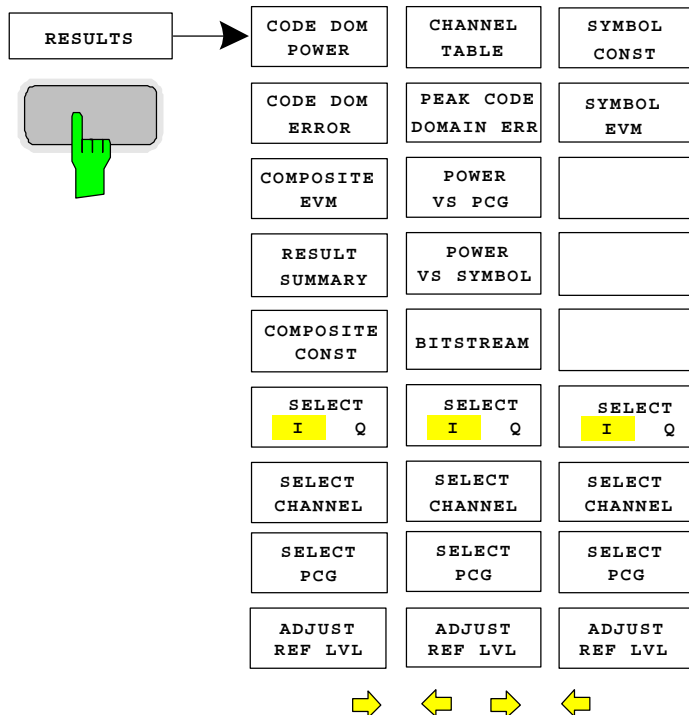
The *RESULTS* hotkey opens the submenu for choosing the analysis. In the main menu, the most important analyses are offered for rapid access, and advanced analyses are available in the side menus.

Note: To go to the far side menu, press the NEXT hardkey twice.

You can choose from the following analyses:

The following softkey columns are shown:

CODE DOM POWER	CHANNEL TABLE	SYMBOL CONST
CODE DOM ERROR	PEAK CODE DOMAIN ERR	SYMBOL EVM
COMPOSITE EVM	POWER VS PCG	
RESULT SUMMARY	POWER VS SYMBOL	
COMPOSITE CONST	BITSTREAM	
SELECT I Q	SELECT I Q	SELECT I Q
SELECT CHANNEL	SELECT CHANNEL	SELECT CHANNEL
SELECT PCG	SELECT PCG	SELECT PCG
ADJUST REF LVL	ADJUST REF LVL	ADJUST REF LVL

CODE DOM POWER	Code domain power analysis, depending on the CODE PWR ABS/REL softkey, in relative or absolute scaling
CODE DOM ERROR	Code domain error-power analysis
COMPOSITE EVM	Square difference between the test signal and the ideal reference signal
COMPOSITE CONST	Composite constellation analysis
RESULT SUMMARY	Tabular results
CHANNEL TABLE	Channel occupancy table
PEAK CODE DOMAIN ERR	Projection of the error between the test signal and the ideal reference signal to the spreading factor of the channel type and subsequent summation over the symbols of each PCG of the differential signal
POWER VS CHIP	Power of the total signal of a PCG at chip level
POWER VS SYMBOL	Power of the selected channel and the selected PCG over all symbols
BITSTREAM	Display of determined bits
SYMBOL CONST	Symbol constellation analysis
SYMBOL EVM	Error vector magnitude analysis

The *SELECT I/Q* softkey determines whether the I or Q branch is to be analyzed.
By entering a channel number (*SELECT CHANNEL* softkey), a channel can be selected for the *POWER VS PCG, SYMBOL CONST*, *SYMBOL EVM, BITSTREAM* and POWER VS SYMBOL analyses.
Using the *SELECT PCG* softkey, a power control group can be selected for the CODE DOM POWER, CODE ERROR, CHANNEL TABLE, SYMB CONST, SYMBOL EVM, BITSTREAM, COMPOSITE CONST and POWER VS SYMBOL analyses.

You can use *ADJUST REF LVL* to obtain optimum matching of the device reference level to the signal level.

> The following user-specific settings are not modified so that the adaptation to the device under test is retained:
>> Level parameters
>> Center Frequency + Frequency Offset
>
> The following user-specific settings are transferred as follows:
>> External trigger sources are retained, while all other trigger sources result in Free Run mode.
>> Additional trigger settings are retained.
>
> To restore adjusted level parameters, they are saved on exiting the code domain analyzer and reset on <u>re-entering</u> the code domain analyzer.

The most important measurement settings, which are based on the displays, are grouped above the diagram:

```
MS,1X,C1 :CODE POWER              SR    38.4 ksps
                                  Chan      0.32
dB TOT            CF 1.85125 GHz  PCG         2
```

Fig. 6-6   Function fields of diagrams

The meanings are as follows:

1st column:	Mobile radio system (mobile station cdma2000 1X)		`MS,1X`
	Band class (Class 0-12) abbreviated	e.g.	`C1` for 1900 MHz band
	Name of selected analysis:	e.g.	`CODE POWER`
	(blank line)		
	Unit of y-axis	e.g.	`dB TOT` for relative to total power
2nd column:	(blank line)		
	(blank line)		
	Center frequency of signal:	e.g.	`CF 1.85125 GHz`
3rd column:	Symbol rate of selected channel:	e.g.	`SR    38.4 ksps`
	Walsh code and spreading factor of selected channel:	e.g.	`Chan      0.32`
	PCG number of selected channel		`PCG         2`
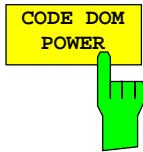
CODE DOM POWER

The *CODE DOM POWER* softkey selects the Code Domain Power (CDP) analysis with relative scaling.

With Code Domain Power analysis, allowance is made for the total signal over precisely one power control group. The power values of the different codes are determined and plotted in a diagram. In this diagram, the x-axis is the code number and the y-axis is a logarithmic level axis. The number of codes on the x-axis, which corresponds to the base spreading factor, can be set by means of the *BASE SF 16/32/64* softkey. The power control group to be analyzed can be set by means of the *SELECT PCG* softkey. The *SELECT I/Q* softkey is used to select the branch to be analyzed.

The power is referred in the default setting to the total power. This power reference was selected since the power control always affects all code channels including the pilot. The power reference can be switched to the power of the pilot using the *POWER REF* softkey; this allows the power of each code channel to be analyzed relative to the pilot. Power control does not change these relative results.

Apart from these relative displays, there is also the option of specifying the absolute power. It can be enabled by means of the CODE PWR ABS/REL softkey. Accordingly, the unit of the y-axis is dBm for absolute analysis, dB PICH for relative analysis with respect to the pilot, and dB TOT for relative analysis with respect to the total power.

The power values of the active and unassigned codes are displayed in different colors: Additionally, codes with alias power may also occur. In this case a code contains power components which result from a higher spreading factor than the base spreading factor.
The following color coding is defined:

- Yellow   Active channel
- Cyan   Unassigned code (neither on I nor Q branch)
- Light blue   Alias power from higher spreading factor
- Light green   Quasi-inactive code (the code on the analyzed branch is inactive, but the code with the same code number on the other branch belongs to an active channel)

Note: *If the code domain power analysis indicates alias power, the highest base spreading factor should be set using the BASE SF softkey.*

A channel in *CODE CHAN AUTOSEARCH* (Automatic Channel Search mode) is termed active when the minimum power entered by the user (refer to the INACT CHAN THRESHOLD softkey) is exceeded and if the signal-to-noise ratio is sufficient. In *CODE CHAN PREDEFINED* mode, each code channel contained in the user-defined channel table is identified as active.

The code domain power analysis supports two sorting orders: the Hadamard and BitReverse order. With the Hadamard order the codes are displayed in ascending order: 0.32, 1.32, 2.32, ..., 31.32. The power in the code is shown for each code. If a code channel in the signal is overlapped by several codes, the individual power of the codes is displayed. If the total power of this bunched code channel is to be read off, the BitReverse order must be used.

Fig. 6-7   CDP diagram in Hadamard order

With the BitReverse order, the sorting sequence of the channels is different since the code numbers are interpreted in reverse order at bit level. This results in the following code sequence for base spreading factor 32: 0.32, 16.32, 8.32, ... 15.32, 31.32 (refer to Chapter 9). The codes of a bunched code channel are now adjacent to each other and the total power of the code channel is displayed.

Fig. 6-8   CDP diagram in BitReverse order for the same signal

By entering a channel number (refer to the *SELECT CHANNEL* softkey), a channel can be highlighted for more detailed displays. The codes of these channels are displayed in red.
The selection of more detailed analyses (e.g. SYMBOL CONSTELLATION) for unassigned codes is possible but not meaningful, since the results are not valid.

To give an overview of the two code domain power measurements in addition to the separate analysis of the I and Q branches, a CODE DOM OVERVIEW softkey, which can be used to switch to Overview mode, is provided in the SETTINGS menu. In Overview mode, the I branch is analyzed on Screen A and the Q branch on Screen B.

Fig. 6-9   CDP diagram in BitReverse order in overview mode

IEC-bus command: :CALCulate<1>:FEED "XPOW:CDP:RAT" (relative)
                     :CALCulate<1>:FEED "XPOW:CDP" (absolute)
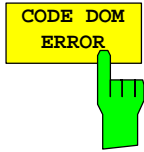
CODE DOM
ERROR

The *CODE DOM ERROR* softkey selects the analysis of the code domain error power (CDEP).

The code domain error-power measurement outputs the power value difference between the measured and ideally generated reference signal for each code in dB. Since it is an error power, active and inactive channels can be assessed jointly at a glance with this analysis.

With the code domain error-power analysis, allowance is made for the total signal over precisely one power control group and the error powers are determined for the different codes and plotted in a diagram. In this diagram, the x-axis is the code number and the y-axis is a logarithmic level axis, dB being the unit. The number of codes on the x-axis, which corresponds to the base spreading factor, can be set by means of the *BASE SF 16/32/64* softkey. The power control group to be analyzed can be set by means of the *SELECT PCG* softkey. The S*ELECT I/Q* softkey is used to select the branch to be analyzed.

The power values of the active and unassigned codes are displayed in different colors: Additionally, codes with alias power may also occur. In this case a code contains power components which result from a higher spreading factor than the base spreading factor.
The following color coding is defined:

- Yellow   Active channel
- Cyan   Unassigned code (neither on I nor Q branch)
- Light blue   Alias power from higher spreading factor
- Light green   Quasi-inactive code (the code on the analyzed branch is inactive, but the code with the same code number on the other branch belongs to an active channel)

Note: *If the code domain power analysis indicates alias power, the highest base spreading factor should be set using the BASE SF softkey.*

A channel in *CODE CHAN AUTOSEARCH* (Automatic Channel Search mode) is termed active when the minimum power entered by the user (refer to the INACT CHAN THRESHOLD softkey) is exceeded and if the signal-to-noise ratio is sufficient. In *CODE CHAN PREDEFINED* mode, each code channel contained in the user-defined channel table is identified as active.
The code domain error-power analysis supports two sorting orders: the Hadamard and BitReverse order. With the Hadamard order the codes are displayed in ascending order: 0.32, 1.32, 2.32 ... 31.32. The power in the code is shown for each code.
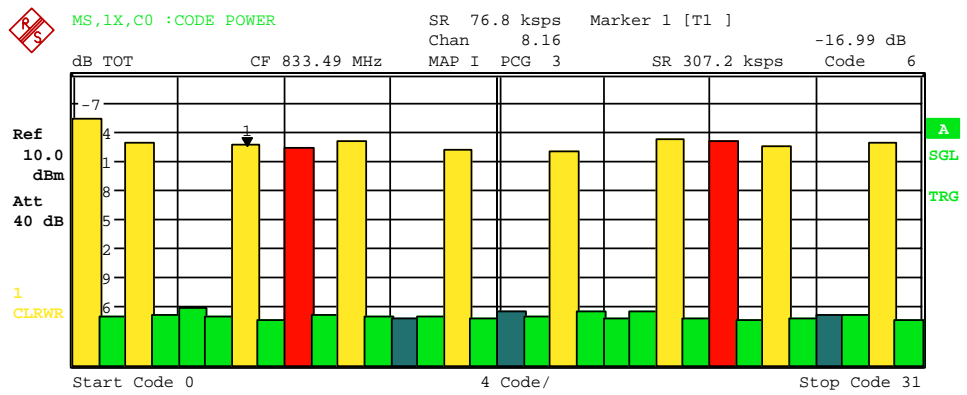

Fig. 6-10   CDEP diagram in Hadamard order

With the BitReverse order, the sorting sequence of the channels is different

since the code numbers are interpreted in reverse order at bit level. This results in the following code sequence for base spreading factor 32: 0.32, 16.32, 8.32, ..., 15.32, 31.32 (refer to Chapter 9). Unlike code domain power analysis, with code domain error-power analysis no power values of the bunched code channel are displayed since the code domain error-power analysis is used for error powers.
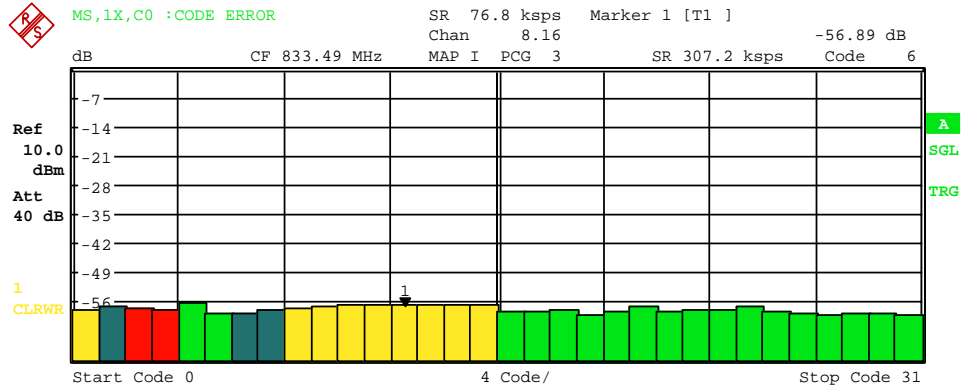
Fig. 6-11   CDEP diagram in BitReverse order for the same signal

By entering a channel number (refer to the *SELECT CHANNEL* softkey), a channel can be highlighted for more detailed displays. The codes of these channels are displayed in red.
The selection of more detailed analyses (e.g. SYMBOL CONSTELLATION) for unassigned codes is possible but not meaningful, since the results are not valid.

To give an overview of the two code domain power measurements in addition to the separate analysis of the I and Q branches, a CODE DOM OVERVIEW softkey, which can be used to switch to Overview mode, is provided in the SETTINGS menu. In Overview mode, the I branch is analyzed on Screen A and the Q branch on Screen B.

IEC-bus command: :CALCulate<1>:FEED "XPOW:CDEP"
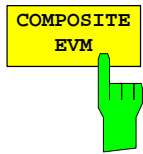
COMPOSITE EVM

The *COMPOSITE EVM* softkey selects the analysis of the error vector magnitude (EVM) over the total signal (modulation accuracy).

The composite EVM measurement determines the square root from the error square between the real and imaginary components of the test signal and of an ideally generated reference signal (EVM referred to the total signal).

The measurement result consists of one composite EVM measurement value per power control group (PCG). The number of PCGs can be set by means of the *CAPTURE LENGTH* softkey. Accordingly, the COMPOSITE EVM analysis takes into account the total signal over the whole period of observation.

Only the channels detected as being active for this channel type are used to generate the ideal reference signal. In the case of a channel which is not detected as being active on account of, say, low power, the difference between the test/reference signal and the composite EVM is therefore very large (refer to the figure).
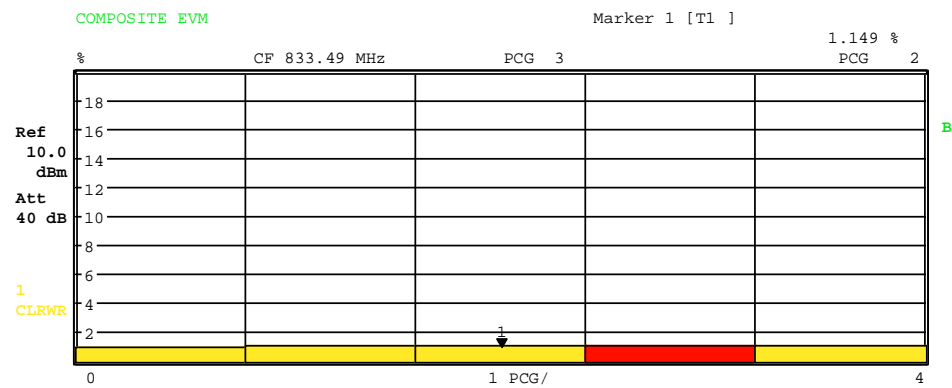
Fig. 6-12 Display of Composite EVM when all channels contained in the signal were detected as active
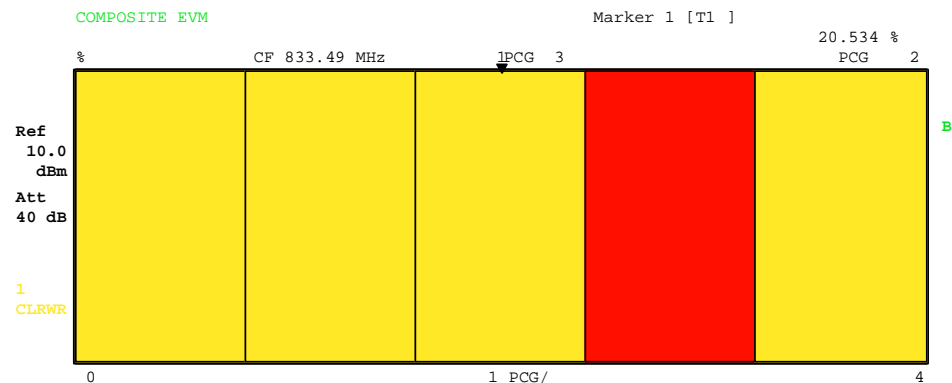
Fig. 6-13 Display of Composite EVM when one code channel was not detected as active

As with the selection of a code channel in the CDP or CDEP diagram, there is the option of selecting a PCG in the Composite EVM diagram. Selection is performed by entering the PCG number (refer to the *SELECT PCG* softkey). The selected PCG is displayed as a red bar.

IEC-bus command: :CALCulate2:FEED "XTIM:CDP:MACCuracy"

PEAK CODE DOMAIN ERR
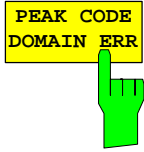
The *PEAK CODE DOMAIN ERR* softkey selects the analysis of the peak code domain error.

With the peak code domain error measurement, there is a projection of the error between the test signal and the ideally generated reference signal to the base spreading factor. The unit on the y-axis is dB. The base spreading factor is selected using the *BASE SF 16/32/64* softkey. The S*ELECT I/Q* softkey is used to select the branch to be analyzed.

The measurement result consists of one numerical value per PCG for the peak code domain error. The number of PCGs can be set by means of the *CAPTURE LENGTH* softkey. Accordingly, the peak code domain-error analysis takes into account the total signal over the whole period of observation.

Only the channels detected as being active are used to generate the ideal reference signal for the peak code domain error. If an assigned code is not detected as being active on account of low power, the difference between the test signal and the reference signal is very large. The R&S FS-K83 therefore displays a peak code domain error that is too high (refer to figure).
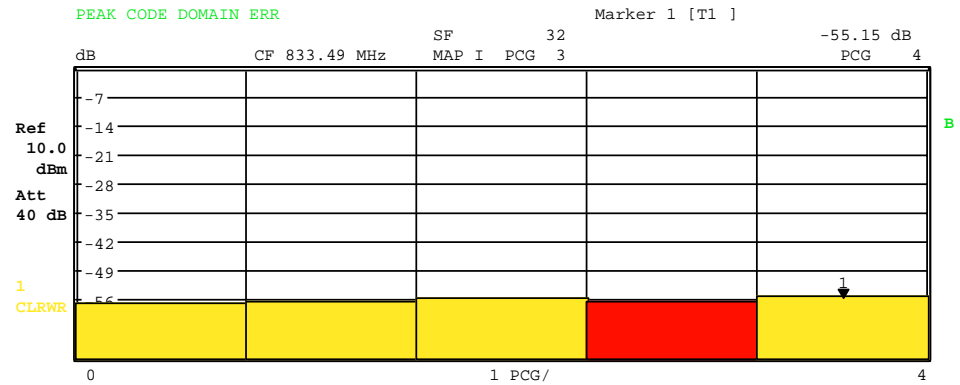
Fig. 6-14   Peak code domain error in the event of all channels contained in the signal being detected as active
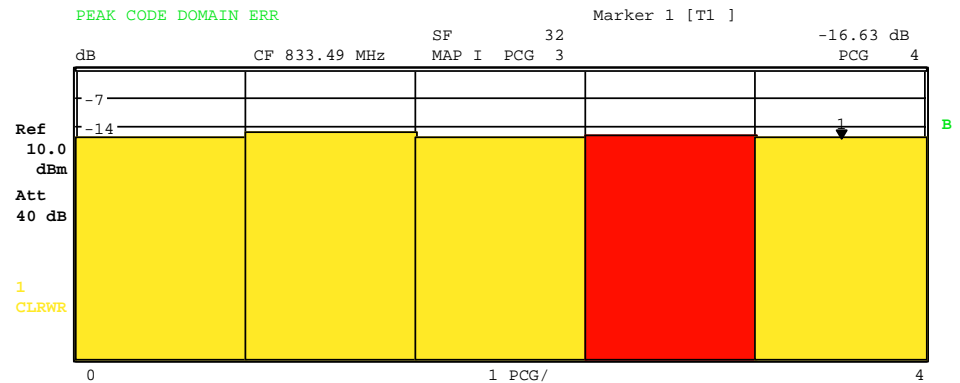
Fig. 6-15   Peak code domain error in the event of one channel not being detected as active

As with the selection of a code channel in the CDP or CDEP diagram, there is the option of selecting a PCG in the peak code domain-error diagram. Selection is performed by entering the PCG number (refer to the *SELECT PCG* softkey). The selected PCG is displayed as a red bar.

IEC-bus command: :CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"
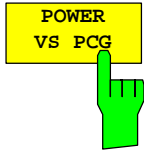
The *POWER VS PCG* softkey enables the POWER versus power control group (PCG) analysis.

The absolute power for the selected channel is displayed as an average for each PCG. The unit on the y-axis is dBm.

The measurement result consists of one numerical value per PCG for the power value. The number of PCGs can be set by means of the *CAPTURE LENGTH* softkey. Accordingly, the POWER VS PCG analysis allows for one code channel over the whole period of observation.

Note: *The external trigger must be used to ensure that the beginning of a power control group is always detected correctly in the case of a power-controlled signal.*
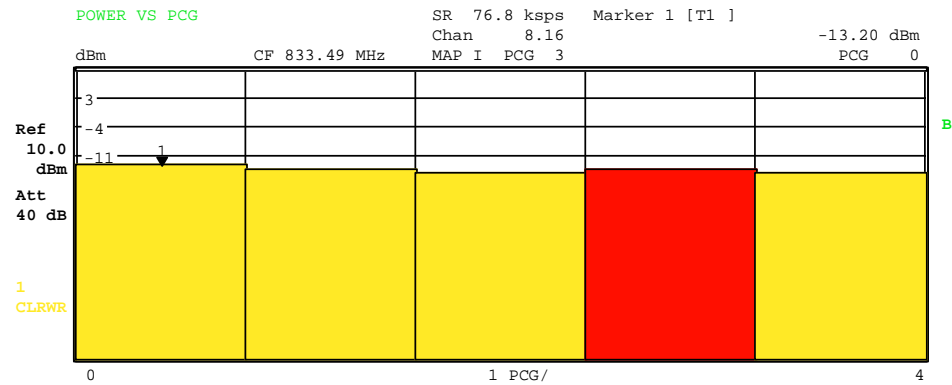
Fig. 6-16   Power versus PCG for an assigned channel with power control

As with the selection of a code channel in the CDP or CDEP diagram, there is the option of selecting a PCG in the Power versus PCG diagram. Selection is performed by entering the PCG number (refer to the *SELECT PCG* softkey). The selected PCG is displayed as a red bar.

IEC-bus command: :CALCulate2:FEED "XTIM:CDP:PVSLot"

RESULT
SUMMARY

The *RESULT SUMMARY* softkey selects the numerical analysis of all measurement results. The analysis has the following structure:

```
RESULT SUMMARY TABLE              SR  76.8 ksps
                                  Chan    8.16
                   CF 833.49 MHz  MAP I  PCG  3
        ┌───────────────────────────┬──────────────────────────────┐
        │      RESULTS FOR PCG  3:   │      GLOBAL RESULTS:          │
        │ Total PWR         -0.26 dBm│ Carr Freq Error    -1.13 kHz │   B
Ref     │ Pilot PWR        -11.21 dBm│ Carr Freq Error    -1.36 ppm │
10.0    │ RHO            0.99989     │ Chip Rate Error    -1.34 ppm │
 dBm    │ Composite EVM     1.06 %   │ Trg to Frame  383.776751 ns  │
Att     │ Pk CDE (SF  32/I)-56.29 dB │ Active Channels        5      │
40 dB   │ IQ Imbal/Offset 0.04/0.83 %│                              │
        ├───────────────────────────┼──────────────────────────────┤
        │      CHANNEL RESULTS:      │ Mapping               I      │
1       │ Symbol Rate       76.8 ksps│ Timing Offset    -0.10 ns    │
CLRWR   │ Channel.SF        8.16     │ Phase Offset      0.66 mrad  │
        │ Channel Power Rel-13.95 dB │ Channel Power Abs -14.21 dBm │
        │ Symbol EVM        0.91 % rms│ Symbol EVM       2.56 % Pk   │
        └───────────────────────────┴──────────────────────────────┘
```

Fig. 6-17   Result summary

The top left-hand part shows measurement results which affect the total signal (i.e. all channels) for the power control group selected using the *SELECT PCG* softkey:

Total Power: Specifies the total power of the signal.

Pilot Power: Specifies the pilot power.

RHO: Specifies the RHO quality parameter. According to the cdma2000 specification, RHO is the normalized, correlated power between the measured and the ideally generated reference signal. The cdma2000 specification requires that only the pilot channel be input during measurement of RHO.

Composite EVM: The Composite EVM value is the difference between the test signal and the ideal reference signal (refer to the *COMPOSITE EVM* softkey).

Pk CDE: The *PEAK CODE DOMAIN ERR* measurement specifies a projection of the difference between test signal and ideal reference signal to the selected base spreading factor (refer to the *PEAK CODE DOMAIN ERR* and *SELECT BASE SF* softkeys). The base spreading factor, for which the projection is made, is specified next to the measured value.

IQ Imbalance: IQ imbalance of the signal in %

IQ Offset: DC offset of the signal in %

The top right-hand part shows measurement results which affect the total signal (i.e. all channels) for the whole period of observation (i.e. all PCGs):

Carrier Freq Error:

                    Specifies the frequency error referred to the set center frequency of the analyzer. The absolute frequency error is the sum of the frequency error of the analyzer and that of the device under test. Differences of more than 2.0 kHz between transmitter and receiver frequency impair synchronization of the CDP measurement. If at all possible, the transmitter and the receiver should be synchronized (refer to the chapter "Getting Started"). The frequency error is available in Hz, and in ppm referred to the carrier frequency.

Chip Rate Error: Specifies the chip rate error (1.2288 Mcps) in ppm. A large chip rate error results in symbol errors and, consequently, possibly in the CDP measurement not being able to perform

synchronization. This measurement result is also valid if the analyzer was not able to synchronize to the cdma2000 signal.

Trigger to Frame:

This measurement result reproduces the timing offset from the beginning of the acquired signal section until the start of the first PCG. In the case of triggered data acquisition, this corresponds to the timing offset frame-trigger (+ trigger-offset) - start of the first PCG. If the analyzer was not able to synchronize to the cdma2000 signal, the value of Trg to Frame is not meaningful. If the *FREE RUN* trigger is selected, dashes (---) are displayed.

No of Active Chan:

Specifies the number of active channels which were found in the signal.

The lower part of the RESULT SUMMARY shows the results of measurements on the selected channel and the selected PCG.

Symbol Rate: Symbol rate with which the channel is transmitted.

Mapping: Indicates whether the I or Q branch is being analyzed.

Channel.SF: Number of channel and its associated spreading factor.

Timing Offset: Timing offset between the selected channel and the pilot channel. This measurement can be enabled by means of the *TIME/PHASE* softkey.

Phase Offset: Phase offset between the selected channel and the pilot channel. This measurement can be enabled by means of the *TIME/PHASE* softkey.

Chan Pow rel. / abs.:

Relative channel power (referred to the pilot or total power, depending on the *POWER REF TOT/PICH* softkey) and absolute channel power.

Symbol EVM Pk / RMS:

Peak or mean value of the results of the error vector magnitude measurement (refer to the *SYMBOL EVM* softkey). The measurement provides information about the EVM of the selected channel for the selected PCG at symbol level.

If the *MAX/MIN HOLD* or *AVERAGE* trace statistics are enabled using the *TRACE* hardkey, the values are interlinked accordingly from one analysis to the next. The Active Channels, Symbol Rate, Channel.SF and Mapping values are not statistically interlinked. In the case of the values which have an expectation value of 0 (Carr Freq Error, Trg to Frame, IQ Imbal/Offset, Timing and Phase Offset), the maximum value is formed in such a way that the maximum is sought among the absolute values and then output with sign. In this way it is possible to determine the largest deviation including the direction of the deviation. The minimum value is formed in the same way.

IEC-bus command:`:CALCulate2:FEED "XTIM:CDP:ERR:SUMM"`
`    :CALCulate<1|2>:MARKer<1>:FUNCtion:CDPower:RESult?`
`    PTOTal | FERRor | RHO | PPICh | FERPpm |`
`    CERRor| TFRame | IQOFfset | IQIMbalance |`
`    MACCuracy | PCDerror | SLOT | ACTive | SRATe |`
`    TOFFset | CHANnel | POFFset | SFACtor |`
`    CDPabsolute | CDPRelative |EVMRms | EVMPeak`
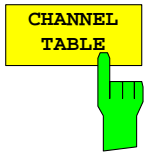
CHANNEL
TABLE

The *CHANNEL TABLE* softkey selects the channel occupancy table analysis.

The channel occupancy table can contain a maximum of 128 entries, corresponding to the highest base spreading factor 64 for both I and Q branch. The Channel Occupancy Table analysis makes allowance for the total signal over precisely one power control group. The power control group to be analyzed can be set by means of the *SELECT PCG* softkey.

The channels are listed in ascending code number order (within a code number: first I and then Q branch). The unassigned codes are therefore always located at the end of the table.

```
MS,1X,C0 :CHANNEL TAB
                                Chan     8.16    Max T    0.15 ns  @  1.2
                   CF 833.49 MHz    MAP I  PCG  3    Max Ph   0.66 mrad @  8.16
```

	Type	Chan.SF	Symb Rate ksps	Map	Status	Pwr Abs dBm	Pwr Rel dB	T Offs ns	Ph Offs mrad	
Ref	PICH	0.32	38.4	I	active	-11.21	-10.95	0.00	0.00	**A**
10.0	S1CH	1.2	614.4	Q	active	-2.21	-1.95	0.15	-0.14	**SGL**
dBm	S2CH	2.4	307.2	I	active	-8.21	-7.95	-0.02	0.44	
	FCH	4.16	76.8	Q	active	-11.22	-10.96	0.15	-0.64	**TRG**
Att	DCCH	8.16	76.8	I	active	-14.21	-13.95	-0.10	0.66	
40 dB	----	0.32	38.4	Q	qinact	-56.88	-56.62	-.--	-.--	
	----	1.32	38.4	I	qinact	-57.54	-57.28	-.--	-.--	
	----	2.32	38.4	Q	qinact	-58.64	-58.38	-.--	-.--	
1	----	3.32	38.4	I	qinact	-14.21	-13.95	-.--	-.--	
CLRWR	----	4.32	38.4	I	qinact	-56.55	-56.29	-.--	-.--	
	----	5.32	38.4	I	qinact	-59.08	-58.82	-.--	-.--	
	----	6.32	38.4	Q	qinact	-59.04	-58.78	-.--	-.--	

Fig. 6-18   Channel table

The following parameters are determined for the channels by means of the CDP measurement:

Type: Type of channel

Chan.SF: Number of the spreading code of the channel (0 to [spreading factor-1]) including the spreading factor of the channel in Chan.SF notation.

Symb Rate: Symbol rate with which the channel is transmitted (19.2 ksps to 614.4 ksps)

Mapping: Mapping of the channel (I or Q branch)

Status: Displays the status. Unassigned codes are identified as inactive channels.

Pwr Abs / Pwr Rel:
                 Specifies the absolute and relative power (referred to the PICH or total power of the signal) of the channel.

T Offs: Timing offset. Timing offset between this channel and the pilot channel can be enabled by means of the *TIME/MEAS* softkey.

Ph Offs: Phase offset. Phase offset between this channel and the pilot channel can be enabled by means of the *TIME/MEAS* softkey.

A data channel is referred to as active in *CODE CHAN AUTOSEARCH* mode when it exhibits the minimum power (refer to the *INACT CHAN THRESHOLD* softkey) and a sufficient signal-to-noise ratio. In *CODE CHAN PREDEFINED* mode, all code channels contained in the channel table are marked as active.

If the TIME/PHASE softkey is set to ON, the maximum value of the TIMING and PHASE OFFSET is displayed together with the associated channel on the right-hand side above the channel table. Since the TIMING and PHASE values of each active channel can be either negative or positive, the absolute values are compared and the maximum is then displayed with the original sign.

IEC-bus command: :CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"
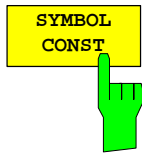
SYMBOL
CONST

The *SYMBOL CONST* softkey selects the analysis of the constellation diagram at symbol level.
Analysis of the symbols is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected PCG (*SELECT PCG* softkey). This means that this analysis makes allowance for results of a channel for a power control group.

The S*ELECT I/Q* softkey is used to select the branch to be analyzed.

Evaluation of the constellation diagram is possible for unassigned codes, but the results are meaningless since unassigned code channels do not contain data.
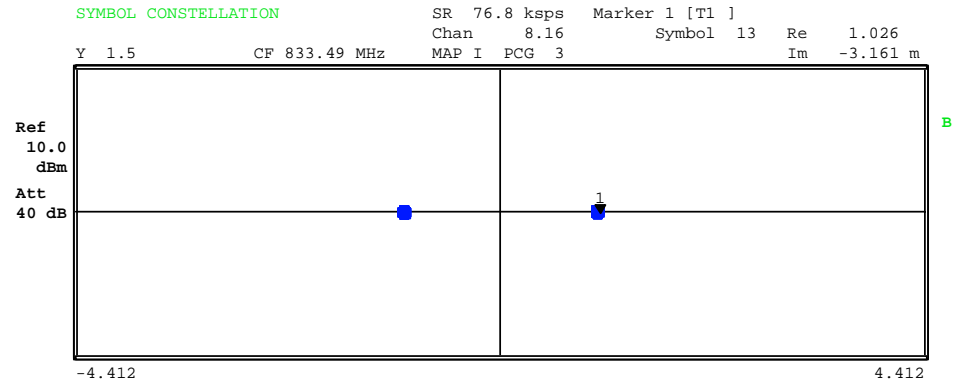
Fig. 6-19   Symbol constellation diagram

IEC-bus command: :CALCulate2:FEED "XTIM:CDP:SYMB:CONS"
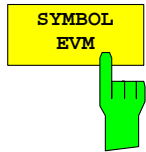
SYMBOL
EVM

The *SYMBOL EVM* softkey selects the analysis for the symbol error vector magnitude. Analysis of the EVM is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected PCG (*SELECT PCG* softkey). This means that this analysis makes allowance for results of a channel for a power control group.

Evaluation of the symbol error vector magnitude for unassigned codes is possible, but the results are not valid.
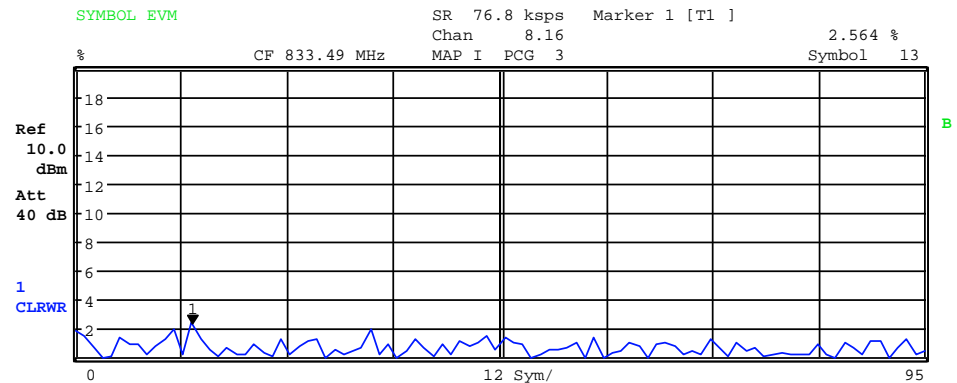
Fig. 6-20   Error vector magnitude for a PCG of a channel

IEC-bus command: :CALCulate2:FEED "XTIM:CDP:SYMB:EVM"

BITSTREAM

The *BITSTREAM* softkey selects the "Bit Stream" analysis.

Analysis of the determined bits is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected PCG (*SELECT PCG* softkey). This means that this analysis makes allowance for results of a channel for a power control group. The S*ELECT I/Q* softkey is used to select the branch to be analyzed.

Depending on the symbol rate of the channel, a minimum of 24 and a maximum of 768 symbols can be contained in a power control group. With BPSK-modulated channels, a symbol always consists of one bit.
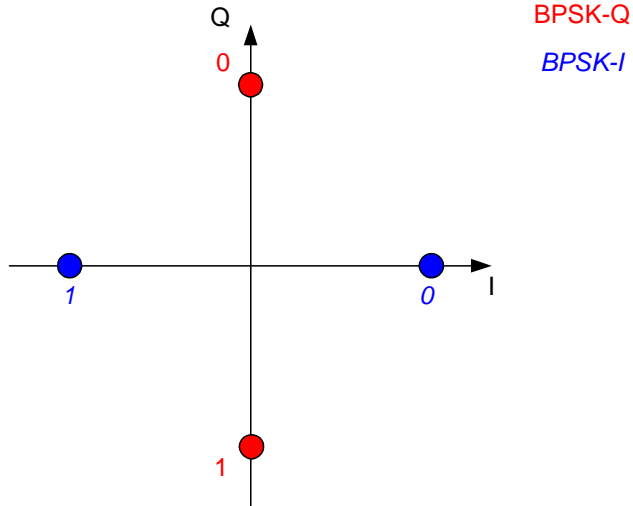
Fig. 6-21   Constellation diagram for BPSK-I and BPSK-Q including bit values

Depending on the radio configuration and the channel type, there are BPSK-I or BPSK-Q-modulated channels in the cdma2000 system.

An analysis of the bit stream for unassigned codes is indeed possible, but since the results are not meaningful on account of the missing data, all bits are identified as invalid ("-") in this case.

The marker can be used to scroll in the bit stream.
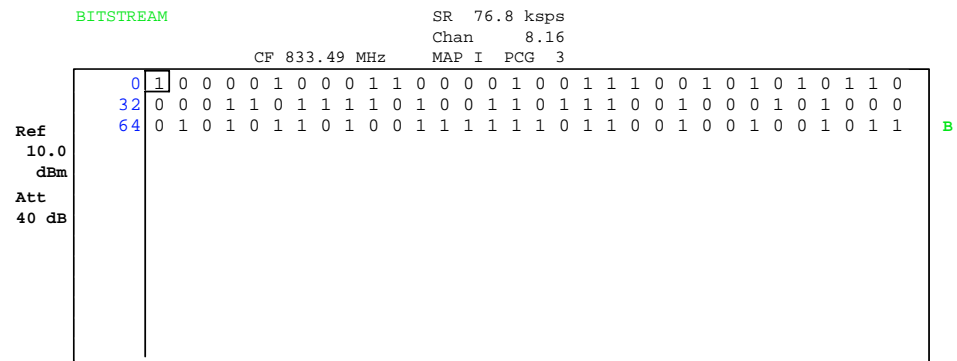
Fig. 6-22   Demodulated bits for a PCG of the channel

IEC-bus command::CALCulate2:FEED "XTIM:CDP:BSTReam"
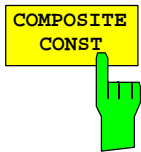
COMPOSITE
CONST

The *COMPOSITE CONST* softkey selects the analysis of the constellation diagram at chip level.

With the COMPOSITE CONST, the total signal is taken into account over the selected power control group (*SELECT PCG* softkey).

A constellation point is plotted for each of the 1536 chips in the diagram.
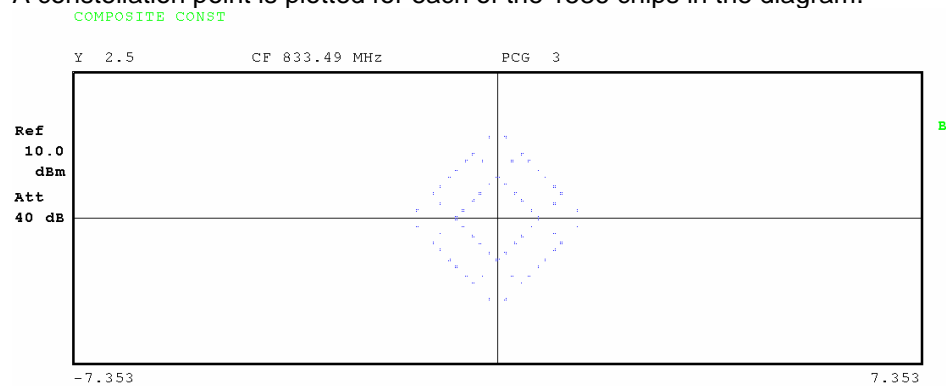
Fig. 6-23   Composite constellation diagram

IEC-bus command: :CALCulate2:FEED "XTIM:CDP:COMP:CONS"
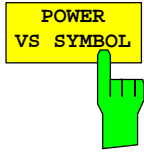
POWER VS SYMBOL

The *POWER VS SYMBOL* softkey selects the Power versus Symbol analysis. The analysis outputs the absolute power in dBm at each symbol time for the selected channel (*SELECT CHANNEL* softkey) and the selected PCG (*SELECT PCG* softkey). This means that this analysis makes allowance for results of a channel for a power control group. The *SELECT I/Q* softkey is used to select the branch to be analyzed.

```
POWER VS SYMBOL                      SR  76.8 ksps   Marker 1 [T1 ]
                                     Chan    8.16                    -13.99 dBm
         dBm           CF 833.49 MHz  MAP I  PCG  3           Symbol   13
```
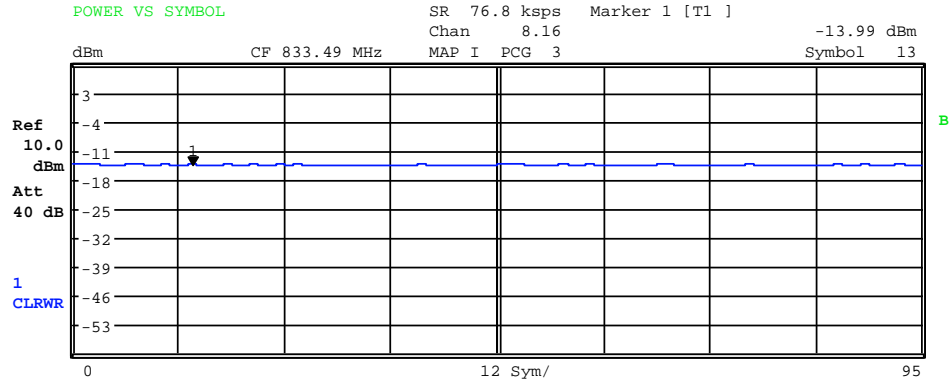

Fig. 6-24   Power versus Symbol for one PCG of a channel

IEC-bus command: :CALCulate2:FEED "XTIM:CDP:PVSY"
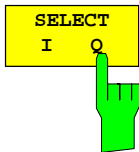
SELECT I Q

The branch to be analyzed (I or Q) is selected using the *SELECT I/Q* softkey. The I branch is selected after a Preset.

IEC-bus command: :[SENSe:]CDPower:MAPPing I | Q

SELECT CHANNEL

A channel is selected using the *SELECT CHANNEL* softkey. All analyses that take the results for a channel into account specify the results for the newly selected channel: POWER VS PCG, POWER VS SYMBOL, RESULT SUMMARY, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM.
In the analyses CODE DOMAIN POWER, CODE DOMAIN ERROR POWER and CHANNEL TABLE (all on Screen A), the selected channel is identified in red to distinguish it.

Channels are entered in decimal format. The entered value is always converted to the base spreading factor. It is displayed in the input field in <channel>.<base spreading factor> format.

Example:
> Base spreading factor is 64. (*BASE SF* softkey).
> The number 14 is entered using the *SELECT CHANNEL* softkey.
> 14.32 is displayed.

Normally the code is displayed referred to the base spreading factor in the function field above the diagrams.
If, however, the current channel table contains a bunched channel to which the selected channel referred to the base spreading factor belongs, this bunched channel together with the associated code number and spreading factor is displayed in the function field and highlighted in red in the respective analyses.

Example:
> Entries as for the example above.
> Now the channel table of channel 2.4 is active.
> Code 14.32 belongs to this channel, so 2.4 is displayed in the function

field and channel 2.4 is highlighted in red on Screen A. In the Hadamard order, all codes associated with channel 2.4 are therefore highlighted: 2.32, 6.32, 10.32, **14.32**, ..., 62.32

If the channel configuration changes at the next measurement, the changed channel to which the channel <channel>.<base spreading factor> belongs, is displayed accordingly in the function field and highlighted in red on Screen A.
Example:
As for the example above, except that the channel configuration has been changed
and channel 6.8 is now active.
Channel 6.8 is displayed in the function field and
highlighted in red on Screen A. In the Hadamard order the codes 6.32, **14.32**, 22.32, ..., 54.32 are therefore highlighted.

The rotating wheel behaviour depends on the analysis on Screen A and is geared to the graphic display. With CODE DOMAIN POWER or CODE DOMAIN ERROR POWER, it depends on whether the Hadamard or BitReverse order is active. (Refer to the *ORDER* softkey). It is always the adjacent channel that is selected with the rotating wheel. With the channel table, the rotating wheel is used to scroll through the list.
Entries made using the IEC/IEEE bus are generally referred to the base spreading factor.

IEC-bus command: `:[SENSe:]CDPower:CODE 0...(BASE SF-1)`
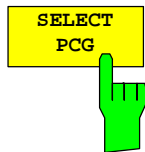
SELECT PCG

The *SELECT PCG* softkey is used to select a power control group. PCGs are entered in decimal format. In this instance the range of values is from 0 to (IQ-Capture-Length); refer to the *CAPTURE LENGTH* softkey. All analyses that take the results for a PCG into account specify the results for the newly selected PCG: (CODE DOMAIN POWER, CODE DOMAIN ERROR POWER, CHANNEL TABLE, POWER vs. SYMBOL, COMPOSITE CONSTELLATION, RESULT SUMMARY, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM)

In the analyses POWER vs. PCG, COMPOSITE EVM and PEAK CODE DOMAIN ERROR, the selected PCG is highlighted in red.

IEC-bus command: `:[SENSe:]CDPower:SLOT 0 ...`
                    `(IQ_CAPTURE_LENGTH–1)`
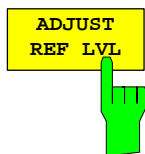
ADJUST REF LVL

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer 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 the analyzer being overloaded or the dynamic response being limited by too low a signal-to-noise ratio.

IEC-bus command: `SENS:POW:ACH:PRES:RLEV`

Measurement configuration

CHAN CONF hotkey
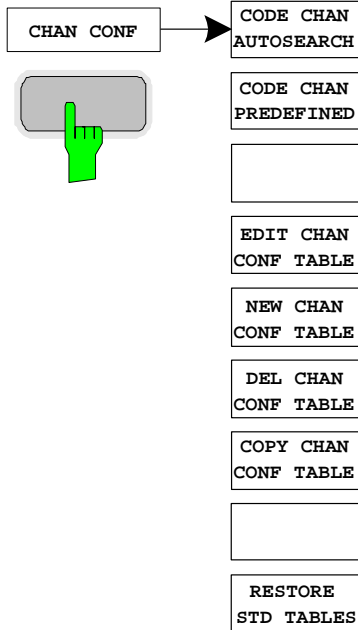
The *CHAN CONF* hotkey opens a submenu with the configuration options for the channel search. In this submenu, predefined channel tables can be selected and are then taken as a basis for measurements of the code domain analyzer.

When the hotkey is clicked, a table containing the channel tables stored on the hard disk of the measuring instrument is opened. The table is used merely to obtain an overview; one of the tables can be selected for the measurement only after the *CODE CHAN PREDEFINED* softkey has been operated. The *RECENT* entry is the channel table of the last Code Domain Power analysis to be performed.

IEC-bus command: `:CONFigure:CDPower:CTABle:CATalog?`

The *CODE CHAN AUTOSEARCH* softkey supports measurements of the code domain power analyzer in Autosearch mode. In this mode, the entire code domain (all permissible symbol rates and channel numbers) is searched for active channels. A channel is active when the minimum power, referred to the total power, entered by the user is exceeded (refer to the *INACT CHAN THRESHOLD* softkey) and a sufficient signal-to-noise ratio exists.

CODE CHAN AUTOSEARCH mode is the default search mode with which the CDP analysis starts. It is primarily used to provide the user with an overview of the channels contained in the signal. If the signal contains channels which are not detected as being active in Autosearch mode, the CDP analysis can be performed with predefined channel configurations by changing to *CODE CHAN PREDEFINED* mode.

IEC-bus command:
   `:CONFigure:CDPower:CTABle[:STATe] OFF`
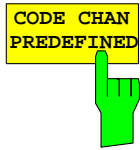
The *CODE CHAN PREDEFINED* softkey switches the CDP analysis to the measuring mode with the help of predefined channel tables. In this mode, there is no search for active channels in the code domain, but the channels of a channel table defined before the measurement are assumed to be active.

When the softkey is clicked, a table containing all the channel tables stored on the measuring instrument is opened. The CDP analysis is switched to "Predefined Channel Table" mode. In this instance, the last table of the automatic search mode is taken as a basis for the measurement. This table is available at the *RECENT* entry .

Switching to one of the predefined channel tables is done by selecting the corresponding table entry and operating one of the units keys or by pressing Enter; the selected channel table is taken as a basis for the analysis as from the next measurement. A checkmark marks the selected channel table.

When the R&S FS-K83 leaves the factory, the channel tables from Chapter 4 on page 22 are stored on the measuring instrument.

IEC-bus command: `:CONFigure:CDPower:CTABle[:STATe]`
`ON:CONFigure:CDPower:CTABle:SELect "RTCHOP3"`

EDIT CHAN CONF TABLE → HEADER VALUES

INSERT LINE

DELETE LINE

MEAS CHAN CONF TABLE

SAVE TABLE

SORT TABLE

PAGE UP

PAGE DOWN
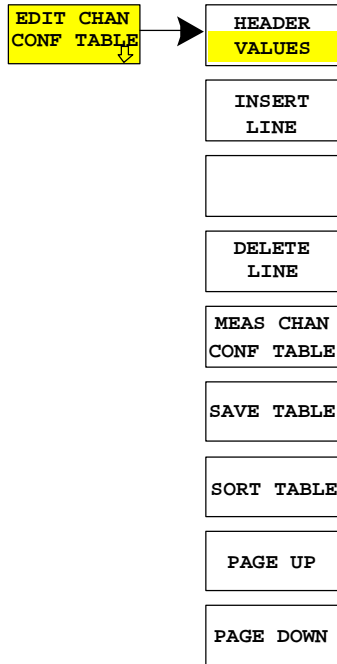
The *EDIT CHAN CONF TABLE* softkey opens the selected channel table in which the channel configuration can be modified. In addition, a submenu is opened with the softkeys required for editing the channel table.

EDIT CHANNEL TABLE					
NAME:	REVTCO				
COMMENT:	Standard Reverse Traffic Channel Operation				
TYPE	CHAN.SF	SYMBOL RATE [ksps]	MAPPING	CDP REL [dB]	STATUS
PICH	0.32	38.4	I	0.0	ACTIVE
S1CH	2.4	307.2	Q	0.0	ACTIVE
FCH	4.16	76.8	Q	0.0	ACTIVE
S2CH	6.8	153.6	I	0.0	ACTIVE
DCCH	8.16	76.8	I	0.0	ACTIVE
CQICH	12.16	76.8	Q	0.0	ACTIVE
ACKCH	16.64	19.2	Q	0.0	ACTIVE
CHAN	0.32	38.4	Q	0.0	INACTIVE
CHAN	1.32	38.4	I	0.0	INACTIVE
CHAN	1.32	38.4	Q	0.0	INACTIVE
CHAN	2.32	38.4	I	0.0	INACTIVE
CHAN	3.32	38.4	I	0.0	INACTIVE
CHAN	3.32	38.4	Q	0.0	INACTIVE
CHAN	4.32	38.4	I	0.0	INACTIVE
CHAN	5.32	38.4	I	0.0	INACTIVE
CHAN	5.32	38.4	Q	0.0	INACTIVE
CHAN	7.32	38.4	I	0.0	INACTIVE
CHAN	7.32	38.4	Q	0.0	INACTIVE
CHAN	8.32	38.4	Q	0.0	INACTIVE
CHAN	9.32	38.4	I	0.0	INACTIVE
CHAN	9.32	38.4	Q	0.0	INACTIVE
CHAN	10.32	38.4	I	0.0	INACTIVE
CHAN	11.32	38.4	I	0.0	INACTIVE
CHAN	11.32	38.4	Q	0.0	INACTIVE
CHAN	12.32	38.4	I	0.0	INACTIVE

Fig. 6-25   Table for editing a channel configuration

As a general rule, each of the channel tables stored on the measuring instrument can be modified at will. The edited table is not stored automatically on the hard disk of the measuring instrument but only by selecting the *SAVE TABLE* softkey. This prevents a table from being accidentally overwritten (e.g. one of the channel models).

If a table that is currently the basis for the Code Domain Power analysis is edited, the edited table is used for the next measurement immediately after being saved. The effects of the changes in the table are therefore immediately visible. Here again, the edited table is not saved on the hard disk of the measuring instrument until the *SAVE TABLE* softkey is clicked.

If a table is edited that is stored on the hard disk of the measuring instrument but is not currently enabled, the changes will not be visible until it has been saved (*SAVE TABLE* softkey) and then enabled.

If the CHAN NO parameter, spreading factor or mapping of a channel is modified, a code domain conflict check is performed after confirming the input (units keys). If a code domain conflict is detected, the associated channels are identified by an asterisk. You are given the opportunity of eliminating the code domain conflicts. If a table with code domain conflicts is used for a CDP analysis, the results are invalid.
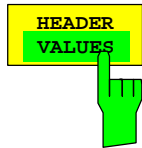
The *HEADER/VALUES* softkey sets the focus of the edit option either to the entries in the table or to the table header.

Editing the table header (*HEADER*):
Overwriting of saved tables can be avoided by changing the name of a table. A table name must not consist of more than 8 characters.

IEC-bus command:
```
:CONFigure:CDPower:CTABle:NAME "NEW_TAB"
```

Editing table entries (*VALUES*):
The actual data of the channel table are edited here. The following entries are available for each of the channels contained in the table (confirm an input using the units keys):

TYPE: Channel type; the special channels are identified by name (PICH, EACH, CCCH, DCCH, ACKCH, CQICH, CQICH, FCH, S1CH, S2CH). All inactive channels have the entry CHAN.

CHAN.SF: The channel number and the spreading factor are entered for the channel in this column. If values are entered without a decimal point, the base spreading factor is used for the spreading factor of the channel (refer to the *BASE SF* softkey). Invalid entries are rejected.

SYMBOL RATE: Symbol rate with which the channel is transmitted. It depends directly on the spreading factor of the channel (refer to Table 6-14) and cannot therefore be edited.

MAPPING: Specifies whether the channel is active on the I or Q branch.

CDP REL.: Indicates the relative channel power (referred to the pilot or total power, depending on the *POWER REF TOT/PICH* softkey). The entry cannot be edited and only exists for the *RECENT* table; it is used to detect channels with low power.

STATUS: Status of the channel (active/inactive). When a change of channel status occurs, a channel that has been entered in the table can be hidden in the Code Domain Power analysis without having to remove the corresponding entry from the table. Only channels having an "active" channel status are used for the CDP analysis.

IEC-bus commands
```
CONFigure:CDPower:CTABle:DATA
  0,5,0,0,0,0,1,0,         'Selects PICH 0.32 on I and
  2,3,2,1,0,0,1,0          'CCCH 2.8 on Q
 :CONFigure:CDPower:CTABle:COMMent "Comment for
new table"
```

**INSERT
LINE**
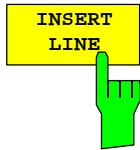
The PICH pilot channel is always contained in the channel table. The *ADD SPECIAL* softkey allows additional channels to be added to the channel table.

ADD SPECIAL CHANNEL	
EACH	Enhanced Access Channel
CCCH	Reverse Common Control Channel
DCCH	Reverse Dedicated Control Channel
ACKCH	Reverse Acknowledgment Channel
CQICH	Reverse Channel Quality Indicator Channel
FCH	Fundamental Channel
S1CH	Reverse Supplemental 1 Channel
S2CH	Reverse Supplemental 2 Channel

Fig. 6-26   Table of special channels

IEC-bus command: -- (Integrated in
command:`CONFigure:CDPower:CTABle:DATA`)
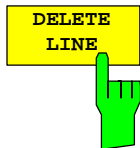
**DELETE
LINE**

The *DELETE LINE* softkey deletes the highlighted line from the table.

IEC-bus command: --

**MEAS CHAN
CONF TABLE**
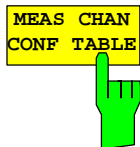
The *MEAS CHAN CONF TABLE* softkey initiates a measurement in *CODE CHAN AUTOSEARCH* mode. The measurement results are applied to the open channel table. The softkey is only available in *CODE CHAN AUTOSEARCH* mode.

IEC-bus command: --
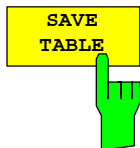
**SAVE
TABLE**

The *SAVE TABLE* softkey saves the table under the specified name. Note: Editing of the channel models and saving under the original name results in the models being overwritten.

IEC-bus command: -- (Automatic with remote control)
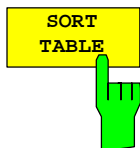
**SORT
TABLE**

The *SORT TABLE* softkey sorts the table in ascending spreading factor order and in ascending channel number order within the spreading factors.

IEC-bus command: --

**DEL CHAN
CONF TABLE**

The *DEL CHAN CONF TABLE* softkey deletes the highlighted table. The currently active table in *CODE CHAN PREDEFINED* mode cannot be deleted.

IEC-bus command: `:CONFigure:CDPower:CTABle:DELete`

COPY CHAN
CONF TABLE
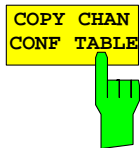
The *COPY CHAN CONF TABLE* softkey copies the selected table. The system asks for the name under which you want to save the copy.

IEC-bus command:
```
:CONFigure:CDPower:CTABle:COPY "CTAB2"
```

RESTORE
STD TABLES

The *RESTORE STD TABLES* softkey restores the predefined channel tables including all of their values (refer to Chapter 4) to the state in which they were in when the device left the factory. In this way unintentional overwriting can be undone.

IEC-bus command::
```
CONFigure:CDPower:CTABle:RESTore
```

```
┌──────────────┐          ┌──────────────┐
│  NEW CHAN    │─────────▶│   VALUES     │
│  CONF TABLE  │          │   HEADER     │
└──────────────┘          └──────────────┘

                          ┌──────────────┐
                          │   INSERT     │
                          │    LINE      │
                          └──────────────┘

                          ┌──────────────┐
                          │              │
                          └──────────────┘

                          ┌──────────────┐
                          │   DELETE     │
                          │    LINE      │
                          └──────────────┘

                          ┌──────────────┐
                          │  MEAS CHAN   │
                          │  CONF TABLE  │
                          └──────────────┘

                          ┌──────────────┐
                          │  SAVE TABLE  │
                          └──────────────┘

                          ┌──────────────┐
                          │  SORT TABLE  │
                          └──────────────┘

                          ┌──────────────┐
                          │   PAGE UP    │
                          └──────────────┘

                          ┌──────────────┐
                          │  PAGE DOWN   │
                          └──────────────┘
```
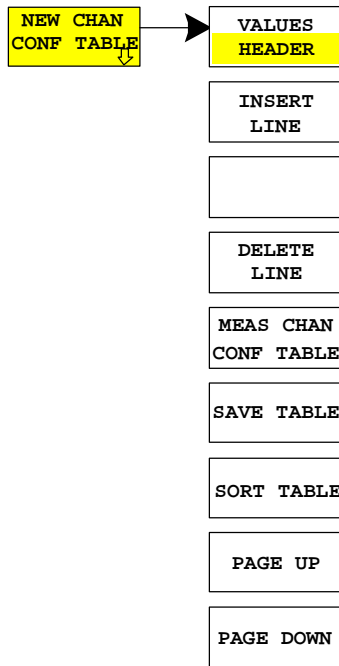
The *NEW CHAN CONF TABLE* softkey opens a submenu that is identical to that described for the *EDIT CHAN CONF TABLE* softkey. Unlike *EDIT CHAN CONF TABLE*, however, only the pilot channel PICH is entered in the table with *NEW CHAN CONF TABLE*; the name of the table is also as yet undecided:

EDIT CHANNEL TABLE					
NAME:	default				
COMMENT:	default				
TYPE	CHAN.SF	SYMBOL RATE [ksps]	MAPPING	CDP REL [dB]	STATUS
PICH	0.32	38.4	I	0.0	ACTIVE

Fig. 6-27   Creating a new channel configuration

Configuring the application firmware – SETTINGS

SETTINGS hotkey

SETTINGS	→	BAND CLASS	LONG CODE MASK
		BASE SF ⇩	LONG CODE OFFSET
		CAPTURE LENGTH	
		ORDER HADAM BITRE	INACT CHAN THRESHOLD
		CODE DOM OVERVIEW	
		SELECT I Q	
		CODE PWR ABS REL	INVERT Q ON OFF
		POWER REF TOT PICH	SIDE BAND NORM INV
		TIME/PHASE ON OFF	NORMALIZE ON OFF
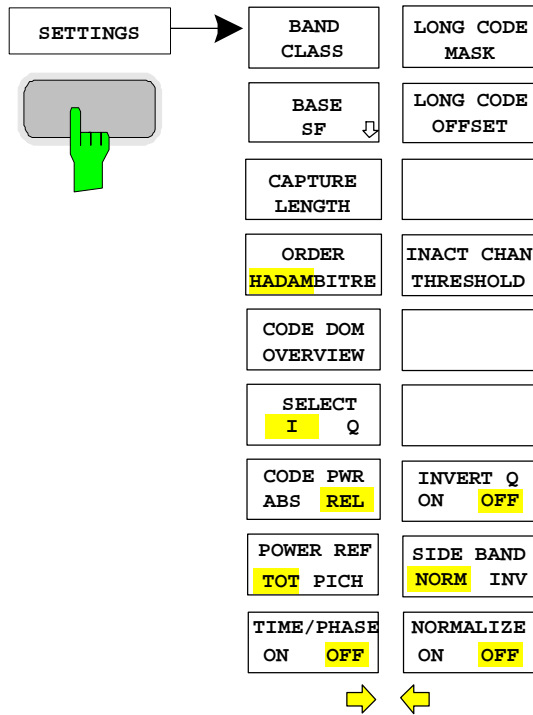
The *SETTINGS* hotkey opens a submenu for setting the measurement parameters of the application firmware.

The *BAND CLASS* softkey is a setting parameter for the RF measurements "adjacent channel power" and "spectrum emission mask".

All other softkeys configure the measurements in the code domain analyzer.
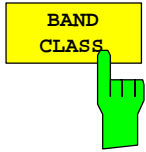
BAND CLASS

The *BAND CLASS* softkey allows input of the used frequency band for the RF measurements "adjacent channel measurement" and "spectrum emission mask". The selection is made from a table in which the name of the band class is displayed.

Entry of the center frequency is not restricted by the band class selection.

```
        BAND CLASS SELECTION

    Band Class  0 (800 MHz Band)
  √ Band Class  1 (1900 MHz Band)
    Band Class  2 (TACS Band)
    Band Class  3 (JTACS Band)
    Band Class  4 (Korean PCS Band)
    Band Class  5 (450 MHz Band)
    Band Class  6 (2 GHz Band)
    Band Class  7 (700 MHz Band)
    Band Class  8 (1800 MHz Band)
    Band Class  9 (900 MHz Band)
    Band Class 10 (Secondary 800 MHz Band)
    Band Class 11 (400 MHz European PAMR Band)
    Band Class 12 (800 MHz PAMR Band)
```

Fig. 6-28   Band class selection

You can scroll in the table, and the entry currently being used is checked, while a bar displays the selected entry; press ENTER to apply the value.
The numerical value is specified by means of the IEC/IEEE bus.

IEC-bus command: :CONFigure:CDPower:BCLass 1 '1900 MHz
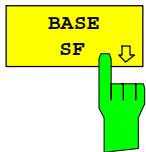
BASE SF

The *BASE SF* softkey opens a submenu in which a base spreading factor of 16, 32 or 64 can be selected. If channels of spreading factor 64 are analyzed, base spreading factor 64 should be used since alias power is displayed in the CODE DOMAIN POWER and CODE DOMAIN ERROR POWER diagram if base spreading factor 16 or 32 is used. (Refer to the color coding used for these analyses.)

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IEC-bus command: :[SENSe:]CDPower:SFACtor 16 | 32 | 64

32

64
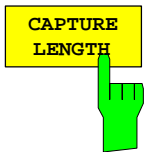
CAPTURE LENGTH

The *CAPTURE LENGTH* softkey allows entry of the number of power control groups (PCGs) to be acquired. The input is always made as a multiple of the PCG. The range is from 2 to 50 for the R&S FSU, R&S FSQanalyzers and from 2 to 12 for the R&S FSP analyzer. For all analyses that exhibit one value per PCG on the x-axis, the maximum value on the x-axis is the set CAPTURE LENGTH -1.

IEC-bus command: :[SENSe:]CDPower:IQLength 2..50 (2..12)
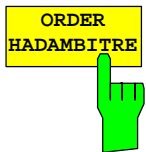
ORDER HADAMBITRE

The *ORDER HADAM/BITRE* softkey allows the channel sorting order to be determined for the CODE DOMAIN POWER and CODE DOMAIN ERROR POWER analyses. With the Hadamard order (softkey to HADAM), the codes are sorted in ascending order. With the BitReverse order (softkey to BITRE), channels with bunched codes are adjacent to each other since the code numbers are sorted with the bits reversed. (Refer to the CODE DOMAIN POWER and CODE DOMAIN ERROR POWER analyses.)

IEC-bus command: :[SENSe:]CDPower:ORDer HADamard | BITReverse
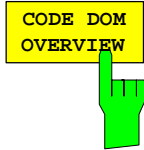
**CODE DOM
OVERVIEW**

The *CODE DOM OVERVIEW* softkey is available and can be enabled for the code domain power and code domain error-power measurements. If Overview mode is activated, Screen A always displays the I branch and Screen B the Q branch of the CDP and CDEP analysis.

IEC-bus command: `:[SENSe:]CDPower:OVERview ON|OFF`
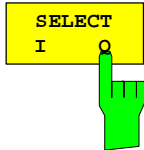
**SELECT
I   Q**

The I or Q branch to be analyzed is selected with the *SELECT I/Q* softkey. The I branch is selected after a Preset.

IEC-bus command: `:[SENSe:]CDPower:MAPPing I | Q`
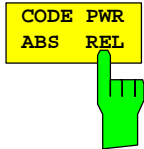
**CODE PWR
ABS   REL**

The *CODE PWR ABS/REL* softkey selects for the CODE DOMAIN POWER analysis whether the y-values should be displayed as absolute (dBm) or relative (dB). In relative mode, the reference is either the total power or the pilot power.

IEC-bus command:

`:CALCulate<1>:FEED "XPOW:CDP:RAT"` (relative)
`:CALCulate<1>:FEED "XPOW:CDP"` (absolute)
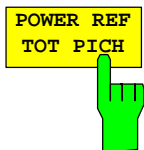
**POWER REF
TOT PICH**

The *POWER REF TOT/PICH* softkey determines the reference power for the relative power analyses:

TOT   For each PCG, all relative power values (*CDP RELATIVE* analyses) are referred to the total power of the signal in the respective PCG.

PICH   The reference power is that of the pilot channel in the corresponding PCG.

The default setting of the softkey is *TOT*.

IEC-bus command: `:[SENSe:]CDPower:PREFerence TOTal | PICH`
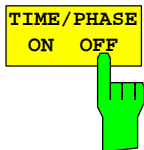
**TIME/PHASE
ON   OFF**

The *TIME/PHASE ON/OFF* softkey supports specific enabling and disabling of the Timing and Phase Offset analysis of the channels for the pilot. If the value of the softkey is OFF (default setting) or there are more than 50 active channels in the signal, dashes ('---') are entered in the channel occupancy table and in the Result Summary analysis for timing and phase offset. If the softkey is ON, the analysis will take place and the values will be displayed.

IEC-bus command: `:[SENSe:]CDPower:TPMeas ON | OFF`

**LONG CODE
MASK**

The *LONG CODE MASK* softkey is used to define the long code mask of the mobile in hexadecimal form. The advantage of a default value of 0 is that no long code offset (refer to the *LONG CODE OFFSET* softkey) has to be defined since this offset is not taken into consideration for a long code mask of 0. The value range is from 0 to 4FFFFFFFFFF.

IEC-bus command:
`:[SENSe:]CDPower:LCODe:MASK`   `'#H0'`   ...
                                                  `'#H4FFFFFFFFFF'`
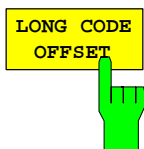
**LONG CODE
OFFSET**

The *LONG CODE OFFSET* softkey allows the long code offset, including the PN offset, to be set 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 long code offset is used for offsetting at the next trigger pulse (which cannot occur until a setup time of 300 ms has elapsed). The command is only available if a

long code mask unequal to 0 is set.

The chips offset is calculated as follows: $t_{SinceStartGPS}$ * 1.2288 MChips/s, where $t_{SinceStartGPS}$ should be in seconds.

Example: The hexadecimal offset of 258000 h chips is set for the first even second clock trigger.

The default value is 0.

IEC-bus command:
```
:[SENSe:]CDPower:LCODe:OFFSet '#H0' ...
                              '#H1FFFFFFFFFFF8000'
```

INACT CHAN THRESHOLD
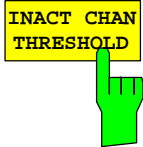
The *INACT CHAN THRESHOLD* softkey allows entry of the minimum power that an individual channel must have in comparison with the total signal in order to be regarded as an active channel.
Channels below the specified threshold are regarded as "inactive".
The two measurements *COMPOSITE EVM* and *PEAK CODE DOMAIN ERR*, which are specified as measurements on the total signal, are performed using the list of active channels. Distortions of these two measurements always occur when active channels are not detected as being active and unassigned codes are wrongly given the status of "occupied channel". *INACT CHAN THRESHOLD* can therefore be used to influence the results of the two measurements.
The default value is –40 dB, which should result in all channels being detected by the CDP analysis. If not all channels contained in the signal are detected automatically, *INACT CHAN THRESHOLD* must be decremented.

IEC-bus command:
```
:[SENSe:]CDPower:ICTReshold -100 dB ... 0 dB
```

INVERT Q ON OFF
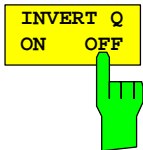
The *INVERT Q* softkey inverts the sign of the Q component of the signal. The default setting is OFF.

IEC-bus command: `:[SENSe]:CDP:QINVert OFF`
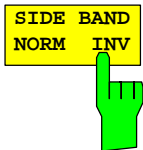
SIDE BAND NORM INV

The *SIDEBAND NORM / INV* softkey chooses between measurement of the signal in normal (NORM) and inverted spectral position (INV).

NORM   The normal position allows measurement of mobile station RF signals.

INV   The inverted position is practical for measurements on IF modules or components in the case of spectral inversion.

The default setting is NORM.

IEC-bus command: `:[SENSe:]CDPower:SBANd NORMal|INVers`
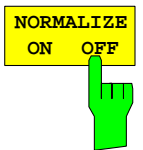
NORMALIZE ON OFF

The *NORMALIZE ON / OFF* softkey removes the DC offset from the signal. The default setting of the parameter is OFF.

IEC-bus command: `:[SENSe:]CDP:NORMalize OFF`

Frequency settings – *FREQ* key
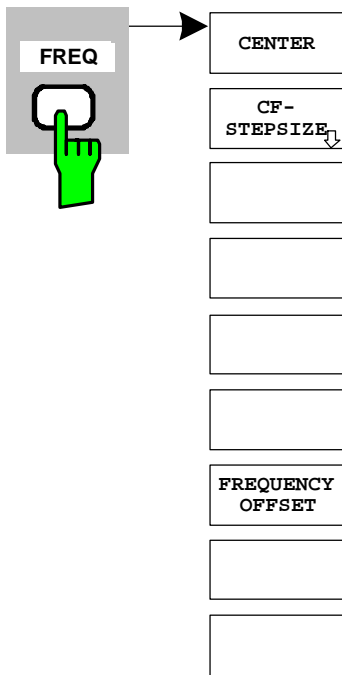
The *FREQ* key opens a submenu for changing the measurement frequency.

The *CENTER* softkey opens the input window for manually entering the center frequency.
The permissible input range of the center frequency is

$$\text{Minspan}/2 \leq f_{center} \leq f_{max} - \text{Minspan}/2$$

f_{center}	center frequency
Minspan	smallest selectable span >0 Hz (10 Hz)
f_{max}	maximum frequency

IEC-bus command: `:FREQ:CENT 100MHz`

CF-STEPSIZE opens a submenu for setting the step size of the center frequency change. It is possible to enter the step size manually (*MANUAL* softkey) or using the current measurement frequency (*CENTER* softkey). The softkeys are described in the manual for the basic device.

The *FREQUENCY OFFSET* softkey enables entry of an arithmetic frequency offset which is added to the frequency axis labeling. The range for the offset is -100 GHz to 100 GHz. The default setting is 0 Hz.

IEC-bus command: `:FREQ:OFFS 10 MHz`

The following softkeys appear in the submenu:
- CENTER
- CF-STEPSIZE
- FREQUENCY OFFSET

Span settings – *SPAN* key

The *SPAN* key is disabled for measurements in the code domain analyzer. For all other measurements (refer to the MEAS key), the permissible span settings are explained for the measurement concerned. The associated menu corresponds to that of the measurement in the basic device and is described in the manual for the basic device.

Level settings – *AMPT* key

AMPT	REF LEVEL
	ADJUST REF LEVEL
	REF LEVEL POSITION
	Y PER DIV
	REF VALUE POSITION
	RF ATTEN MANUAL
	RF ATTEN AUTO
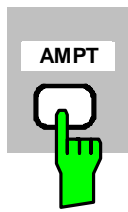
The *AMPT* key opens a submenu for setting the reference level.

The *REF LEVEL* softkey enables entry of the reference level. The entry is performed in dBm.

IEC-bus command: :DISP:WIND:TRAC:Y:RLEV –60dBm

ADJUST REF LEVEL executes a routine for optimum adaptation of the reference level to the signal.

IEC-bus command: :[SENSe<1|2>:]CDPower:LEVel:ADJust

The *REF LEVEL OFFSET* softkey enables entry of an arithmetic level offset. This is added to the measured level irrespective of the selected unit. The Y-axis scaling is changed accordingly.
The setting range is ±200 dB in steps of 0.1 dB.

IEC-bus command: :DISP:WIND:TRAC:Y:RLEV:OFFS –10dB

Y PER DIV sets the grid spacing on the y-axis for all diagrams in which this is possible.

IEC-bus command:
        :DISPlay[:WINDow<1|2>]:TRACe<1..3>:Y[:SCALe]:RPOSition

REF VALUE POSITION supports entry of the position of the y-axis reference value on the axis (0 to 100%).

IEC-bus command:
        :DISPlay[:WINDow<1|2>]:TRACe<1..3>:Y[:SCALe]:PDIVision

The *RF ATTEN MANUAL* softkey enable entry of the attenuation, irrespective of the reference level.
If the required reference level can no longer be set for the given RF attenuation, it will be adjusted and the message "Limit reached" will be issued.

IEC-bus command: INP:ATT 40 DB

The *RF ATTEN AUTO* softkey sets the RF attenuation automatically irrespective of the set reference level.
This ensures that the optimum RF attenuation desired by the user is always used.
RF ATTEN AUTO is the default setting.

IEC-bus command: INP:ATT:AUTO ON

Marker settings - *MKR* key

MARKER 1

MARKER 2

MARKER 3

MARKER 4

MARKER
NORM DELTA

ALL MARKER
OFF
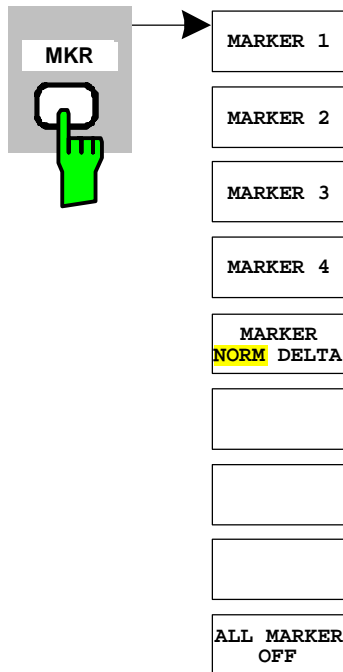
The *MARKER* key opens a submenu for the marker settings.

Markers are not available for the *RESULT SUMMARY* and *CHANNEL TABLE* analyses. Up to four markers can be enabled in all other analyses and defined as markers or delta markers using the *MARKER NORM/DELTA* softkey.

The *MARKER 1/2/3/4* softkeys simultaneously select and enable the marker concerned.
Marker 1 is always the normal marker after it has been enabled, while markers 2 to 4 are delta markers referring to marker 1 after they have been enabled. The *MARKER NORM DELTA* softkey is used to transform these markers into markers with absolute measured value display. If marker 1 is the active marker, *MARKER NORM DELTA* is enabled as an additional delta marker.
Pressing the *MARKER 1* to *MARKER 4* softkeys disables the selected marker.

IEC-bus command:

```
:CALC:MARK ON;
:CALC:MARK:X <value>;
:CALC:MARK:Y?
:CALC:DELT ON;
:CALC:DELT:MODE ABS|REL
:CALC:DELT:X <value>;
:CALC:DELT:X:REL?
:CALC:DELT:Y?
```

The *ALL MARKER OFF* softkey disables all markers (reference and delta markers). It also disables the functions and displays associated with the markers and delta markers.

IEC-bus command: :CALC:MARK:AOFF

The parameters relating to an enabled marker are read out above the diagrams:

```
Marker 1 [T1]
                      -5.00 dB
PCG  3 SR  19.2 ksps    1.64
```
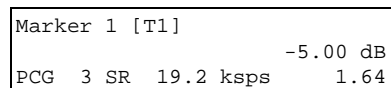
Fig. 6-29   Diagram marker field

The channel parameters are also specified in addition to the channel power, which is displayed as relative referred to the value specified under *POWER REF TOT/PICH*. The meanings are as follows (for the channel assigned to the marker):

PCG 03:   PCG number of the channel
SR 19.2 ksps: Symbol rate of the channel (9.6 ksps for unassigned codes)
1.32:   Walsh code number and spreading factor of the channel

For all other measurements not belonging to the code domain analyzer the marker functions of the basic device apply.

Changing instrument settings – *MKR→* key
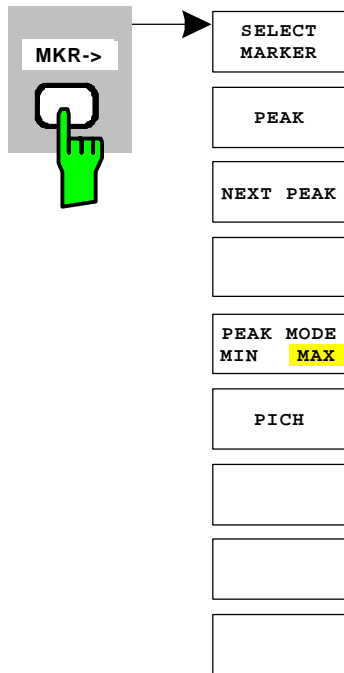
The *MKR→* key opens a submenu for marker functions:

The *SELECT MARKER* softkey selects the desired marker in a data input field. If the marker is disabled, it is enabled and can then be moved. You enter a number. Delta marker 1 is selected by entering '0'.

IEC-bus command: :CALC:MARK1 ON;
                                     :CALC:MARK1:X <value>;
                                     :CALC:MARK1:Y?

The *PEAK* softkey sets the active marker or delta marker to the maximum/minimum of the associated trace.
If no marker had been active before the *MKR->* menu was opened, marker 1 is automatically enabled and the Peak function is executed.

IEC-bus command: :CALC:MARK:MAX
                                     :CALC:DELT:MAX
                                     :CALC:MARK:MIN
                                     :CALC:DELT:MAX

The *NEXT PEAK* softkey sets the active marker or delta marker to the next lower maximum/minimum value of the associated trace. The search direction is specified by the setting in the *NEXT MODE LEFT/RIGHT* submenu.

IEC-bus command: :CALC:MARK:MAX:NEXT
                                     :CALC:DELT:MAX:NEXT
                                     :CALC:MARK:MIN:NEXT
                                     :CALC:DELT:MIN:NEXT

The *PEAK MODE MIN/MAX* softkey sets whether the peak search should determine the maximum or minimum value of the trace. The parameter affects the behaviour of the *PEAK* and *NEXT PEAK* softkeys.

IEC-bus command: --

The *MARKER → PICH* softkey sets the marker to the pilot channel (channel number 0.32).
IEC-bus commands:
       :CALCulate<1|2>:MARKer<1>:FUNCtion:PICH
       :CALCulate<1|2>:MARKer<1>:Y?

Marker functions – MKR *FCTN* key

The *MKR FCTN* key is disabled for all measurements of the code domain analyzer. For all other measurements of the R&S FS-K83, the softkeys of the menu are described in the manual for the basic device.

Bandwidth setting – *BW* key

The *BW* key is disabled for all measurements of the code domain analyzer. For all other measurements of the R&S FS-K83, the softkeys associated with the menu are described in the manual for the basic device.

Measurement control – *SWEEP* key

The menu of the *SWEEP* key contains options for switching between single measurement and continuous measurement, and also control of single measurements. For measurements in the spectral range, the measurement time for a sweep and the number of sweep points can also be set. All the softkeys associated with the menu are described in the manual for the basic device.

Measurement selection – *MEAS* key

The menu of the *MEAS* key contains all the measurements that can be selected on the R&S FS-K83 by pressing a key. The menu and its submenus are described in Chapter 6.

Trigger settings – *TRIG* key

The selectable trigger options depend on the measurement selected. For the code domain power analyzer, a free-run mode and a mode with the external even second clock trigger called for by the cdma2000 Standard are possible. The trigger options for all other measurements are identical to those of the corresponding measurement in the basic device. The associated softkeys are described in the manual for the basic device.

Trace settings – *TRACE* key
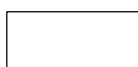
The *TRACE* key opens the following submenu:

The *CLEAR/WRITE* softkey enables the Overwrite mode for the acquired measured values, i.e. the trace is rewritten for each sweep.
After the *CLEAR/WRITE* softkey has been operated, the device deletes the selected trace memory and restarts the measurement.

IEC-bus command: :DISP:WIND:TRAC:MODE WRIT

The *MAX HOLD* softkey activates the peak value detector.
With each sweep, the analyzer only adopts the new measured value in the saved trace data if it is larger than the previous one.
Pressing the *MAX HOLD* softkey a second time deletes the trace memory and starts peak value detection from the beginning again.

IEC-bus command: :DISP:WIND:TRAC:MODE MAXH

The *MIN HOLD* softkey activates the minimum value detector.
With each sweep, the analyzer only adopts the new measured value in the saved trace data if it is smaller than the previous one.
Pressing the *MIN HOLD* softkey a second time deletes the trace memory and starts minimum value detection from the beginning again.

IEC-bus command: :DISP:WIND:TRAC:MODE MINH

The *AVERAGE* softkey enables the trace averaging function. The average is formed from several sweeps. Averaging is performed irrespective of the AVG MODE LOG / LIN setting on the logarithmic level values or on the measured power/voltage values.
Averaging is restarted every time the *AVERAGE* softkey is pressed. The trace memory is always cleared.

IEC-bus command: :DISP:WIND:TRAC:MODE AVER

For the measurements in the code domain analyzer, an AVERAGE/ MAX HOLD or MIN HOLD is possible.
With the Channel Occupancy Table analysis, the channel configuration measured on the first sweep is retained for the trace statistics.
If the signal is reconfigured, the SINGLE SWEEP softkey (and, if necessary, the CONTINUOUS SWEEP softkey) must be pressed again.
The BITSTREAM analyse and the CONSTELLATION diagrams support only CLEAR WRITE mode as a general rule.

The *SWEEP COUNT* softkey sets the number of sweeps over which the average value is formed. The permissible range is 0 to 30000, though the following should be noted:

Sweep Count = 0   means   running   averaging   with   averaging

length of 10

Sweep Count = 1   means no averaging

Sweep Count > 1   means averaging over the specified number of sweeps; in continuous sweep mode averaging changes over to running averaging once this number has been reached.

The default setting is running averaging (Sweep Count = 0). The number of sweeps used for averaging is always equal to the averaging length of 10 for all active traces in the selected diagram.

IEC-bus command: `:SWE:COUN 64`

Display lines – *LINES* key

The *LINES* key is disabled for all measurements of the code domain analyzer. The menu setting options for all other measurements are equivalent to those of the corresponding measurement in the basic device. The respective softkeys are described in the manual for the basic device.

Measurement screen settings – *DISP* key

The menu of the *DISP* key contains softkeys for configuring the measurement screen. The menus and the softkey properties are described in the manual for the basic device.

Storing and loading of device data – *FILE* key

The FILE menu is the same as that of the basic device. All softkeys are described in the manual for the basic device.

Preset of device – *PRESET* key

The *PRESET* key presets the device. The behaviour is the same as of the basic unit and is described in the manual for the basic unit.

Calibration of device – *CAL* key

The menu *CAL* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit.

Setup of device – *SETUP* key

The menu *SETUP* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit. The usage of transducer factors is possible in the Code-Domain as well as in the RF measurements.

Printing – *HCOPY* key

The menu *HCOPY* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit.

All keys on the front panel of the unit that are not specifically mentioned are identical to those of the basic unit. The functions of the keys and the softkeys are described in the manual of the basic unit.

7 Remote Control Commands

This chapter describes the remote control commands for the application firmware. An alphabetical list following the description provides a quick overview of the commands.

The commands, which also apply to the basic device in SPECTRUM mode, and the system settings are described in the operating manual for the analyzer.

CALCulate:FEED subsystem

The CALCulate:FEED subsystem selects the type of analysis for the measured data. This corresponds to the result display selection in manual operation.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2> :FEED	<string>		No query

:CALCulate<1|2>:FEED <string>

    This command selects the measured data that will be displayed.

    Parameters: <string>::=   'XPOW:CDP' |
                                            'XPOW:CDP:RAT' |
                                            'XPOW:CDEP' |
                                            'XTIM:CDP:MACCuracy' |
                                            'XTIM:CDP:PVSLot' |
                                            'XTIM:CDP:PVSYmbol' |
                                            'XTIM:CDP:BSTReam' |
                                            'XTIM:CDP:ERR:SUMM' |
                                            'XTIM:CDP:ERR:CTABle' |
                                            'XTIM:CDP:ERR:PCDomain' |
                                            'XTIM:CDP:SYMB:CONStellation' |
                                            'XTIM:CDP:SYMB:EVM' |
                                            'XTIM:CDP:COMP:CONStellation'

    The meanings of the string parameters are as follows:

'XPOW:CDP'	Result display of the code domain power absolute in the bar chart (CALCulate<1>)'
XPOW:CDP:RAT'	Result display of the code domain power ratio (relative) in the bar chart (CALCulate<1>)'
XPOW:CDEP'	Result display of the code domain error power in the bar chart (CALCulate<1>)'
XTIM:CDP:ERR:SUMM'	Tabular analysis of results (CALCulate2)'
XTIM:CDP:ERR:CTABle'	Display of the channel occupancy table (CALCulate<1>)'
XTIM:CDP:ERR:PCDomain'	Result display of the peak code domain error (CALCulate2)'
XTIM:CDP:MACCuracy'	Result display of the composite EVM (CALCulate2)'
XTIM:CDP:PVSLot'	Result display of power versus power control group (CALCulate2)'
XTIM:CDP:PVSYmbol'	Result display of power versus symbol (CALCulate2)'
XTIM:CDP:BSTReam'	Result display of bit stream (CALCulate2)'
XTIM:CDP:SYMB:CONStellation'	Result display of symbol constellation (CALCulate2)'
XTIM:CDP:SYMB:EVM'	Result display of error vector magnitude (CALCulate2)'
XTIM:CDP:COMP:CONStellation'	Result display of composite constellation (CALCulate2)

Example: `"INST:SEL MC2K"`   'Activate cdma2000 MS
                 `"INIT:CONT OFF"`   'Select single sweep
                 `"CALC2:FEED 'XTIM:CDP:MACC'"`   'Select COMP EVM analysis
                 `"INIT;*WAI"`   'Start measurement with
                                                  'synchronization
                 `"TRAC? TRACE2"`   'Query COMP EVM data

Features: *RST value: 'XPOW:CDP:RAT'   (CALCulate<1>)
                                 'XTIM:CDP:ERR:SUMM' (CALCulate<2>)
                 SCPI: Conforms

Note: *The code domain power measurements are always shown in split screen mode and the allocation of the analysis to the measurement window is fixed. Therefore, specify for every analysis in brackets the numerical suffix that is necessary or allowed at* `CALCulate`*.*

To activate the Overview mode for Code Domain Power and Code Domain Error-Power, you must use the CDP:OVER ON command. If you then switch to an analysis different from these two (e.g. the Channel Occupancy table), you leave Overview mode and the analysis you used last is restored on the other screen.

CALCulate:LIMit:SPECtrum subsystem

The CALCulate:LIMit:SPECtrum subsystem defines the limit check for spectral measurements.

COMMAND	PARAMETER	UNIT	COMMENT

CALCulate<1|2>
   LIMit<1...8>
     :ESPectrum
       :MODE
       :RESTore
	
	AUTO | USER		

:CALCulate:LIMit:ESPectrum:MODE AUTO | USER

This command automatically enables and disables automatic selection of the limit line in the spectrum emission mask measurement.

The limit lines normally depend on the selected band class. (Command `CONF:CDP:BCL`)

Parameters: AUTO The limit line depends on the measured channel power.
USER Query only, user-defined limit lines are
enabled (refer to the description of limit lines in the
manual for the device).

Example:
`"INST:SEL MC2K"`	'Activate cdma2000 MS
`"INIT:CONT OFF"`	'Select single sweep
`"CONF:CDP:BCL 1"`	'Select band class 1, 1900 MHz
`"CONF:CDP:MEAS ESP"`	'Measure spectrum emission 'Select mask
`"CALC:LIM:ESP:MODE AUTO"`	'Activates automatic selection of 'limit line
`"INIT;*WAI"`	'Start measurement with 'synchronization
`"CALC:LIM:FAIL?"`	'Query result of the limit check

Features: *RST value: AUTO
SCPI: Device-specific

:CALCulate:LIMit:ESPectrum:RESTore

This command restores the standard limit lines for the spectrum emission mask measurement. All changes made to the standard limit lines are lost and the state of these limit lines as they left the factory is restored .

Example:
`"INST MC2K"`	'Switches the device to cdma2000 MS mode
`"CALC:LIM:ESP:REST"`	'Resets the spectrum emission mask limit lines 'to their default setting

Features: *RST value: -- SCPI: Device-specific

This command is an event and therefore has neither a query function nor a *RST value.

CALCulate:MARKer subsystem

COMMAND	PARAMETER	UNIT	COMMENT

CALCulate<1|2>
  :MARKer<1...4>
    :FUNCtion
      :PICH
      :CDPower
        :RESult?
	SLOT | PTOTal | PPICh | RHO | MACCuracy | PCDerror | ACTive | FERRor | FERPpm | CERRor | TFRame I IQOFfset | IQIMbalance | SRATe | CHANnel | SFACtor | TOFFset | POFFset | CDPabsolute | CDPRelative | EVMRms | EVMPeak		Query only

:CALCulate<1\|2>:MARKer<1>:FUNCtion:PICH

This command sets marker1 to channel 0.16, 0.32 or 0.32, depending on the base spreading factor.

Example:	"INST:SEL MC2K"	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	"INIT:CONT OFF"	'Select single sweep
	"INIT;*WAI"	'Start measurement with 'synchronization
	"CALC:MARK:FUNC:PICH"	'Activate marker and on pilot
	"CALC:MARK:Y?"	'Query value of CDP rel. of PICH

Features:	*RST value:	-
	SCPI:	Device-specific

This command is an "event" and therefore has neither a *RST value nor a query function.

:CALCulate<1\|2>:MARKer<1>:FUNCtion:CDPower:RESult?

SLOT | PTOTal | PPICh | RHO | MACCuracy | PCDerror | ACTive | FERRor | FERPpm | CERRor | TFRame I IQOFfset | IQIMbalance | SRATe | CHANnel | SFACtor | TOFFset | POFFset | CDPabsolute | CDPRelative | EVMRms | EVMPeak

This command queries the measured and calculated values of the Code Domain Power analysis. The channel results are given for the channel to which the code selected using the command `CDPower:CODe` belongs.

Parameters:

Global results of the selected PCG:

SLOT	PCG number
PTOTal	Total power in dBm
PPICh	Pilot power in dBm
RHO	RHO
MACCuracy	Composite EVM in %
PCDerror	Peak code domain error in dB
IQIMbalance	IQ imbalance in %
IQOFfset	IQ offset in %

Global results of all PCGs:

FERRor	Frequency error in Hz
FERPpm	Frequency error in ppm
CERRor	Chip rate error in ppm
TFRame	Trigger to frame
ACTive	Number of active channels

Channel results:

SRATe	Symbol rate in ksps	TOFFset	Timing offset in s
CHANnel	Channel number	POFFset	Phase offset in rad
SFACtor	Spreading factor of channel		

CDPRelative	Channel power relative in dB	CDPabsolute	Channel power absolute in dBm (relative to total or PICH power, refer to command `CDP:PREF`)
EVMRms	Error vector magnitude RMS in %	EVMPeak	Error vector mag. peak in %

_Note:_The Trigger to Frame value (`TFRame`) supplies a '9' if the trigger is at _FREE RUN_.The Timing/Phase Offset values (`TOFFset`/`POFFset`) supply a '9' if timing and phase measurement is disabled (refer to `CDP:TPM`) or the number of active channels is higher than 50.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"INIT;*WAI"`	'Start measurement with 'synchronization
	`"CALC:MARK:FUNC:CDP:RES? PTOT"`	'Read out total power
	`"CDP:SLOT 2"`	'Selects power control group 2
	`"CDP:CODE 11"`	'Select code number 11
	`"CALC:MARK:FUNC:CDP:RES? EVMR"`	'Read out EVM RMS of code with 'number 11 in PCG 2

Features:	*RST value:	-
	SCPI:	Device-specific

CALCulate:STATistics subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functions in the device. The measurement window cannot be selected for these measurement functions. The numerical suffix is ignored accordingly with CALCulate.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate			
:STATistics			
:CCDF			
[:STATe]	<Boolean>		
:NSAMples	<numeric_value>		
:SCALe			
:Y			
:UPPer	<numeric_value>		
:LOWer	<numeric_value>MEAN | PEAK |		
:RESults?	CFACtor | ALL		Query only

:CALCulate:STATistics:CCDF[:STATe] ON | OFF

This command enables and disables measurement of the complementary cumulated distribution function (CCDF).

Example: `"CALC:STAT:CCDF ON"`

Features: *RST value: OFF
SCPI: Device-specific

:CALCulate:STATistics:NSAMples   100 ... 1E9

This command sets the number of measurement points for the statistical measurement functions.

Example: `"CALC:STAT:NSAM 5000"`

Features: *RST value: 100000
SCPI: Device-specific

:CALCulate:STATistics:SCALe:Y:UPPer   1E-5 ...1.0

This command defines the upper limit for the y-axis of the diagram in statistical measurements.
Since probabilities are plotted on the y-axis, the entered numerical values have no units.

Example: `"CALC:STAT:SCAL:Y:UPP 0.01"`

Features: *RST value: 1.0
SCPI: Device-specific

:CALCulate:STATistics:SCALe:Y:LOWer   1E-6 ...0.1

This command defines the lower limit for the y-axis of the diagram in statistical measurements.
Since probabilities are plotted on the y-axis, the entered numerical values have no units.

Example: `"CALC:STAT:SCAL:Y:LOW 0.001"`

Features: *RST value: 1E-6
SCPI: Device-specific

:CALCulate:STATistics:RESult? MEAN | PEAK | CFACtor | ALL

This command reads out the results of statistical measurements from a recorded trace.

Parameters:	The desired result is selected by means of the following parameters:
MEAN	Mean (RMS) power measured in the period of analysis in dBm
PEAK	Peak power in dBm measured in the period of analysis
CFACtor	Determined CREST factor (i.e. ratio of peak power to mean power) in dB

ALL   Results of all three named measurements, separated by a comma:
<mean power>,<peak power>,<crest factor>

Example:	`"CALC:STAT:RES? ALL"`	'Reads out all three measurement results. Example of reply string: 5.56,19.25,13.69 i.e. mean power: 5.56 dBm, peak power 19.25 dBm, CREST factor 13.69 dB

Features:	*RST value:	--
	SCPI:	Device-specific

Operating mode: A

CONFigure:CDPower subsystem

This subsystem contains the commands for the selection and configuration of measurements in the cdma2000 application firmware. Only the numerical suffix 1 is allowed with `CONFigure`. Further settings for the code domain power analysis can be found under the `:[SENSe]:CDPower` command.Further settings for the spectrum emission mask measurement can be found under the `CALCulate:LIMit:ESPectrum` command.

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			
:CDPower			
:MEASurement	POWer | ACLR | ESPectrum | OBANdwidth | OBWidth | CDPower | CCDF		
:CTABle			
[:STATe]	\<Boolean>		
:SELect	\<file_name>		
:NAME	\<file_name>		
:DATA	\<numeric_value>, \<numeric_value>, \<numeric_value>, \<numeric_value>, \<numeric_value>, \<numeric_value>, \<numeric_value>, \<numeric_value> ...		
:COMMent	\<string>		
:COPY	\<file_name>		
:DELete			
:CATalog?			
:RESTore			
:BCLass	\<numeric_value>		

CONFigure\<1>:CDPower:MEASurement   POWer | ACLR | ESPectrum | OBANdwith | OBWidth | CDPower | CCDF

This command selects the measurement of Application FS-K83, cdma2000 mobile station tests. The predefined settings of the different measurements are described at length in Chapter 6.

Parameters:	POWer	Channel power measurement (cdma2000 standard forward) with predefined settings
	ACLR	Adjacent channel power measurements (cdma2000 standard forward) with predefined settings
	ESPectrum	Check on signal power (Spectrum Emission Mask)
	OBANdwith | OBWidth	Measurement of occupied bandwidth
	CDPower	Code domain analyzer measurement.
	CCDF	Measurement of the Complementary Cumulative Distribution function (signal statistics measurement)

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"INIT:CONT OFF"`	'Select single sweep
	`"CONF:CDP:MEAS POW"`	'Select channel power measurement
	`"INIT;*WAI"`	'Start measurement with

synchronization**Features:**

        *RST value: CDPower
        SCPI: Device-specific

:CONFigure<1>:CDPower:CTABle[:STATe] ON | OFF

This command enables and disables the channel table. Enable results in the measured channel table being saved as "RECENT" and enabled. After the channel table called "RECENT" has been enabled, another channel table can be selected with the `CONF:CDP:CTABle:SELect` command

Note: *Always use the* `CONF:CDP:CTAB:STAT` *command to enable the "RECENT" channel table and then the* `CONF:CDP:CTAB:SELect` *command to select the required channel table.*

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"INIT;*WAI"`	'Start measurement with 'synchronization so that channel table 'can be enabled
	`"CONF:CDP:CTAB ON"`	'Use predefined channel table
	`"CONF:CDP:CTAB:SEL 'CTAB_1'"`	'Select channel table
	`"INIT;*WAI"`	'Start measurement with 'synchronization

Example:

Features:	*RST value:	OFF
	SCPI:	Device-specific

:CONFigure<1>:CDPower:CTABle:SELect   <string>

This command selects a predefined channel table file. Before this command, you must first enable the "RECENT" channel table with the `CONF:CDP:CTAB ON` command.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"INIT;*WAI"`	'Start measurement with 'synchronization so that channel table 'can be enabled
	`"CONF:CDP:CTAB ON"`	'Use predefined channel table
	`"CONF:CDP:CTAB:SEL 'CTAB_1'"`	'Select channel table
	`"INIT;*WAI"`	'Start measurement with 'synchronization
Features:	*RST value:	"RECENT"
	SCPI:	Device-specific

:CONFigure:CDPower:CTABle:NAME   <file_name>

This command selects a channel table for editing or creating. It is not used for the analysis. Refer to the commands `CONF:CDP:CTAB:STAT and CONF:CDP:CTAB:SEL`.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"CONF:CDP:CTAB:NAME 'NEW_TAB'"`	'Select table for processing

Features:	*RST value:	""
	SCPI:	Device-specific

:CONFigure:CDPower:CTABle:DATA 0..9, 1..6, 0..63, 0..1, 0, 0, 0 | 1, <numeric_value>...

This command defines a channel table. The whole table is defined in one go. The inactive channels (INACtive) do not have to be defined. Eight values are specified for a line of table.

<Channel type>, <Code class>, <Code number>, <Mapping>, <Reserved1>, <Reserved2>, <Status>, <CDP relative [dB]>, ...

Channel type	The channel type is numerically coded as follows:
	0 = PICH
	1 = EACH
	2 = CCCH
	3 = DCCH
	4 = ACKCH
	5 = CQICH
	6 = FCH
	7 = S1CH
	8 = S2CH
	9 = INACTIVE
Code class:	1...6
Code number:	0...63
Mapping	0 = I branch
	1 = Q branch
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
CDP relative:	Any with setting command, relative with CDP query

Before using this command, you must set the name of the channel table using the `CONF:CDP:CTAB:NAME` command. Only valid cdma2000 MS or 1xEV-DV MS channels are accepted as active.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"CONF:CDP:CTAB:NAME 'NEW_TAB'"`	'Select table for processing
	`"CONF:CDP:CTAB:DATA 0,5,0,0,0,0,1,0,`	
	`                    2,3,2,1,0,0,1,0"`	
		'Selects PICH 0.32 on I and
		'CCCH 2.8 on Q.
Features:	*RST value: -	
	SCPI: Device-specific	

:CONFigure:CDPower:CTABle:COMMent   <string>

This command defines a comment on the selected channel table.

Before using this command, you must set the name of the channel table using the `CONF:CDP:CTAB:NAME` command and enter a valid channel table by means of `CONF:CDP:CTAB:DATA`.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"CONF:CDP:CTAB:NAME 'NEW_TAB'"`	'Select table for processing
	`"CONF:CDP:CTAB:COMM 'Comment for NEW_TAB'"`	
Features:	*RST value: ""	
	SCPI: Device-specific	

:CONFigure:CDPower:CTABle:COPY <file_name>

This command copies one channel table to another. You select the channel table you want to copy by means of the `CONF:CDP:CTAB:NAME` command.

Parameters:	<file_name> ::= Name of the new channel table	
Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"CONF:CDP:CTAB:NAME 'CTAB_1'"`	'Select table for processing
	`"CONF:CDP:CTAB:COPY 'CTAB_2'"`	'Copies CTAB_1 to C_TAB2
Features:	*RST value: --	
	SCPI: Device-specific	

The name of the channel table may contain up to 8 characters. This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower:CTABle:DELete

This command deletes the selected channel table. You select the channel table you want to delete by means of the `CONF:C2KP:CTAB:NAME` command.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"CONF:CDP:CTAB:NAME 'CTAB_2'"`	'Select table for processing
	`"CONF:CDP:CTAB:DEL"`	'Deletes CTAB_2
Features:	*RST value: --	
	SCPI: Device-specific	

This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower:CTABle:CATalog?

This command queries the names of all the channel tables for cdma2000 MS stored on the hard disk.

The syntax of this output format is as follows:

<Sum of file sizes of all subsequent files>,<Free storage space on hard disk>,<1st file name>,<1st file size>,<2nd file name>,,<2nd file size>,....,<nth file name>,,<nth file size>,..

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"CONF:CDP:CTAB:CAT?"`	'Query catalog
Features:	*RST value: --	
	SCPI: Device-specific	

:CONFigure:CDPower:CTABle:RESTore

This command restores the "predefined channel tables" to the state they were in when the device was supplied. In this way unintended overwriting of these channel tables can be undone.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"CONF:CDP:CTAB:REST"`	'Restore table
Features:	*RST value: --	
	SCPI: Device-specific	

This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower:BCLass   0...12

This command selects the band class.

Band class	Name
0	800 MHz band
1	1900 MHz band
2	TACS band
3	JTACS band
4	Korean PCS band
5	450 MHz band
6	2 GHz band
7	700 MHz band
8	1800 MHz band
9	900 MHz band
10	Secondary 800 MHz band
11	400 MHz European PAMR band
12	800 MHz PAMR band

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS
	`"INIT:CONT OFF"`	'Select single sweep
	`"CONF:CDP:BCL 1"`	'Select band class 1, 1900 MHz

Features:	*RST value:	0
	SCPI:	Device-specific

INSTrument subsystem

The INSTrument subsystem selects the operating mode of the device either by means of text parameters or by means of permanently assigned numbers.

COMMAND	PARAMETER	UNIT	COMMENT
INSTrument			
[:SELect]	SANalyzer | MC2K		
:NSELect	<numeric_value>		

:INSTrument[:SELect] SANalyzer | MC2K

This command switches from one operating mode to another by means of text parameters.

Selecting cdma2000 MS (MC2K) sets the device to a defined set. The preset values are described in Chapter 2.

Example: `"INST MC2K"`   'Activate cdma2000 MS
Features: *RST value: SANalyzer
                  SCPI: Conforms

Switching to `MC2K` presupposes the option cdma2000 REV (MS) R&S FS-K83.

:INSTrument:NSELect 1 | 11

This command switches from one operating mode to another by means of numbers.

Parameters: 1:   Spectral analysis mode

                   11:       cdma2000 REV (MS) mode

Example: `"INST:NSEL 11"`   'Activate cdma2000 MS.

Features: *RST value: 1
                  SCPI: Conforms

Switching to 11 presupposes the option cdma2000 REV (MS) R&S FS-K83.

SENSe:CDPower subsystem

This subsystem sets the parameters for the code domain measurements mode. The numerical suffix for SENSe<1|2> is irrelevant for this subsystem.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe<1|2>]			
:CDPower			
:ICTReshold	<numeric_value>	DB	
:SBANd	NORMal | INVerse		
:LEVel			
:ADJust			
:LCODe			
:MASK	<string>	--	
:OFFSet	<string>	--	
:CODE	<numeric_value>	--	
:SLOT	<numeric_value>	--	
:MAPPing	I | Q	--	
:SFACtor	16 | 32 | 64	--	
:NORMalize	<Boolean>	--	
:QINVert	<Boolean>	--	
:PREFerence	TOTal | PICH	--	
:IQLength	<numeric_value>	--	
:ORDer	HADamard | BITReverse	--	
:TPMeas	<Boolean>	--	
:OVERview	<Boolean>	--	

:[SENSe:]CDPower:ICTReshold   -100 dB ...0 dB

This command sets the threshold value from which a channel is regarded as active. The level refers to the signal total power.

Example:	"INST:SEL MC2K"	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
	"INIT:CONT OFF"	'Select single sweep
	"CDP:ICTR –10DB"	'Threshold value to -10dB
	"INIT;*WAI"	'Start measurement with
		'synchronization

Features:	*RST value:	-40dB
	SCPI:	Device-specific

:[SENSe:]CDPower:SBANd   NORMal | INVers

This command is used to swap the left and right sideband.

Example:	"INST:SEL MC2K"	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
	"INIT:CONT OFF"	'Select single sweep
	"CDP:SBAN INV"	'Swap sidebands
	"INIT;*WAI"	'Start measurement with
		'synchronization

Features:	*RST value:	NORM
	SCPI:	Device-specific

:[SENSe:]CDPower:LEVel:ADJust

This command initiates automatic setting of the RF attenuation and IF gain to the level of the applied signal. The device is placed in the *ATTEN MANUAL* mode to set RF attenuation and IF gain independently of each other to optimum values. This mode is retained even after the mode has changed from cdma2000 MS to SPECTRUM.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:LEV:ADJ"`	'Start automatic level setting
	`"INIT;*WAI"`	'Start measurement with
		'synchronization

| **Features:** | *RST value: | - |
| | SCPI: | Device-specific |

This command is an "event" and therefore has neither a *RST value nor a query function.

:[SENSe:]CDPower:LCODe:MASK '#H0' ... '#H4FFFFFFFFFF'

This command defines the mask of the long code in hexadecimal format.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on 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

| **Features:** | *RST value: | '#H0' | SCPI: | Device-specific |

:[SENSe:]CDPower:LCODe:OFFSet '#H0' ... '#H1FFFFFFFFFFF8000'

This command defines the offset of the long code 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 long code offset is used for offsetting at the next trigger pulse (which cannot occur until a setup time of 300 ms has elapsed). The command is only available if a long code mask unequal to 0 is set.The chips offset is calculated as follows: $t_{SinceStartGPS}$ * 1.2288 MChips/s, where $t_{SinceStartGPS}$ should be in seconds. For example, the hexadecimal offset of 258000 h chips is set for the first even second clock trigger.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on 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

| **Features:** | *RST value: | '#H0' |
| | SCPI: | Device-specific |

:[SENSe:]CDPower:CODE 0 ... 63

This command selects the code number. The maximum value depends on the base spreading factor.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:CODE 11"`	'Select code number 11
	`"INIT;*WAI"`	'Start measurement with
		synchronization

| **Features:** | *RST value: | 0 |
| | SCPI: | Device-specific |

:[SENSe:]CDPower:SLOT 0 ...IQLength-1

This command selects the power control group (PCG).

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:SLOT 2"`	'Selects power control group 2
	`"INIT;*WAI"`	'Start measurement with
		'synchronization

| **Features:** | *RST value: | 0 |
| | SCPI: | Device-specific |

:[SENSe:]CDPower:MAPPing I | Q

This command selects whether the I or Q branch should be analyzed.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit is
		'I branch is selected
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:MAPP Q"`	'Selects Q branch
	`"INIT;*WAI"`	'Starts measurement with
		'synchronization

| **Features:** | *RST value: | I |
| | SCPI: | Device-specific |

:[SENSe:]CDPower:SFACtor 16 | 32 | 64

This command defines the base spreading factor. The base spreading factor should be set to 64 if channels of code class 6 (spreading factor 64) exist, otherwise alias power values will be measured in the code domain power analysis.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:SFAC 64"`	'Select base spreading factor 64
	`"INIT;*WAI"`	'Start measurement with synchronization
Features:	*RST value:	32
	SCPI:	Device-specific

:[SENSe:]CDPower:NORMalize ON | OFF

This command enables and disables elimination of the IQ offset.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:NORM OFF"`	'Elimination of IQ offset OFF
	`"INIT;*WAI"`	'Start measurement with 'synchronization

| **Features:** | *RST value: | OFF |
| | SCPI: | Device-specific |

:[SENSe:]CDPower:QINVert ON | OFF

This command inverts the sign of the signal Q component.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:QINV ON"`	'Enable Q component inversion
	`"INIT;*WAI"`	'Start measurement with 'synchronization

| **Features:** | *RST value: | OFF |
| | SCPI: | Device-specific |

:[SENSe:]CDPower:PREFerence TOTal | PICH

This command sets the reference for the relative CDP measured values to the total power or the PICH power.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:PREF PICH"`	'Reference is PICH power
	`"INIT;*WAI"`	'Start measurement with 'synchronization

| **Features:** | *RST value: | TOTal |
| | SCPI: | Device-specific |

:[SENSe:]CDPower:IQLength FSU/FSQ: 2...50, FSP: 2..12

This command sets the capture length (IQ Capture Length) in multiples of the power control group. The range is from 2 to 50 for the R&S FSU, R&S FSQ analyzers and from 2 to 12 for the R&S FSP analyzer.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:IQL 8"`	'8 PCG capture length
	`"INIT;*WAI"`	'Start measurement with 'synchronization

| **Features:** | *RST value: | 3 |
| | SCPI: | Device-specific |

:[SENSe:]CDPower:ORDer　HADamard | BITReverse

This command sets the order of the code domain analysis. The codes are sorted either in the Hadamard order or in the BitReverse order.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"INIT;*WAI"`	'Start measurement with
		'synchronization
	`"CDP:ORD HAD"`	'Hadamard order
	`"TRAC? TRACE2"`	'Read out CDP in Hadamard order
	`"CDP:ORD BITR"`	'BitReverse order
	`"TRAC? TRACE2"`	'Read out CDP in BitReverse order
Features:	*RST value:　　HADamard	
	SCPI:　　　　　Device-specific	

:[SENSe:]CDPower:TPMeas　ON | OFF

This command supports the specific enabling and disabling of the timing and phase offset analysis of the channels for the pilot channel. If the value is OFF or if more than 50 channels are active, the command `TRACe? TRACe1` and `CALC:MARK:FUNC:CDP:RES?` returns a value of '9' for the timing and phase offset as the result. If the value is ON, the timing and phase offsets are calculated and returned.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"CDP:TPM ON"`	'Enable Analyze Timing and Phase
		'Offset
	`"INIT;*WAI"`	'Start measurement with
		'synchronization
	`"CDP:SLOT 2"`	'Selects power control group 2
	`"CDP:CODE 11"`	'Select code number 11
	`"CALC:MARK:FUNC:CDP:RES? TOFF"`	'Read out timing offset of code with
		'number 11 in PCG 2
	`"CALC:MARK:FUNC:CDP:RES? POFF"`	'Read out phase offset of code with
		'number 11 in PCG 2
Features:	*RST value:　　OFF	
	SCPI:　　　　　Device-specific	

:[SENSe:]CDPower:OVERview ON | OFF

This command can be enabled by means of ON when either the Code Domain Power or the Code Domain Error Power analysis is active. (Refer to the command CALC1:FEED). In Overview mode, the I branch of the signal is normally displayed on Screen A and the Q branch of the signal on Screen B with the CDP/CDEP. The branches can be read out separately by means of TRAC:DATA? TRACE1 and TRAC:DATA? TRACE2.

The previous analyses become active again when you exit Overview mode.

If an analysis other than Code Domain Power or Code Domain Error Power is selected when Overview mode is active, you exit Overview mode and the previous analysis is reset on the other screen.

Example:	`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B
	`"INIT:CONT OFF"`	'Select single sweep
	`"INIT;*WAI"`	'Start measurement with 'synchronization
	`"CDP:OVER ON"`	'Activate Overview mode 'CDP relative on Screen A I branch 'CDP relative on Screen B Q branch
	`"TRAC? TRACE1"`	'Read out CDP relative of I branch
	`"TRAC? TRACE2"`	'Read out CDP relative of Q branch
	`"CDP:OVER OFF"`	'Disable Overview mode: 'CDP relative on Screen A and 'Result Summary active on Screen B

| **Features**: | *RST value: | OFF |
| | SCPI: | Device-specific |

TRACe subsystem

:TRACe[:DATA]   TRACE1 | TRACE2 | CTABle

The command transfers trace data from the controller to the device, and the query command reads trace data from the device.

TRACE1, TRACE2 or CTABle can be read out, depending on the display.

The trace data (TRACE1 | TRACE2) are formatted for the different displays as shown in the following; CTABle is described under Channel Table:

<u>CODE DOMAIN POWER ABSOLUTE/CODE DOMAIN POWER RELATIVE (TRACE1):</u>

The following is output for each channel:

Code class	Code class of the channel; with the Hadamard order it is the code class which corresponds to the base spreading factor. With the BitReverse order, values are between 1..6Code number Code number of the channel, values are between 0..63
Level	- With CODE DOMAIN POWER ABSOLUTE, units are dBm - With CODE DOMAIN POWER RELATIVE, units are dB (referred to the total or pilot power, refer to the command `CDPower:PREFerence`) In the Hadamard order, power values of the individual codes are usually specified; in the BitReverse order, the consolidated channel power is returned.
Power ID	0 - Inactive channel 1 - Power of device antenna 2 - Alias power of device antenna 3 - Quasi-inactive channel (on the analyzed branch, the channel is not assigned, but an active channel exists on the other branch) Alias power can be avoided by ensuring that the correct base spreading factor is selected when performing the analysis. (Refer to the `CDPower:SFACtor` command)

Four values are thus transferred for all channels:
<Code class>, <Code number>, <Level>, <Power ID>, ...

The Hadamard or BitReverse order is important for sorting the channels and consolidation (refer to the command `CDPower:ORDer`). With Hadamard, the individual codes are output in ascending order with their code power. The number of codes which are output corresponds to the base spreading factor.
With BitReverse, codes which belong to a particular channel are adjacent to each other and are therefore output in the class of the channel together with the channel power. The maximum number of codes or channels that are output cannot be higher than the base spreading factor, and decreases with each bunched channel.

Example:

The example shows the results of the query for 2 channels with the following configuration:

```
PICH    0.32    (CC 5)          I       -7.0   dB
CCCH    2.8     (CC 3)          Q      -10.0  dB
```

`"INST:SEL MC2K"`		'Activate cdma2000 MS, implicit are
		'CDP relative on Screen A and
		'Result Summary active on Screen B
		'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
5, 0,-52.3,3,	*5, 1,-53.3,0,*	*'Code 0 is quasi-inactive since PICH is*
		set to I
5, 2,-16.1,1,	5, 3,-55.3,0,	'**Channel 2.8** is distributed between the
		'active codes
....	5, 9,-58.2,0,	'2.32, 10.32, 18.32 and 26.32
5,10,-16.0,1,	5,11,-53.4,0,	'each with one quarter of the
....	5,17,-49.0,0,	'power -10dB-6dB=-16.0 dB
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	
`"CDP:ORD BITR"`		'Set order to BitReverse
`"TRAC? TRACE1"`		'Read out CDP relative/BitReverse/Q
		'Sorting is changed according to
		'BitReverse.
5, 0,-52.3,3,	5,16,-57.3,0	*'Code 0 is quasi-inactive since PICH is*
		'set to I
5, 8,-56.3.0,	....	
3, 2,-10.0,1,	5, 6,-55.3,0,	'**Channel 2.8** can now be read out
....	5,31,-51.7,0	'directly with its total power
`"CDP:OVER ON"`		'Activate Overview mode
		'CDP relative on Screen A I branch
		'CDP relative on Screen B Q branch
`"TRAC? TRACE1"`		'Read out CDP relative of I branch
5, 0, -7.0,1,	5,16,-52.3,0	'PICH is active
5, 8,-57.1.0,	....	
5, 2,-49.0,3,	*5,18,-49.0,3,*	'Codes of channel 2.8 are
5,10,-49.0,3,	*5,26,-49.0,3*	'quasi-inactive
5, 6,-55.3,0,	5, 6,-53.4,0,	
....	5,31,-51.7,0	
`"TRAC? TRACE2"`		'Read out CDP relative of Q branch
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	

<u>CODE DOMAIN ERROR POWER (TRACE1):</u>

The following is output for each channel:

Code class	Code class of the channel, which with the CDEP generally corresponds to the class which belongs to the base spreading factor.
Code number	Code number of the channel, values are between 0..63
Error power	In dB
	No distinction is made for power between the Hadamard and BitReverse order
Power ID	0 - Inactive channel
	1 - Power of device antenna
	2 - Alias power of device antenna
	3 - Quasi-inactive channel (on the analyzed branch, the channel is not assigned, but an active channel exists on the other branch)
	Alias power can be avoided by ensuring that the correct base spreading factor is selected when performing the analysis.
	(Refer to the `CDPower:SFACtor` command)

Four values are thus transferred for all channels:
<Code class>, <Code number>, <Level>, <Power ID>, ...

The Hadamard or BitReverse order is important for sorting the channels (refer to the command `CDPower:ORDer`).
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.

Example:

The example shows the results of the query for 2 channels with the following configuration:

```
PICH   0.32           (CC 5)      I      -7.0  dB
CCCH   2.8            (CC 3)      Q      -10.0 dB
```

`"INST:SEL MC2K"`		'Activate cdma2000 MS, implicit are 'CDP relative on Screen A and 'Result Summary active on Screen B 'Mapping set to I
`"INIT:CONT OFF"`		'Select single sweep
`"CDDP:MAPP Q"`		'Select Q branch
`"CALC2:FEED 'XPOW:CDEP'"`		'Code Domain Error Power analysis
`"INIT;*WAI"`		'Start measurement with 'synchronization
`"TRAC? TRACE1"`		'Read out CDEP Hadamard/Q
5, 0,-52.3,3,	*5, 1,-53.3,0,*	*'Code 0 is quasi-inactive since PICH is 'set to I*
5, 2,-52.1,1,	5, 3,-55.3,0,	'**Channel 2.8** is distributed between the
....	5, 9,-58.2,0,	'2.32, 10.32, 18.32 and 26.32
5,10,-49.8,1,	5,11,-53.4,0,	'each with one quarter of the
....	5,17,-49.0,0,	'power -10dB-6dB=-16.0 dB
5,18,-51.3,1,	5,19,-53.3,0,	
....	5,25,-51.0,0,	
5,26,-53.3,1,	5,27,-54.7,0	
....	5,31,-51.7,0	

active codes (label for the left column of bold active-code values)

<u>CHANNEL TABLE (TRACE1):</u>

The following is output for each channel:

Channel type	The channel type is numerically coded as follows:

0	= PICH
1	= EACH
2	= CCCH
3	= DCCH
4	= ACKCH
5	= CQICH
6	= FCH
7	= S1CH
8	= S2CH
9	= INACTIVE

Code class	Code class of the channel, values are between 1..6
Code number	Code number of the channel, values are between 0..63
Mapping	0 = I branch
	1 = Q branch
Absolute level	In dBmRelative level
	In dB, referred to the total or pilot power (refer to the command `CDPower:PREFerence`**)**
Timing offset	Referred to the pilot in secondsPhase offset
	Referred to the pilot in rad
	If the analysis of the timing and phase offset is not active
	(refer to `CDPower:TPMeas`) or there are more than 50 active channels in the signal, a value of 9 is returned.
	A value of 9 is generally returned for inactive channels.

The class gives the spreading factor of the channel:

Class 6 corresponds to the highest spreading factor (64, symbol rate 19.2 ksps), class 1 to the lowest permissible spreading factor (2, symbol rate 614.4 ksps).

This means that 8 values are transmitted for all active channels:

<Channel type>, <Code class>, <Code number>, <Mapping>, <Absolute level>, <Relative level>, <Timing offset>, <Phase offset>, etc.

All detected active channels are output first, followed by the inactive or quasi-active channels. The channels are sorted in ascending code number order (with identical code numbers: the I branch first, followed by the Q branch). The unassigned codes are displayed together with the code factor of the base spreading factor.

Example:

The example shows the results of the query for 2 channels with the following configuration:

```
PICH      0.32       (CC 5) I       -7.0   dB
CCCH      2.8        (CC 3) Q       -10.0  dB
"INST:SEL MC2K"        'Activate cdma2000 MS, implicit are
                       'CDP relative on Screen A and
                       'Result Summary active on Screen B
"INIT:CONT OFF"        'Select single sweep
"CALC2:FEED 'XTIM:CDP:ERR:CTAB'"
                       'Analyze channel tables
"INIT;*WAI"            'Start measurement with synchronization
"TRAC? TRACE1"         'Read out channel table
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
```

CHANNEL TABLE (CTABle):

In addition to the results of the channel table which are output using the TRACE1 command, active timing and phase offset measurement (refer to `CDPower:TPMeas`) also has the CTABle query command which displays the maximum values of the TIMING and PHASE OFFSET together with the associated channel.

The following values are output:<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>

Example:

`"INST:SEL MC2K"`	'Activate cdma2000 MS, implicit are
	'CDP relative on Screen A and
	'Result Summary active on Screen B
`"INIT:CONT OFF"`	'Select single sweep
`"CALC2:FEED 'XTIM:CDP:ERR:CTAB'"`	
	'Analyze channel tables
`"CDP:TPM ON"`	'Activate timing and phase offset measurement
`"INIT;*WAI"`	'Start measurement with synchronization
`"TRAC? CTAB"`	'Read out maximum timing and phase offsets
`1.20E-009,2,3,`	'Max. time offset with code number and
	'code class of associated channel
`-3.01E-003,2,3,`	'Max. phase offset with code number
	'and code class of associated channel
`0,0,0,0,0,0`	'6 reserved values

RESULT SUMMARY (TRACE2):

The results of the RESULT SUMMARY are output in the following order:

<SLOT>, <PTOTal>, <PPICh>, <RHO>, <MACCuracy>, <PCDerror>, <ACTive>, <FERRor>, <FERPpm>, <TFRame>, <CERROr>, <IQOFfset>, <IQIMbalance>, <SRATe>, <CHANnel>, <SFACtor>, <TOFFset>, <POFFset>, <CDPRelative>, <CDPabsolute>, <EVMRms>, <EVMPeak>

In this instance the results have the following meaning and units:

Global results of the selected PCG:

SLOT	PCG number		Global results for all PCGs:
PTOTal	Total power in dBm	FERRor	Frequency error in Hz
PPICh	Pilot power in dBm	FERPpm	Frequency error in ppm
RHO	RHO	CERROr	Chip rate error in ppm
MACCuracy	Composite EVM in %	TFRame	Trigger to frame
PCDerror	Peak code domain error in dB	ACTive	Number of active channels
IQOFfset	IQ offset in %		
IQIMbalance	IQ imbalance in %		

Channel results:

SRATe	Symbol rate in ksps	TOFFset	Timing offset in s
CHANnel	Channel number	POFFset	Phase offset in rad
SFACtor	Spreading factor of channel		
CDPRelative	Channel power relative in dB (relative to total or PICH power, refer to command `CDP:PREF`)	CDPabsolute	Channel power absolute in dBm
EVMRms	Error vector magnitude RMS in %	EVMPeak	Error vector mag. peak in %

Note: *The Trigger to Frame value (`TFRame`) supplies a '9' if the trigger is at FREE RUN. The Timing/ Phase Offset values (`TOFFset`/`POFFset`) supply a '9' if timing and phase measurement is disabled (refer to `CDP:TPM`) or the number of active channels is higher than 50.*

POWER VS PCG, PEAK CODE DOMAIN ERR and COMPOSITE EVM (TRACE2):

The number of returned value pairs corresponds to the IQ capture length.(Refer to the command `CDPower:IQLength`).

POWER VS PCG: <Slot number>,<Level value in dB>, <Slot number>, <Level value in dB>,.....;
PEAK CODE DOMAIN ERROR: <Slot number>, <Level value in dB>, ...;
COMPOSITE EVM: <Slot number>, <Value in %>, ...;

SYMBOL EVM (TRACE2):

The number of values depends on the spreading factor:

Spreading factor 64	:	24	values	Spreading factor 32	:	48	values:
Spreading factor 16	:	96	values	Spreading factor 8	:	192	values;
Spreading factor 4	:	384	values	Spreading factor 2	:	768	values;

<Value in % symbol 0>, <Value in % symbol 1>,.....;

POWER VS SYMBOL (TRACE2):

The number of values depends on the spreading factor:

Spreading factor 64	:	24	values	Spreading factor 32	:	48	values:
Spreading factor 16	:	96	values	Spreading factor 8	:	192	values;
Spreading factor 4	:	384	values	Spreading factor 2	:	768	values;

<Value in dBm symbol 0>, <Value in dBm symbol 1>,.....;

SYMBOL CONST (TRACE2):

The number of value pairs depends on the spreading factor:

Spreading factor 64	:	24	pairs	Spreading factor 32	:	48	pairs:
Spreading factor 16	:	96	pairs	Spreading factor 8	:	192	pairs;
Spreading factor 4	:	384	pairs	Spreading factor 2	:	768	pairs;

The real and imaginary component are transferred as a value pair.<re 0>,<im 0>,<re 1>,<im 1>,.....<re n>, <im n>

COMPOSITE CONST (TRACe2):

The number of value pairs corresponds to the number of chips from the 1536 chips in a power control group. Real and imaginary components are transferred as value pairs.

<re Chip 0>, <in Chip 0>, <re Chip 1>, <in Chip 1>,.....;

BITSTREAM (TRACE2):

The bit stream of a slot is output. A value is read out for each bit (value range 0,1), each symbol consists of one bit for BPSK channels.

Spreading factor 64	:	24	values	Spreading factor 32	:	48	values:
Spreading factor 16	:	96	values	Spreading factor 8	:	192	values;
Spreading factor 4	:	384	values	Spreading factor 2	:	768	values;

If a channel is detected as being active, the invalid bits in the bit stream are identified by "9".
Example of bit stream trace: 0, 0, 1, 0 , 1, 1, 0 ....

STATus-QUEStionable:SYNC register

This register contains information about the error situation in the Code Domain Power analysis of the FS-K83 option.
It can be queried with the commands "STATus:QUEStionable:SYNC:CONDition?" and "STATus:QUEStionable:SYNC[:EVENt]?".

Table 7-1   Meaning of bits in STATus:QUEstionable:SYNC register

Bit No.	Meaning
0	Not used in the FS-K83 application
1	**K83 Frame Sync failed** This bit is set if synchronization is not possible within the application. Possible reasons for this are: Incorrectly set frequency Incorrectly set level Incorrectly set long code mask or long code offset Incorrectly set values for Q-INVERT or SIDE BAND INVERT Invalid signal at input
2 to 14	Not used in the FS-K83 application
15	This bit is always 0.

Table of softkeys with assignment of IEC-bus commands

MEAS key and MEAS hotkey

POWER	`:CONFigure<1>:CDPower:MEASurement POWer`
	Query of results `:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? CPOWer`

ACLR	`:CONFigure<1>:CDPower:MEASurement ACLR`
	Query of results:`:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? ACPower`

NO: OF ADJ CHAN	`:SENS:POW:ACH:ACP 2`

ADJUST SETTINGS	`:SENS:POW:ACH:PRES ACP│CPOW│OBW`

SWEEP TIME	`:SWE:TIM 1 s`

NOISE CORR ON OFF	`:SENS:POW:NCORR ON`

FAST ALCR ON OFF	`:SENS:POW:HSP ON`

DIAGRAM FULL SIZE	–

ADJUST REV LVL	`:SENS:POW:ACH:PRES:RLEV`

ACLR LIMIT
CHECK
	`:CALC:LIM:ACP ON`
	`:CALC:LIM:ACP:ACH:RES?`
	`:CALC:LIM:ACP:ALT:RES?`

EDIT
ACLR LIMIT
	`:CALC:LIM:ACP ON`
	`:CALC:LIM:ACP:ACH 0dB,0dB`
	`:CALC:LIM:ACP:ACH:STAT ON`
	`:CALC:LIM:ACP:ACH:ABS –10dBm,-10dBm`
	`::CALC:LIM:ACP:ACH:ABS:STAT ON`
	`:ALC:LIM:ACP:ALT1 0dB,0dB`
	`:CALC:LIM:ACP:ALT1:STAT ON`
	`:CALC:LIM:ACP:ALT1:ABS –10dBm,-10dBm`
	`:CALC:LIM:ACP:ALT1:ABS:STAT ON`
	`:CALC:LIM:ACP:ALT2 0dB,0dB`
	`:CALC:LIM:ACP:ALT2:STAT ON`
	`:CALC:LIM:ACP:ALT2:ABS –10dBm,-10dBm`
	`:CALC:LIM:ACP:ALT2:ABS:STAT ON`

CHANNEL BANDWIDTH	`:SENS:POW:ACH:BWID 1.2288MHz`

ADJ CHAN
BANDWIDTH
	`:SENS:POW:ACH:BWID:ACH 30kHz`
	`:SENS:POW:ACH:BWID:ALT1 30kHz`
	`:SENS:POW:ACH:BWID:ALT2 30kHz`

ADJ CHAN
SPACING
	`:SENS:POW:ACH:SPAC:ACH 750kHz`
	`:SENS:POW:ACH:SPAC:ALT1 1.98MHz`
	`:SENS:POW:ACH:SPAC:ALT2 4MHz`

ACLR ABS REL	`:SENS:POW:ACH:MODE ABS`

CHAN PWR / HZ	`:CALC:MARK:FUNC:POW:RES:PHZ ON│OFF`

SPECTRUM EM MASK	:CONFigure:CDPower:MEASurement ESPectrum Query of results::CALCulate<1>:LIMit<1>:FAIL?
LIMIT LINE AUTO	:CALC:LIM:ESP:MODE AUTO
LIMIT LINE USER	:CALC:LIMit<1>:NAME <string> :CALC:LIMit<1>:UNIT DBM :CALC:LIMit<1>:CONT[:DATA] <num_value>, <num_value>, ... :CALC:LIMit<1>:CONT:DOMain FREQuency :CALC:LIMit<1>:CONT:TRACe 1 :CALC:LIMit<1>:CONT:OFFset <num_value> :CALC:LIMit<1>:CONT:MODE RELative :CALC:LIM<1>:UPPer[:DATA] <num_value>, <num_value>.. :CALC:LIM<1>:UPPer:STATe ON | OFF :CALC:LIM<1>:UPPer:OFFset <num_value> :CALC:LIM<1>:UPPer:MARGin <num_value> :CALC:LIM<1>:UPPer:MODE ABSolute :CALC:LIM<1>:UPPer:SPACing LINear

Notes:
- If the y-values are entered using the command :CALCulate:LIMit<1>:LOWer[:DATA], the limit check returns "failed" if the limit line is underranged.
- If a user-defined limit line is activated, this has priority over limit lines which have been selected with AUTO.

RESTORE STD LINES	:CALC:LIM:ESP:RESTore
ADJUST REF LVL	:SENS:POW:ACH:PRES:RLEV
OCCUPIED BANDWIDTH	:CONFigure<1>:CDPower:MEASurement OBANdwidth Query of results::CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? OBANdwidth
% POWER BANDWIDTH	:SENS:POW:BWID 99PCT
ADJUST SETTINGS	:SENS:POW:PRES OBW
ADJUST REF LVL	:SENS:POW:ACH:PRES:RLEV
SIGNAL STATISTICS	:CONFigure:CDPower:MEASurement CCDF or :CALCulate:STATistics:CCDF[:STATe] ON Query of results: CALCulate:MARKer:X?
APD	:CALC:STAT:APD ON
CCDF	:CALC:STAT:CCDF ON
PERCENT MARKER	:CALC:MARK:Y:PERC 0...100%
NO OF SAMPLES	CALC:STAT:NSAM <value>
SCALING	
X-AXIS REF LEVEL	:CALC:STAT:SCAL:X:RLEV <value>

X-AXIS RANGE	`:CALC:STAT:SCAL:X:RANG <value>`
X-AXIS MAX VALUE	`:CALC:STAT:SCAL:Y:UPP <value>`
X-AXIS MIN VALUE	`:CALC:STAT:SCAL:Y:LOW <value>`
ADJUST SETTINGS	`:CALC:STAT:SCAL:AUTO ONCE`
DEFAULT SETTINGS	`:CALC:STAT:PRES`
ADJUST SETTINGS	`:CALC:STAT:SCAL:AUTO ONCE`
CONT MEAS	`:INIT:CONT ON;` `:INIT:IMM`
SINGLE MEAS	`:INIT:CONT OFF;` `:INIT:IMM`

RESULTS hotkey and CODE DOM ANALYZER softkey

CODE DOM POWER	`:CALCulate<1>:FEED "XPOW:CDP:RAT"` (relative) `:CALCulate<1>:FEED "XPOW:CDP"` (absolute)
CODE DOM ERROR	`:CALCulate<1>:FEED "XPOW:CDEP"`
COMPOSITE EVM	`:CALCulate2:FEED "XTIM:CDP:MACCuracy"`
PEAK CODE DOMAIN ERR	`:CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"`
POWER VS PCG	`:CALCulate2:FEED "XTIM:CDP:PVSLot"`

RESULT SUMMARY
```
:CALCulate2:FEED "XTIM:CDP:ERR:SUMM"
 Ergebnisabfrage:
:CALCulate<1|2>:MARKer<1>:FUNCtion:CDPower:RESult?
:PTOTal | FERRor | RHO | PPICh | FERPpm |
:CERRor| TFRame | IQOFfset | IQIMbalance |
:MACCuracy | PCDerror | SLOT | ACTive | SRATe |
:TOFFset | CHANnel | POFFset | SFACtor |
:CDPabsolute | CDPRelative |EVMRms | EVMPeak
```

CHANNEL TABLE	`:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"`
SYMBOL CONST	`:CALCulate2:FEED "XTIM:CDP:SYMB:CONS"`
SYMBOL EVM	`:CALCulate2:FEED "XTIM:CDP:SYMB:EVM"`
BITSTREAM	`:CALCulate2:FEED "XTIM:CDP:BSTReam"`
COMPOSITE CONST	`:CALCulate2:FEED "XTIM:CDP:COMP:CONS"`
POWER VS SYMBOL	`:CALCulate2:FEED "XTIM:CDP:PVSY"`
SELECT I Q	`:[SENSe:]CDPower:MAPPing...I	Q`
SELECT CHANNEL	`:[SENSe:]CDPower:CODE 0...(BASE SF-1)`
SELECT PCG	`:[SENSe:]CDPower:SLOT 0 ...(IQ_CAPTURE_LENGTH-1)`
ADJUST REF LVL	`:SENS:POW:ACH:PRES:RLEV`

CHAN CONF hotkey

CODE CHANAUTOSEARCH	`:CONFigure:CDPower:CTABle[:STATe] OFF`
CODE CHANPREDEFINED	`:CONFigure:CDPower:CTABle[:STATe] ON` `:CONFigure:CDPower:CTABle:SELect  <channel table name>`
EDIT CHANCONF TABLE	`---`
NEW CHANCONF TABLE	`---`
HEADER VALUES	`:CONFigure:CDPower:CTABle:NAME "NEW_TAB"`
INSERT LINE	`---`
DELETE LINE	`---`
MEAS CHAN CONF TABLE	`---`
SAVE TABLE	`--`
SORT TABLE	`---`
PAGE UP	`---`
PAGE UP	`---`
DEL CHANCONF TABLE	`:CONFigure:CDPower:CTABle:DELete`
COPY CHANCONF TABLE	`:CONFigure:CDPower:CTABle:COPY "CTAB2"`
RESTORE STD TABLES	`CONFigure:CDPower:CTABle:RESTore"`

SETTINGS hotkey

| BAND CLASS | `:CONFigure:CDPower:BCLass 1 '1900 MHz` |

| BASE SF | `:[SENSe:]CDPower:SFACtor 16 | 32 | 64` |

| 16 |

| 32 |

| 64 |

| CAPTURE LENGTH | `:[SENSe:]CDPower:IQLength 2..50` |

| ORDER HADAMBITRE | `:[SENSe:]CDPower:ORDer HADamard | BITReverse` |

| CODE DOM OVERVIEW | `:[SENSe:]CDPower:OVERview ON | OFF` |

| SELECT I   Q | `:[SENSe:]CDPower:MAPPing I | Q` |

| CODE PWR ABS   REL | `:CALCulate<1>:FEED "XPOW:CDP:RAT" (relative)`
 `:CALCulate<1>:FEED "XPOW:CDP" (absolute)` |

| POWER REF TOT PICH | `:[SENSe:]CDPower:PREFerence TOTal | PICH` |

| ORDER HADAMBITRE | `:[SENSe:]CDPower:ORDer HADamard | BITReverse` |

| TIME PHASE ON   OFF | `:[SENSe:]CDPower:TPMeas ON | OFF` |

| LOG CODE MASK | `:[SENSe:]CDPower:LCODe:MASK ..'#H0' ... '#H4FFFFFFFFFF'` |

| LOG CODE OFFSET | `:[SENSe:]CDPower:LCODe:OFFSet'#H0' ... '#H1FFFFFFFFFFF8000'` |

| INACT CHAN THRESHOLD | `:[SENSe:]CDPower:ICTReshold -100 dB ... 0 dB` |

| INVERT Q ON   OFF | `:[SENSe]:CDP:QINVert ON | OFF` |

| SIDE BAND NORN INV | `:[SENSe:]CDPower:SBANd NORMal|INVers` |

| NORMALIZE ON   OFF | `:[SENSe:]CDPower:NORMalize   ON | OFF` |

8 Checking the Rated Specifications

- Switch off the analyzer before withdrawing or inserting modules.
- Check the position of the mains voltage selector (230 V) before switching on the device.
- Perform measurement of the rated specifications after the device has warmed up for at least 30 minutes and after self-calibration of the analyzer and the SMIQ have been completed. This is the only way to ensure that the guaranteed data are complied with.
- Unless specified to the contrary, all settings are performed starting from the PRESET setting.
- The following conventions apply to settings on the analyzer during measurement:

  [**<KEY>**]   Press a key on the front panel, e.g. [SPAN]

  [<SOFTKEY>]   Press a softkey, e.g. [MARKER -> PEAK]

  [<tbd unit>]   Enter a value and then enter the unit, e.g. [12 kHz]

  {<nn>}   Enter values specified in the table below.

  Successive entries are separated by [:], e.g. [**SPAN**: 15 kHz].
- The values in the sections that follow are not guaranteed; only the specifications in the data sheet are binding.

Measuring equipment and accessories

Item	Device type	Recommended specifications	Recommended device	R&S order number
1	Signal generator	Vector signal generator	SMIQ with options: SMIQB20 SMIQB11 SMIQB60SMIQK12SMIQ-Z5 PARDATA	1125.5555.xx1 125.5190.021 085.4502.041 136.4390.021 105.0435.021 104.8555.02
2	Control computer for signal generation using WinIQSIM PC that is either connected by means of a serial cable to the SMIQ, or has an IEC-bus card and connected by means of an IEC-bus cable to the SMIQ. R&S WinIQSIM software V3.20 is installed on that PC. The software can be downloaded from the Rohde & Schwarz web site on the Internet at http://www.rohde-schwarz.com.			

Test sequence

The performance test refers solely to results of the code domain analyzer.
There is no need to check the measured values of the POWER, ACLR and SPECTRUM measurements, since they are already covered by the performance test of the basic device.

If not done already, the WinIQSIM file with the cdma2000 MS signal must be created first and transferred to the SMIQ as "C2KMS". This is described at length in the section "Generating a cdma2000 reverse link signal with WinIQSIM" on page 10.

Default setting on   *[PRESET]*
SMIQ: *[LEVEL :*   *0 dBm]*
                              [FREQ: *833.49 MHz]*
                              ARB MOD
                              *   SET SMIQ ACCORDING TO WAVEFORM ...*
                              *   SET SMIQ ACCORDING TO WAVEFORM   ON*
                              *   IQ SWAP (VECTOR MODE)   ON*
                              *   TRIGGER OUT MODE   ON*
(These three settings are only required once after generator preset and, in VECTOR MODE, are used to apply the IQ SWAP and, in ARB MOD, to apply trigger setting automatically from the waveform file generated by WinIQSIM. This is particularly convenient when a switch is made between different waveforms.)

                              *   SELECT WAVEFORM... select name 'C2KMS'*
                              *   STATE: ON*

Default setting on   *[PRESET]*
analyzer: *[CENTER:*   *833.49 MHz]*
                              [AMPT: *10 dBm]*
                              [CDMA2k MS]
                              [TRIG   *EXTERN]*
                              [SETTINGS   *TIME/PHASE: ON]*

                              [RESULTS   *CHANNEL TABLE]*

Test setup and other settings
- ➢ Connect the RF output of the SMIQ to the RF input of the analyzer
- ➢ Connect the external trigger input of the analyzer to the TRIG1 port on the Z5 PARDATA BNC ADAPTER
- ➢ Connect the external reference output of the analyzer to the SMIQ.

SMIQ   *UTILITIES*
  REF OSC
    SOURCE: EXT

Analyzer   **[SETUP**:   *REFERENCE INT]*

The measurement result displayed on the screen of the analyzer should have the following appearance:

```
MS,1X,C0 :CHANNEL TAB
                                     Chan    0.32    Max T   -0.06 ns   @   4.16
                        CF 833.49 MHz    MAP I  PCG  0    Max Ph  -0.32 mrad  @   2.4
```

	Type	Chan.SF	Symb Rate ksps	Map	Status	Pwr Abs dBm	Pwr Rel dB	T Offs ns	Ph Offs mrad	
Ref	PICH	0.32	38.4	I	active	-3.51	-3.12	0.00	0.00	**A**
10.0	S1CH	2.4	307.2	Q	active	-6.31	-5.92	-0.03	-0.32	
dBm	FCH	4.16	76.8	Q	active	-6.31	-5.91	-0.06	0.05	
	----	0.32	38.4	Q	qinact	-60.45	-60.06	-.--	-.--	**TRG**
Att	----	1.32	38.4	I	inact	-62.82	-62.43	-.--	-.--	
40 dB	----	1.32	38.4	Q	inact	-60.17	-59.77	-.--	-.--	
	----	2.32	38.4	I	qinact	-58.34	-57.95	-.--	-.--	
	----	3.32	38.4	I	inact	-60.82	-60.42	-.--	-.--	
1	----	3.32	38.4	Q	inact	-61.20	-60.81	-.--	-.--	
CLRWR	----	4.32	38.4	I	qinact	-59.15	-58.76	-.--	-.--	
	----	5.32	38.4	I	inact	-59.55	-59.16	-.--	-.--	
	----	5.32	38.4	Q	inact	-61.20	-60.81	-.--	-.--	

PRN

```
RESULT SUMMARY TABLE                     SR   38.4 ksps
                                         Chan    0.32
                        CF 833.49 MHz    MAP I  PCG  0
```

	RESULTS FOR PCG 0:		GLOBAL RESULTS:		
Ref	Total PWR	-0.39 dBm	Carr Freq Error	75.72 mHz	**B**
10.0	Pilot PWR	-3.51 dBm	Carr Freq Error	0.00 ppm	
dBm	RHO	0.99993	Chip Rate Error	0.14 ppm	
	Composite EVM	0.83 %	Trg to Frame	457.315679 ns	
Att	Pk CDE (SF 32/I)	-57.49 dB	Active Channels	3	
40 dB	IQ Imbal/Offset	0.05/0.51 %			
	CHANNEL RESULTS:		Mapping	I	
	Symbol Rate	38.4 ksps	Timing Offset	0.00 ns	
1	Channel.SF	0.32	Phase Offset	0.00 mrad	
CLRWR	Channel Power Rel	-3.12 dB	Channel Power Abs	-3.51 dBm	
	Symbol EVM	0.19 % rms	Symbol EVM	0.42 % Pk	

9 Code Table for Hadamard and BitReverse Order

The following tables show the code sequences for the Hadamard and BitReverse order for the Code Domain Power and Code Domain Error Power analyses.
Using channel 2.8 as an example (channel number 2 with spreading factor 8), the highlighted entries indicate where the individual codes of this channel are located.

Table 9-1   Code table for base spreading factor 16

	HADAMARD									BITREVERSE	
0	0000	0	0	0	0	0	0	0	0	0000	0
1	0001	0	0	0	1	1	0	0	0	1000	8
2	0010	0	0	1	0	0	1	0	0	0100	4
3	0011	0	0	1	1	1	1	0	0	1100	12
4	0100	0	1	0	0	0	0	1	0	**0010**	**2**
5	0101	0	1	0	1	1	0	1	0	**1010**	**10**
6	0110	0	1	1	0	0	1	1	0	0110	6
7	0111	0	1	1	1	1	1	1	0	1110	14
8	1000	1	0	0	0	0	0	0	1	0001	1
9	1001	1	0	0	1	1	0	0	1	1001	9
10	1010	1	0	1	0	0	1	0	1	0101	5
11	1011	1	0	1	1	1	1	0	1	1101	13
12	1100	1	1	0	0	0	0	1	1	0011	3
13	1101	1	1	0	1	1	0	1	1	1011	11
14	1110	1	1	1	0	0	1	1	1	0111	7
15	1111	1	1	1	1	1	1	1	1	1111	15

Table 9-2   Code table for base spreading factor 32

	HADAMARD											BITREVERSE	
0	000000	0	0	0	0	0	0	0	0	0	0	00000	0
1	000001	0	0	0	0	1	1	0	0	0	0	10000	16
2	**000010**	0	0	0	1	0	0	1	0	0	0	01000	8
3	000011	0	0	0	1	1	1	1	0	0	0	11000	24
4	000100	0	0	1	0	0	0	0	1	0	0	00100	4
5	000101	0	0	1	0	1	1	0	1	0	0	10100	20
6	000110	0	0	1	1	0	0	1	1	0	0	01100	12
7	000111	0	0	1	1	1	1	1	1	0	0	11100	28
8	001000	0	1	0	0	0	0	0	0	1	0	**00010**	**2**
9	001001	0	1	0	0	1	1	0	0	1	0	**10010**	**18**
10	**001010**	0	1	0	1	0	0	1	0	1	0	**01010**	**10**
11	001011	0	1	0	1	1	1	1	0	1	0	**11010**	**26**
12	001100	0	1	1	0	0	0	0	1	1	0	00110	6
13	001101	0	1	1	0	1	1	0	1	1	0	10110	22
14	001110	0	1	1	1	0	0	1	1	1	0	01110	14
15	001111	0	1	1	1	1	1	1	1	1	0	11110	30
16	010000	1	0	0	0	0	0	0	0	0	1	00001	1
17	010001	1	0	0	0	1	1	0	0	0	1	10001	17
18	**010010**	1	0	0	1	0	0	1	0	0	1	01001	9
19	010011	1	0	0	1	1	1	1	0	0	1	11001	25
20	010100	1	0	1	0	0	0	0	1	0	1	00101	5
21	010101	1	0	1	0	1	1	0	1	0	1	10101	21
22	010110	1	0	1	1	0	0	1	1	0	1	01101	13
23	010111	1	0	1	1	1	1	1	1	0	1	11101	29
24	011000	1	1	0	0	0	0	0	0	1	1	00011	3
25	011001	1	1	0	0	1	1	0	0	1	1	10011	19
26	**011010**	1	1	0	1	0	0	1	0	1	1	01011	11
27	011011	1	1	0	1	1	1	1	0	1	1	11011	27
28	011100	1	1	1	0	0	0	0	1	1	1	00111	7
29	011101	1	1	1	0	1	1	0	1	1	1	10111	23
30	011110	1	1	1	1	0	0	1	1	1	1	01111	15
31	011111	1	1	1	1	1	1	1	1	1	1	11111	31

Table 9-3   Code table for base spreading factor 64

	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

10 Glossary

ACKCH	Acknowledgment channel (with 1xEV-DV only) 16.64
CCCH	Common control channel 2.8
CDEP	Code domain error power
CDP	Code domain power
Composite EVM	According to the 3GPP specifications, the composite EVM measurement determines the square root of the squared error between the real and imaginary components of the test signal and of an ideally generated reference signal (EVM referred to the total signal).
Crest factor	Ratio of peak to mean value of a signal
CQICH	Channel quality indicator channel (with 1xEV-DV only) 12.16
EACH	Enhanced access channel 2.8
FCH	Fundamental channel 4.16
MC1	Multicarrier1 (a carrier system 1X)
PCG	Power Control Group: Term used in the cdma2000 system which describes 1536 chips or a period of 1.25 ms. During a power control group, the system transmits at a constant power.
PICH	Pilot channel 0.32
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
SF	Spreading factor
x.y	Walsh code x.y, where: x is the code number and y is the spreading factor of the channel.

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