



ROHDE & SCHWARZ

Test and Measurement Division

Software Manual

TD-SCDMA Mobile Station Test

Application Firmware R&S FS-K77

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Contents of Application Firmware R&S FS-K77 Software Manual

This software manual contains information on operation of the Spectrum Analyzer R&S FSU, R&S FSP or Signal Analyzer R&S FSQ configured with the Application Firmware R&S FS-K77. It includes a description of the menus and remote control commands for the TD-SCDMA mobile station test application firmware.

All other details of analyzer operation can be found in the relevant operating manual.

The software manual of the application firmware consists of a data sheet and nine chapters:

Data Sheet	details guaranteed and typical specifications and firmware characteristics.
Chapter 1	describes how to enable the application firmware.
Chapter 2	describes typical measurements by test examples.
Chapter 3	describes the measurement setup for mobile station tests.
Chapter 4	gives a schematic overview of the operating menus.
Chapter 5	contains a detailed description of all functions for mobile station tests as a reference for manual operation. The chapter also lists the corresponding IEC/IEEE bus command for each function.
Chapter 6	describes all remote control commands defined for the application firmware. A table containing the IEC/IEEE bus commands assigned to the softkeys is given at the end of the chapter.
Chapter 7	describes the procedure for checking rated characteristics.
Chapter 8	explains terms relating to measured variables in code domain measurement.
Chapter 9	contains the index of this software manual.

TD-SCDMA Mobile station Test Application Firmware R&S FS-K77

When configured with the Application Firmware R&S FS-K77, the analyzer performs code domain power measurements on reverse link signals (mobile station). The measurements are based on the 3GPP (Third Generation Partnership Project) standard.

The basic standards are 3GPP TS 25.102 „User Equipment (UE) radio transmission and reception (TDD)“, version V5.5.0 and 3GPP TS 25.221 „Physical channels and mapping of transport channels onto physical channels (TDD)“, version V5.5.0. When TD-SCDMA specifications are mentioned in the document, this standard is meant.

In addition to the measurements specified by the TD-SCDMA standard in the code domain, the application firmware 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 Application Firmware

Installation

If the Application Firmware R&S FS-K77 is not yet installed on the unit, a firmware update is necessary. This has already been done in the case of installation at the factory.

You must install appropriate basic firmware on the analyzer to enable installation of the application firmware. Refer to the release notes of the current Application Firmware R&S FS-K77 for compatible versions.

If the basic firmware has to be updated, start the update with the floppy disks containing the basic firmware by *SETUP* → *NEXT* → *FIRMWARE UPDATE*.

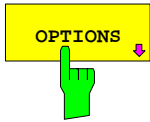
If the correct basic firmware is installed, start the update for the application firmware from the floppy disks containing the Application Firmware R&S FS-K77 by the the same operation *SETUP* → *NEXT* → *FIRMWARE UPDATE*.

After installation of the application firmware, you must enable it as described below.

Enabling

The Application Firmware R&S FS-K77 is enabled in the *SETUP* → *GENERAL SETUP* menu by entering a keyword. The keyword comes with the application firmware. If the application is installed at the factory it will already be enabled.

GENERAL SETUP menu:



The *OPTIONS* softkey opens a submenu in which you can enter the keywords for the application firmware. The existing applications are displayed in a table that opens when you enter the submenu.



The *INSTALL OPTION* softkey enables entry of the keyword for an application firmware.

A keyword can be entered in the entry 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 an invalid keyword is entered, *OPTION KEY INVALID* is displayed.

If the version of the application firmware and that of the basic firmware are not compatible, you see a corresponding message. In this case, follow the instructions in the above chapter "Installation".

2 Getting Started

The following chapter explains basic TD-SCDMA mobile station tests using a setup with the Signal Generator R&S SMIQ as the device under test. It describes how to avoid operating and measuring errors by correct default settings.

The measurement screen is presented in Chapter 5 for the different measurements.

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

- Measurement 1: measuring signal spectrum
- Measurement 2: measuring spectrum emission mask
- Measurement 3: measuring relative code domain power and frequency error
 - Setting: center frequency
 - Setting: scrambling code
- Measurement 4: measuring composite EVM
- Measurement 5: measuring peak code domain error
- Measurement 6: measuring RHO factor

TD-SCDMA raw data are created with the R&S WinIQSIM Software and loaded in the arbitrary waveform generator of the R&S SMIQ.

Measurements are performed with the following units and accessories:

- Spectrum Analyzer R&S FSU, R&S FSP or Signal Analyzer R&S FSQ with Application Firmware R&S FS-K77 mobile station test for TD-SCDMA.
- Vector Signal Generator R&S SMIQ with hardware options B11 Data Generator, B20 Modulation Coder and B60 Arbitrary Waveform Generator plus firmware version 5.70 or higher with enabled option K14 TD-SCDMA and R&S SMIQ-Z5 PARADATA BNC Adapter for an external trigger signal.
- A PC that is either connected to the R&S SMIQ by a serial cable or has an IEC/IEEE bus card and is connected to the R&S SMIQ by an IEC/IEEE bus cable. Installed on this PC is the R&S WinIQSIM Software 4.00 or higher. You can download this software from the Rohde & Schwarz Internet site <http://www.rohde-schwarz.com>.
- One coaxial cable, 50 Ω , approximately 1 m, N connector.
- Two coaxial cables, 50 Ω , approximately 1 m, BNC connector.

Generating TD-SCDMA signal with R&S WinIQSIM

You can download the R&S WinIQSIM Software from <http://www.rohde-schwarz.com> and install it on a PC. Using the R&S WinIQSIM Software you can generate TD-SCDMA signals and then transfer them to an R&S SMIQ or R&S AMIQ. In what follows you learn how to generate a test signal to TD-SCDMA specifications. You are assumed to be using R&S WinIQSIM version 4.00 or higher.

Start and select standard: Start **WinIQSIM.exe**.
In the **File** menu select **New** and in the following list **TD-SCDMA**. The **Block Diagram - TD-SCDMA** dialog appears.
Select **TD-SCDMA Configuration** to configure the TD-SCDMA signal, and the following dialog opens:

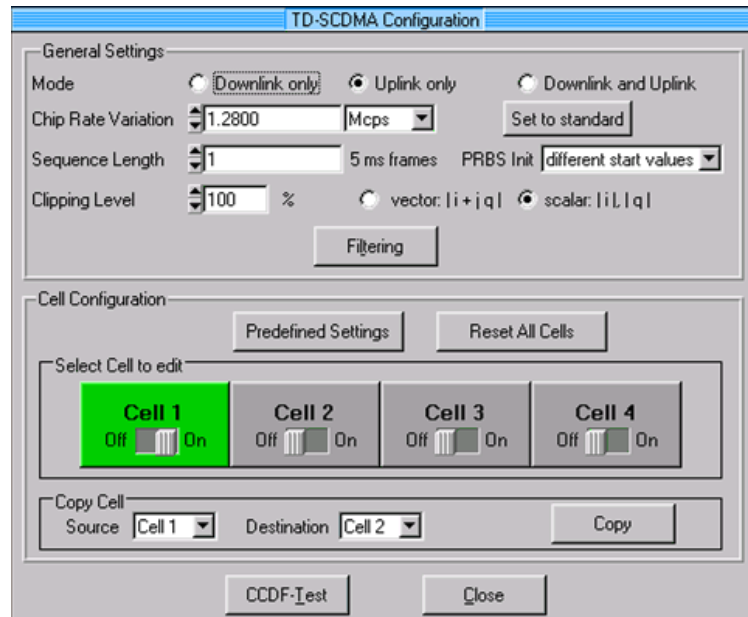


Fig. 2-1 R&S WinIQSIM – TD-SCDMA configuration

Set transmit filter:

Select **Filtering** to configure the TD-SCDMA transmit filter. Increase **Impulse Length** to 120.

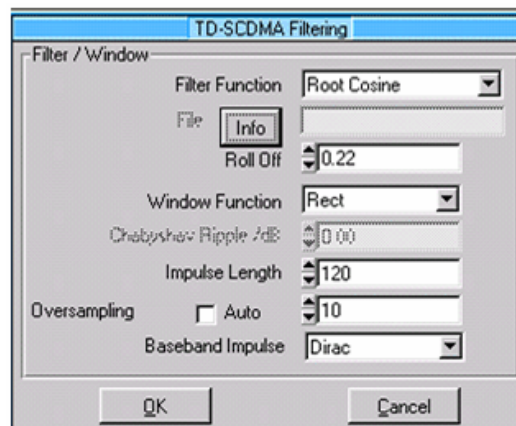


Fig. 2-2 R&S WinIQSIM – transmit filter settings

Configure subframe:

Set as follows in **TD-SCDMA Cell Configuration** for a signal with one channel in slot 1. The **Scrambling Code** must be kept on 0. Set **Mode** to

Uplink only and select **Cell 1** to edit.
Slot 1 must be **On**:

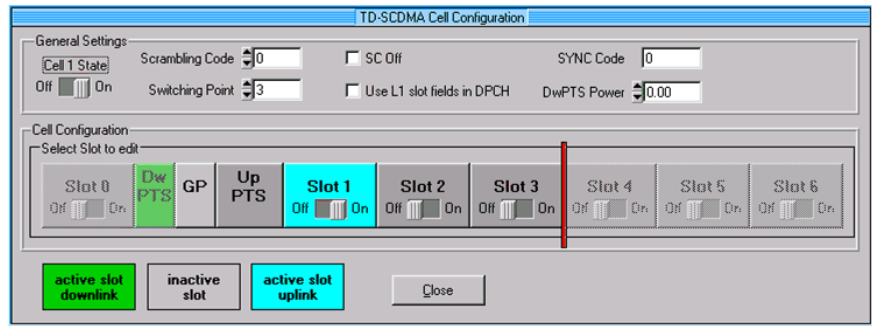


Fig. 2-3 R&S WinIQSIM – subframe configuration

Set channels:

For synchronization of the Application Software R&S FS-K77, an arbitrary channel in an uplink slot must be active. For instant, choose a channel with “gross data rate”: 17.6 kbps (SF 16) and “Spr. Code” 0 in slot 1. The MA Shift should be set to 120 for a valid code/midamble allocation (An invalid code/midamble allocation influences the channel table only and has no effect on the other measurements or synchronization). Other channels in slot 1 are not activated. After completing your settings, normalize the power of the channels by clicking on **Adjust Total Power to 0 dB**.

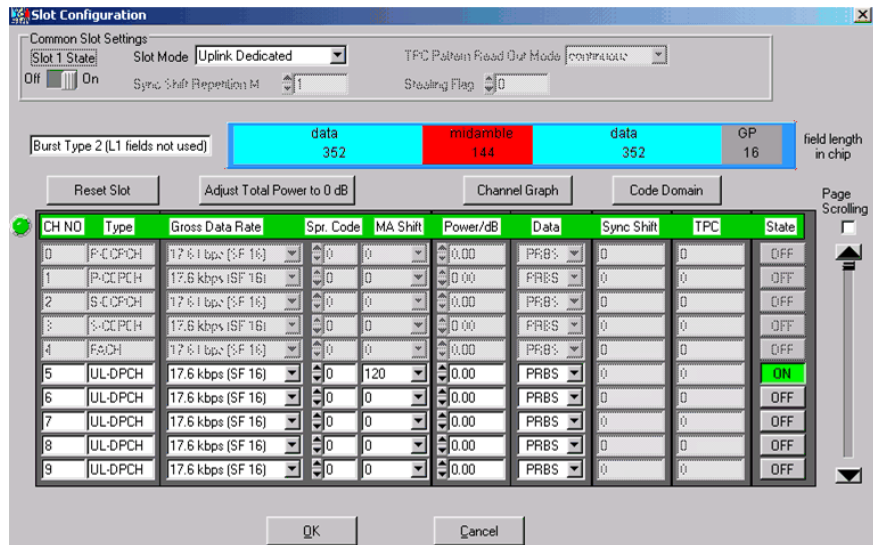


Fig. 2-4 R&S WinIQSIM – channel settings in slot 0

Note: *The MA shift parameter in R&S WinIQSIM relates directly to the number of bits by which a basic midamble is cyclically shifted. This parameter does not correspond to the midamble shift parameter in TD-SCDMA specifications and in the Application Firmware R&S FS-K77 mobile station test for TD-SCDMA.*

Define trigger settings:

Now you have to set the trigger settings in the **ARB, SMIQ (ARB)** menu, item **Trigger Output**. **Current Mode: Restart Clock (SEQUENCE)** is defined for **Mode 1**. The trigger at the subframe limit then appears every 5 ms on TRIG1 of the R&S SMIQ Z5 BNC Adapter.

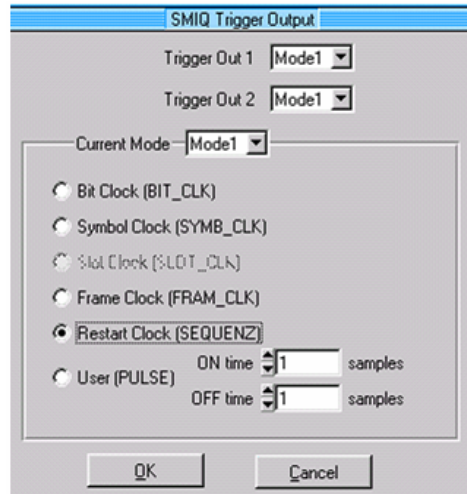


Fig. 2-5 R&S WinIQSIM – trigger settings

Save and transfer to R&S SMIQ:

Use **File|Save Settings As** to save this TD-SCDMA configuration as a file named 'TDS_UE.IQS'.

Connect the R&S SMIQ either serially or by an IEC/IEEE bus card and IEC/IEEE bus cable, and load the generated signal to the R&S SMIQ under the name 'TDS_BS' in the **SMIQ|Transmission** menu.

Trigger settings and synchronisation

Contrary to downlink signals with DwPTS, there is normally no permanent pilot slot in uplink. The UpPTS is used for the initial cell search and handover only. This impacts the synchronisation and trigger of uplink signals.

For measurement of TD-SCDMA uplink signals the following trigger settings are available:

- Free Run (Code Domain Analyser only)
- Extern
- IF Power
- RF Power (FSP with Option FSP-B6 only)

As an external trigger a subframe trigger is expected. An unambiguous slot assignment is possible with subframe trigger only. When using IF or RF power trigger, only **one** slot is allowed to be active. This slot is always assumed to be slot 1 (first slot after UpPTS).

Within the code domain analyser the free run trigger can be used. In free run mode a valid slot allocation will be searched, so that the first active uplink slot of a subframe is placed on slot 1. If an UpPTS is found within the captured signal, it will be used as timing reference for slot allocation.

Example for free run trigger mode:

A TD-SCDMA uplink signal uses slots 2 and 3 and there is no UpPTS. The code domain analyser will show an occupancy of slots 1 and 2.

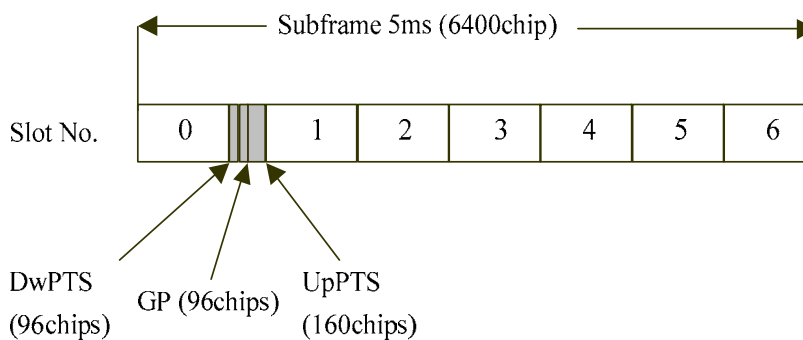


Bild 2-6 Structure of the subframe

Basic settings in TD-SCDMA MS mode

In the default setting after preset the analyzer is in spectrum mode. The following default settings of code domain measurement are not activated until you select TD-SCDMA MS mode with the TDS UE hotkey.

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

Parameters	Setting
Digital standard	TD-SCDMA
Sweep	CONTINUOUS
CDP mode	CODE CHAN AUTOSEARCH
Trigger setting	FREE RUN
Scrambling code	0
Max. number midamble shifts	16
Threshold for inactive channel	-40 dB
Channel	1.16
Slot number	1
Capture length	7 slots
Evaluation	Screen A: CODE PWR RELATIVE Screen B: RESULT SUMMARY

The following conventions apply to the presentation of settings on the analyzer:

- [<Key>] Press a key on the front panel, e.g. [FREQ].
- [<SOFTKEY>] Press a softkey, e.g. [MARKER -> PEAK].
- [<nn unit>] Enter a value and terminate with the unit, e.g. [12 kHz].

The following conventions apply to the presentation of settings on the R&S SMIQ:

- [<Key>] Press a key on the front panel, e.g. [FREQ].
- <MENU> Select a menu, parameter or setting, e.g. DIGITAL STD. The menu level is identified by indenting.
- <nn unit> Enter a value and terminate with the unit, e.g. 12 kHz.

Measurement 1: Measuring signal power

Measurement of the spectrum gives an overview of the TD-SCDMA signal and spurious emissions close to the carrier. This example uses IF-Power trigger. Only one slot is allowed to be active.

Test setup: ➤ Connect the RF output of the R&S SMIQ to the RF input of the analyzer (coaxial cable with N connectors).

Settings on R&S SMIQ:

```

[PRESET]
[LEVEL:           0 dBm]
[FREQ:           2020.0 MHz]
ARB MOD
  SET SMIQ ACCORDING TO WAVEFORM ...
    SET SMIQ ACCORDING TO WAVEFORM ...   ON
    TRIGGER OUT MODE                     ON

```

(These settings are only needed once after presetting the generator and serve for automatically adopting the trigger setting from the waveform file generated by R&S WinIQSIM in ARB MOD. This is especially convenient when changing between different waveforms.)

```

  SELECT WAVEFORM... Select name 'TDS_UE'
  STATE:      ON

```

Settings on analyzer:

```

[PRESET]
[FREQUENCY:      2020.0 MHz]
[TDS UE]
[MEAS:           POWER]
[ADAPT TO SIGNAL]
[AUTO LEVEL&TIME]

```

Measurement on analyzer: The following is displayed:

- Spectrum of the TD-SCDMA signal over the active slot
- Channel power within 1.6 MHz bandwidth

Measurement 2: Measuring spectrum emission mask

TD-SCDMA specifications require a measurement that monitors maintenance of a spectral mask within at least ± 4.0 MHz of the TD-SCDMA carrier. To judge power emissions, the signal power is measured with a 30 kHz filter up to 2.4 MHz and with a 1 MHz filter between 2.4 and 4 MHz. The resulting curve is compared to a limit line defined in TD-SCDMA specifications. This example uses external trigger.

Test setup:

- Connect the RF output of the R&S SMIQ to the RF input of the analyzer (coaxial cable with N connectors).
- Connect the external triggering of the analyzer (EXT TRIG GATE) to the R&S SMIQ trigger (TRIGOUT1 to PARADATA).

Settings on R&S SMIQ: *R&S SMIQ settings as for measurement 1.*

Settings on analyzer:

```

[PRESET]
[FREQUENCY:           2020.0 MHz]
[TDS UE]
[MEAS:                 SPECTRUM EM MASK]
[TRIGGER:             EXTERN]
[ADAPT TO SIGNAL]
[AUTO LEVEL&TIME]
[START SLOT:         1]
[STOP SLOT:         1]
  
```

Measurement on analyzer: The following is displayed:

- Spectrum of the TD-SCDMA signal over slot 1
- The limit line defined in the standard
- Statement of limit line violation (passed/failed)

Measurement 3: Measuring relative code domain power and frequency error

What follows is a measurement of the code domain power. The basic parameters of CDP measurements, which allow analysis of the signal, are changed one after another from values adapted to the measurement signal to non-adapted values to demonstrate the resulting effects.

Test setup: ➤ Connect the RF output of the R&S SMIQ to the RF input of the analyzer.

Settings on R&S SMIQ: *R&S SMIQ settings as for measurement 1.*

Settings on analyzer: **[PRESET]**
[FREQUENCY: 2020.0 MHz]
[TDS UE]
[ADJUST REF LEVEL]
[SELECT SLOT: 1]

Measurement on analyzer: The following is displayed:

Screen A: Code domain power of the signal in slot 1

Screen B: Numeric results of CDP measurement including the frequency error

Setting: Synchronizing reference frequencies

Synchronizing 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 rear of the R&S SMIQ (coaxial cable with BNC connectors).
- Settings on R&S SMIQ: *R&S SMIQ settings as for measurement 1.*
- Settings on analyzer: *As for measurement 3, plus*
[SETUP: REFERENCE EXT]
- Measurement on analyzer: Screen B: Frequency error: The indicated frequency error should be < 10 Hz.

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

Setting: Response to deviating center frequency setting

The following shows the response of the DUT and analyzer to a deviating center frequency setting.

- Settings on R&S SMIQ: ➤ Detune the center frequency of the signal generator in 0.5 kHz increments and observe the analyzer screen while doing so.
- Measurement on analyzer:
 - Up to a frequency deviation of about 4.9 kHz a CDP measurement is still possible on the analyzer. There is no apparent difference in the accuracy of CDP measurement up to this frequency error.
 - Above a frequency deviation of about 5 kHz, a CDP measurement becomes impossible. The "Sync Failed" message appears.
- Settings on R&S SMIQ: ➤ Reset the signal generator center frequency to 2020.0 MHz:
[FREQ: 2020.0 MHz]

The analyzer center frequency should not offset from the DUT frequency by more than 4.9 kHz.

Setting: Response to wrong scrambling code

You can only perform a valid CDP measurement if the scrambling code set on the analyzer matches that of the transmit signal.

Settings on R&S SMIQ: *R&S SMIQ settings as for measurement 1.*

Settings on analyzer: Set the scrambling code to a wrong figure:

[SETTINGS: SCRAMBLING CODE 1]

Measurement on analyzer: The "Sync Failed" message appears. In some cases a wrong scrambling code will lead to display of a valid signal but with the wrong channel occupancy!

Settings on analyzer: Set the scrambling code to the correct figure:

[SETTINGS: SCRAMBLING CODE 0]

Measurement on analyzer: The CDP display again shows the test model.

<p>The setting of the scrambling code on the analyzer must agree with that of the signal to be measured.</p>

Measurement 4: Measuring composite EVM

Composite EVM is a measurement of the mean square error of the total signal required by TD-SCDMA specifications.

An ideal reference signal is generated from the demodulated data. The test signal and reference signal are compared; the square deviation produces the composite EVM.

Test setup: ➤ Connect the RF output of the R&S SMIQ to the RF input of the analyzer (coaxial cable with N connectors).

Settings on R&S SMIQ: *R&S SMIQ settings as for measurement 1.*

Settings on analyzer:

[PRESET]	
[FREQUENCY:	<i>2020.0 MHz]</i>
[TDS UE]	
[ADJUST REF LEVEL]	
[RESULTS	<i>COMPOSITE EVM]</i>
[SELECT SLOT:	<i>1]</i>

Measurement on analyzer: The following is displayed:

Screen A: Code domain power of the signal in slot 1

Screen B: Composite EVM (EVM for total signal)

Note: *EVM measurement serves no purpose in inactive slots. No figure is displayed.*

Measurement 5: Measuring peak code domain error

An ideal reference signal is generated from the demodulated data for peak code domain error measurement. The test signal and reference signal are compared; the difference between the two signals is projected to the class of the spreading factor 16. The peak code domain error is obtained by summing over the symbols of each slot of the difference signal and searching for the maximum error code.

Test setup: ➤ Connect the RF output of the R&S SMIQ to the RF input of the analyzer (coaxial cable with N connectors).

Settings on R&S SMIQ: *R&S SMIQ settings as for measurement 1.*

Settings on analyzer:

[PRESET]	
[FREQUENCY:	<i>2020.0 MHz]</i>
[TDS UE]	
[ADJUST REF LEVEL]	
[RESULTS	<i>PK CODE DOM ERROR]</i>
[SELECT SLOT:	<i>1]</i>

Measurement on analyzer: The following is displayed:

Screen A: Code domain power of the signal in slot 1

Screen B: Peak code domain error (for spreading factor 16)

Note: *Peak code domain error measurement serves no purpose in inactive slots. No figure is displayed.*

Measurement 6: Measuring RHO factor

What follows is a measurement of the RHO factor.

Test setup: ➤ Connect the RF output of the R&S SMIQ to the RF input of the analyzer.

Settings on R&S SMIQ: *R&S SMIQ settings as for measurement 1.*

Settings on analyzer: **[PRESET]**
 [FREQUENCY: 2020.0 MHz]
 [TDS UE]
 [ADJUST REF LEVEL]
 [SELECT SLOT: 1]

Measurement on analyzer: The following is displayed:

Screen A: Code domain power of the signal in slot 1

Screen B: Numeric results of CDP measurement in slot 1
 including the RHO factor

3 Setup for Mobile station Tests



Caution:

Before putting the unit into operation, make sure that:

- The housing covers are in place and their screws have been tightened.
- Vent holes are not obstructed.
- No signal voltage levels above permissible limits are applied to the inputs.
- The outputs of the instrument are not overloaded or wrongly connected.

Any non-compliance with these precautions may cause damage to the instrument.

This chapter describes the default settings of the analyzer for operation as a TD-SCDMA mobile station tester. A requisite before starting is that the analyzer is correctly configured and powered, as described in Chapter 1 of the operating manual for the basic unit. Furthermore, the Application Firmware R&S FS-K77 must be enabled. Installation and enabling of the application firmware are described in Chapter 1 of this software manual.

Standard test setup

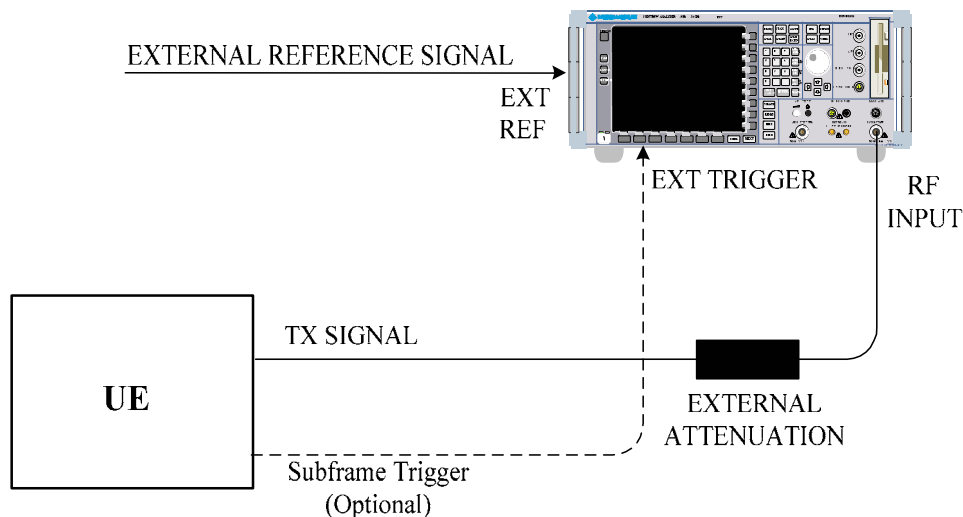


Fig. 3-1 MS test setup

- Connect the antenna output (or TX output) of the mobile station to the RF input of the analyzer through a power attenuator exhibiting suitable attenuation. The following values for external attenuation are recommended to ensure that the RF input of the analyzer is protected and the unit's sensitivity is not excessively degraded:

Max. power	Recommended external attenuation
≥ 55 to 60 dBm	35 to 40 dB
≥ 50 to 55 dBm	30 to 35 dB
≥ 45 to 50 dBm	25 to 30 dB
≥ 40 to 45 dBm	20 to 25 dB
≥ 35 to 40 dBm	15 to 20 dB
≥ 30 to 35 dBm	10 to 15 dB
≥ 25 to 30 dBm	5 to 10 dB
≥ 20 to 25 dBm	0 to 5 dB
< 20 dBm	0 dB

- For signal measurements at the output of twoport networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (*EXT REF IN / OUT*).
- To ensure adherence to the error limits required by TD-SCDMA specifications for frequency measurements on mobile stations, the analyzer must be operated on an external reference. A rubidium frequency standard is a possible reference source.
- If the mobile station has a subframe trigger output, connect it to the rear trigger input of the analyzer (*EXT TRIG GATE*).

Default setting

- Enter the external attenuation. **[AMPT] [NEXT] [REF LVL OFFSET]**
- Enter the reference level. **[AMPT]**
- Enter the center frequency. **[FREQUENCY]**
- Set the trigger. **[TRIG]**
- If used, switch on the external reference. **[SETUP] [REF: EXT]**
- Select the standard and the required measurement. **[TDS UE] [RESULTS]**
- Set the scrambling code. **[SETTINGS] [SCRAMBLING CODE]**
- Set the maximum number of midambles. **[SETTINGS] [MA SHIFTS CELL]**

4 Menu Overview

The Application Firmware R&S FS-K77 (TD-SCDMA mobile station tests) expands the analyzer by RF and code domain power measurements for the TD-SCDMA reverse link mobile radio standard.

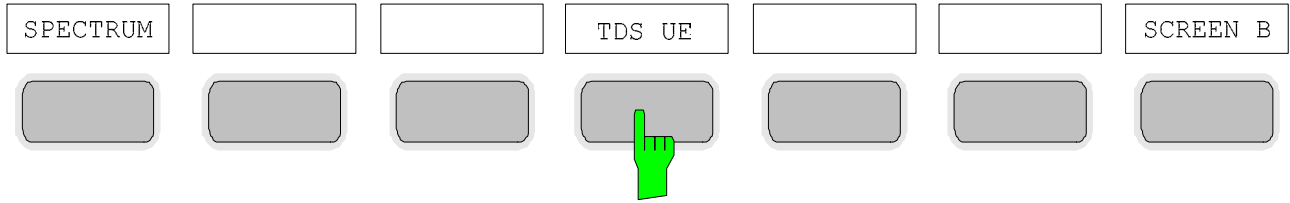


Fig. 4-1 Hotkey bar with enabled Application Firmware R&S FS-K77

After you call up the application firmware with the *TDS UE* hotkey, a new hotkey bar appears at the bottom edge of the screen and the code domain analyzer is selected and started.

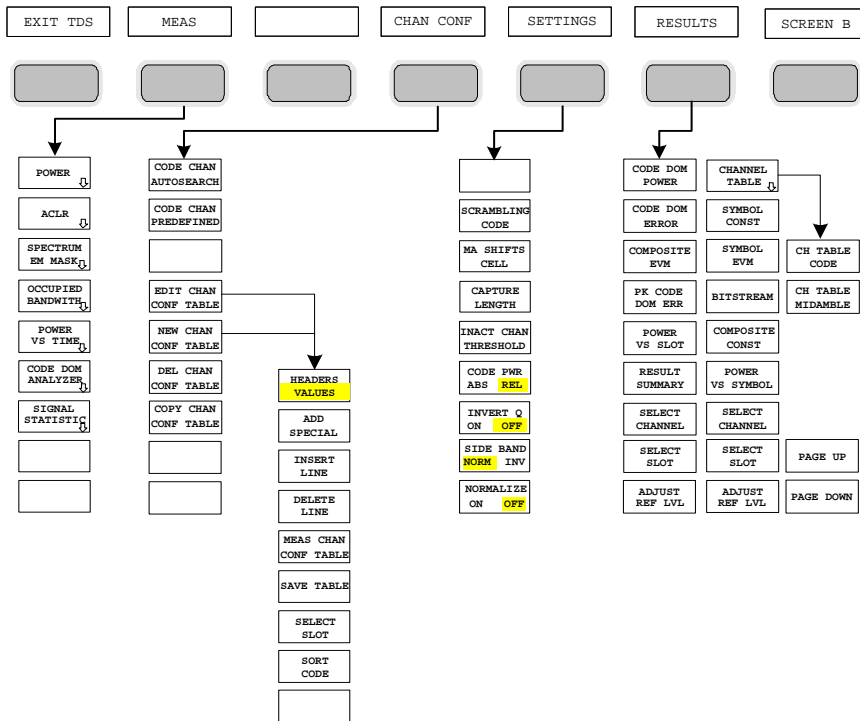


Fig. 4-2 Overview of menus in Application Firmware R&S FS-K77

The code domain analyzer can produce different kinds of results. These can be selected by the *RESULTS* hotkey. The *SETTINGS* hotkey is used to configure the application firmware. In this menu you can set the scrambling code of the mobile station for example. The *CHAN CONF* hotkey sets the channel search mode for the code domain analyzer. Own channel tables can also be defined. The *MEAS* hotkey is identical to the *MEAS* key (right on the front panel) and is used to select the different RF measurements or the code domain analyzer. Selecting the *CHAN CONF* or *RESULTS* hotkey automatically switches to the code domain analyzer. Pressing the *EXIT TDS* hotkey exits from R&S FS-K77. The hotkey bar of the basic unit appears again and the analyzer goes into the default *SPECTRUM* mode.

Change from SPECTRUM mode to application firmware:

The following user-specific settings are not modified, so the matching to the device under test is preserved:
 Reference Level + Ref Level Offset
 Center Frequency + Frequency Offset
 Input Attenuation + Mixer Level

The following user-specific settings are adopted as follows:
 External trigger sources and IF/RF power trigger are preserved, while all other trigger sources result in *FREE RUN* mode.
 Additional trigger settings are preserved.

Change from application firmware to SPECTRUM mode:

The following user-specific settings are not modified, so the matching to the device under test is preserved:
 Reference Level + Ref Level Offset
 Center Frequency + Frequency Offset
 Input Attenuation + Mixer Level

The following user-specific settings are adopted as follows:
 The trigger source is switched to *FREE RUN* and an analyzer frequency sweep is set with the span equal to double the center frequency, or the maximum possible span, so that in any case the center frequency remains unchanged.

The measurements available in R&S FS-K77 can be selected by the *MEAS* hotkey or the *MEAS* key:

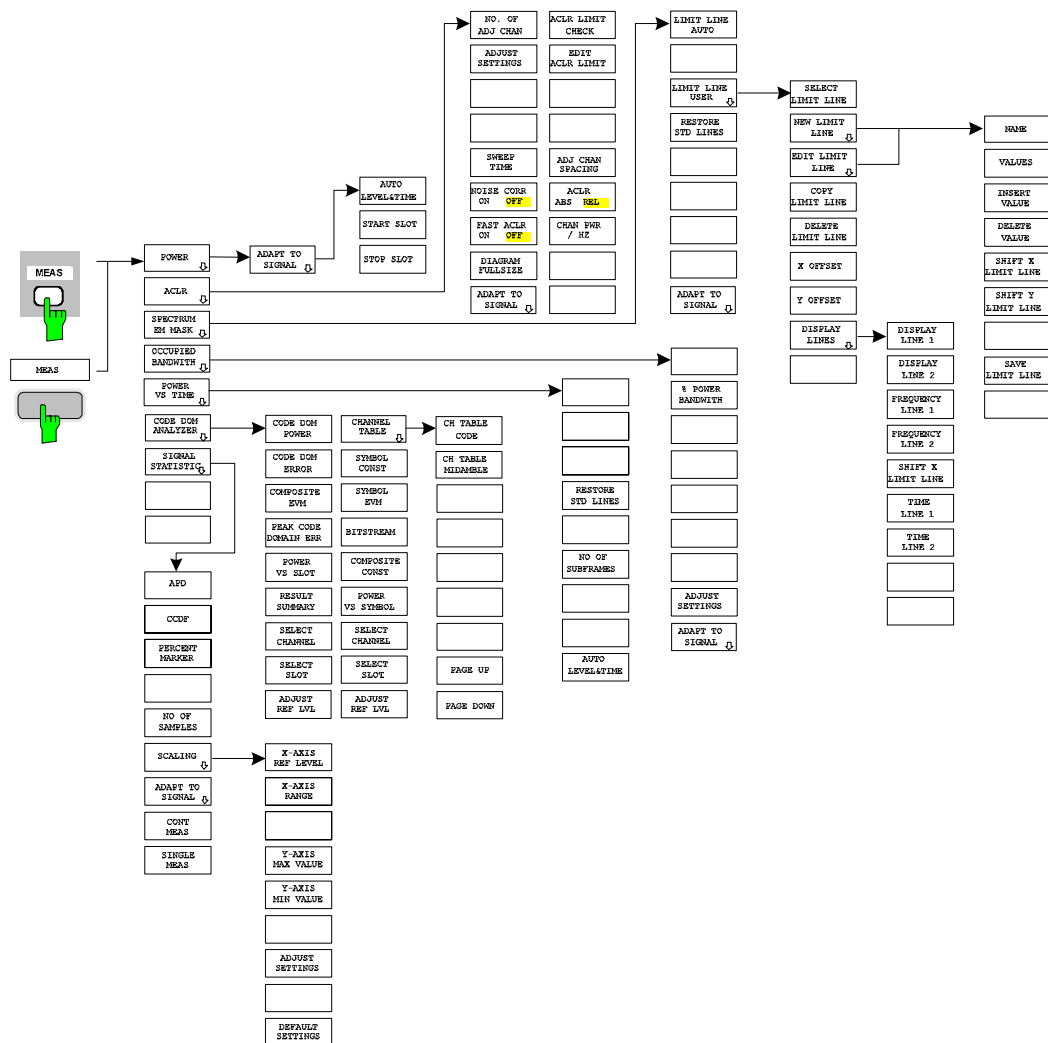


Fig. 4-3 Overview of menus

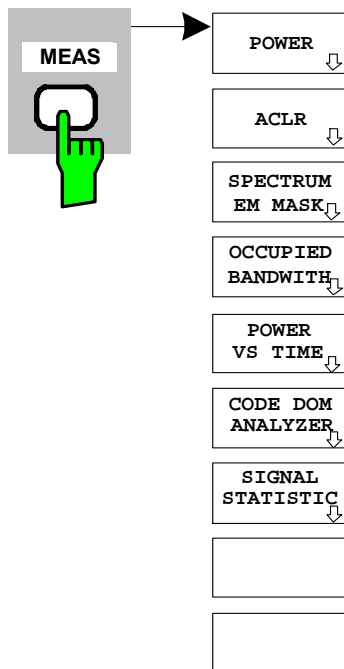
5 Configuration of TD-SCDMA Measurements

The major measurements of the TD-SCDMA specifications for mobile stations can be selected by the *MEAS* hotkey and the *MEAS* key. They are explained below with reference to the softkey functions.

The *CODE DOM ANALYZER* softkey activates the code domain analyzer and takes you to the submenus for selecting the results. Changing the occupancy of the hotkey bar when entering the application ensures that the major parameters of the code domain analyzer can be directly accessed on the hotkey bar.

The *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH* and *POWER VS TIME* softkeys activate mobile station measurements with predefined settings that are performed in *SPECTRUM* mode of the basic unit. The measurements are performed with the parameters of the TD-SCDMA specifications. Subsequent alteration of the settings is possible.

MEAS key or *MEAS* hotkeys

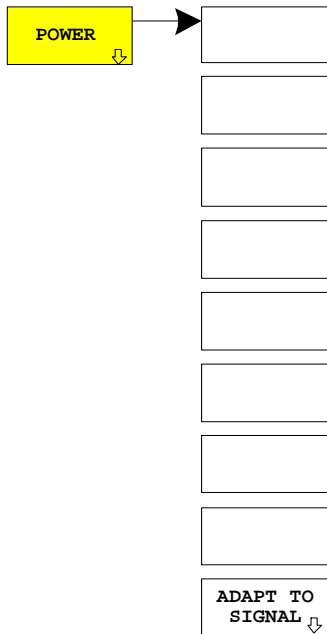


The *MEAS* hotkey or the *MEAS* key opens a submenu for selecting measurements:

- *POWER* activates channel power measurement with defined defaults in *SPECTRUM* mode.
- *ACLR* activates adjacent channel power measurement with defined defaults in *SPECTRUM* mode.
- *SPECTRUM EM MASK* compares the signal power in different carrier offset ranges with the maximum values of the TD-SCDMA specifications.
- *OCCUPIED BANDWIDTH* activates measurement of the bandwidth occupied by the signal.
- *POWER VS TIME* activates measurement of the signal power versus time with the template of TD-SCDMA specifications.
- *CODE DOM ANALYZER* activates the code domain analyzer and opens another menu for choosing the results. All other menus of the analyzer are matched to the functions of the code domain analyzer mode. The code domain analyzer is described in a separate chapter starting on page 44.
- *SIGNAL STATISTIC* evaluates the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).

Measurement of channel power

MEAS key or MEAS hotkey



The **POWER** softkey activates measurement of channel power of the TD-SCDMA signal.

The analyzer measures the power of the RF signal within a bandwidth of 1.6 MHz in selected slots. The power is calculated by summing the values at the trace points. The bandwidth and the associated channel power are displayed below the measurement screen.

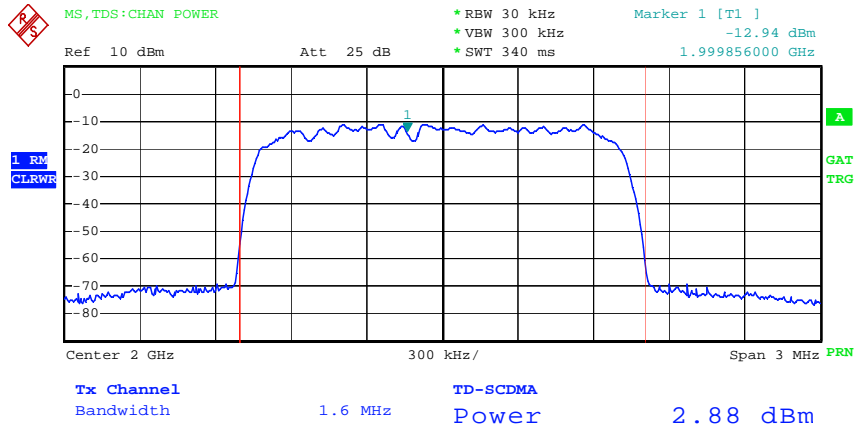


Fig. 5-1 Power measurement within 1.6 MHz bandwidth

The softkey activates **SPECTRUM** mode with defined settings:

The following user-specific settings are not modified, so the matching to the device under test is preserved: Reference Level + Ref Level Offset Center Frequency + Frequency Offset Input Attenuation + Mixer Level	
ADJACENT CHAN POWER	ON
FREQUENCY SPAN	3 MHz
EXT GATE	ON

Proceeding from this setting, the analyzer can be operated with all the functionality it offers in **SPECTRUM** mode, i.e. all parameters can be matched to a specific measurement.

IEC/IEEE bus command: :CONFigure:CDPower:MEASurement Power

Result poll: :CALCulate:MARKer:FUNction:POWer:RESult? CPOwer



The *ADAPT TO SIGNAL* softkey opens a submenu for matching the reference level of the analyzer and configuration of the gated sweep mode. Using an RF/IF power trigger, the trigger threshold is optimal adjusted.

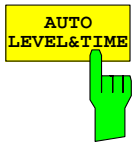
The reference level of the analyzer is matched to the measured channel power. This ensures that the RF attenuation and reference level settings are optimally matched to the signal level without the analyzer being overloaded or the dynamic response limited by too low a signal/noise ratio.

The measurement bandwidth for channel power measurements is considerably less than the signal bandwidth, so the signal path may be overloaded although the trace is still well below the reference level.

Power measurements are only possible in gated sweep mode because the TD-SCDMA signal is slot-based. So the trigger/subframe relationship must be created and the slots set that are to be analyzed. Analysis is possible over contiguous slots 1 through 7. Slot 7 corresponds to slot 0 of the following subframe.

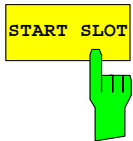
The guard period of the stop slot is excluded from the measurement. The sweep time is adapted to the gate length, so that for every sweep point all selected slots are taken into account.

If IF/RF power trigger is used, only one slot is allowed to be active. A selection of start slot and stop slot is not possible.



The *AUTO LEVEL & TIME* softkey starts the autorange routine for the reference level. This also creates the relationship between trigger and subframe start. Using an RF/IF power trigger, the trigger threshold is optimal adjusted.

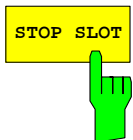
IEC/IEEE bus command: : [SENSe:]POWer:ACHannel:AUTO:LTIME
 Result poll: : [SENSe:]POWer:ACHannel:AUTO:LTIME?



The *START SLOT* softkey allows entry of the start slot for gated sweep mode. The gated mode is on between START SLOT and STOP SLOT. For the remaining slots of a subframe the gated mode is off.

The softkey START SLOT is selectable with external trigger only.

IEC/IEEE bus command: : [SENSe:]POWer:ACHannel:SLOT:START 1...7



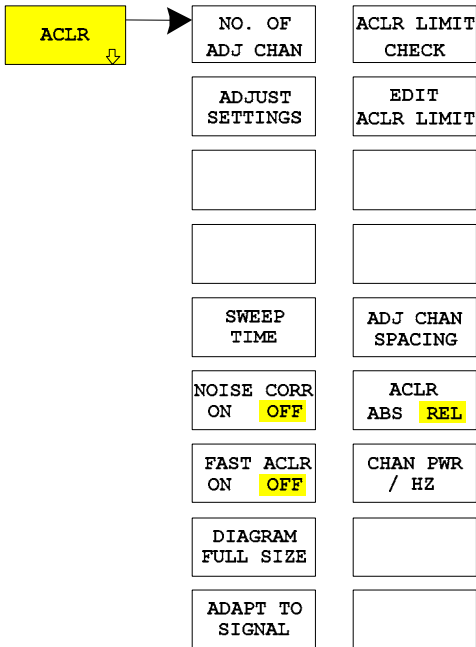
The *STOP SLOT* softkey allows entry of the stop slot for gated sweep mode. The gated mode is on between START SLOT and STOP SLOT. For the remaining slots of a subframe the gated mode is off.

The softkey STOP SLOT is selectable with external trigger only.

IEC/IEEE bus command: : [SENSe:]POWer:ACHannel:SLOT:STOP 1...7

Measurement of adjacent channel power – ACLR

MEAS key or MEAS hotkey



The ACLR (adjacent channel leakage power ratio) softkey activates measurement of adjacent channel power. Settings and limits are taken from the ACLR measurement defined in TD-SCDMA specifications.

The analyzer measures the power of the useful channel and of the adjacent left and right channels in selected slots. In the default setting, only two adjacent channels are considered. Measurement results are displayed below the measurement screen.

The ACLR limit check can be enabled or disabled by the *ACLR LIMIT CHECK* softkey.

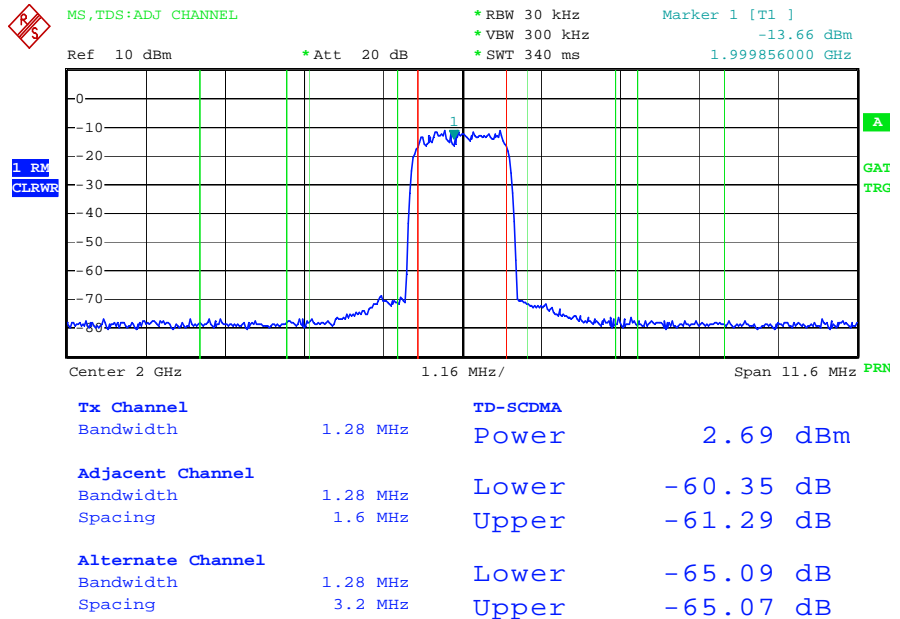


Fig. 5-2 Measuring adjacent channel power

The softkey activates *SPECTRUM* mode with defined settings:

The following user-specific settings are not modified, so the matching to the device under test is preserved: Reference Level + Ref Level Offset Center Frequency + Frequency Offset Input Attenuation + Mixer Level	
ADJACENT CHAN POWER	ON
ACP STANDARD	TD-SCDMA
NO OF ADJ CHANNELS	2
EXT GATE	ON

Table 5-1 Default ACLR settings

Adjacent channel type	Spacing	RBW	Rel. Limit
Adjacent	±1.6 MHz	30 kHz	-33 dB
Alternate	±3.2 MHz	30 kHz	-43 dB

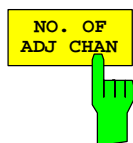
Proceeding from this setting, the analyzer can be operated in all the functions it features in *SPECTRUM* mode, i.e. all measurement parameters can be matched to the specific measurement.

IEC/IEEE bus command:

:CONFigure:CDPower:MEASurement ACLR

Result poll:

:CALCulate:MARKer:FUNction:POWer:RESult? ACPower



The *NO. OF ADJ CHAN* softkey activates entry of the number $\pm n$ of adjacent channels that are taken into account for the adjacent channel power measurement.

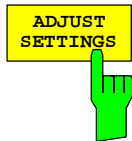
A number between 0 and 3 can be entered.

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 and of the next two upper and two lower channels (alternate channel 1 and alternate channel 2) are measured.

IEC/IEEE bus command:

:SENS:POW:ACH:ACP 2



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

- Frequency span:
The frequency span must at least cover all channels to be considered. When channel power is measured, the span is set to double the channel bandwidth.
The setting of the span for adjacent channel power measurement depends on the channel spacing and channel bandwidth of the adjacent channel ADJ, ALT1 or ALT2 furthest 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 math and trace averaging functions are switched off. The reference level is not influenced by *ADJUST SETTINGS*. It can be separately adjusted with *AUTO LEVEL&TIME*.

Adjustment is performed once; if necessary, the unit settings can be modified afterwards.

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

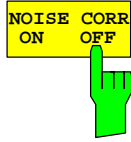
For manual setting of the measurement parameters differing from the settings made with *ADJUST SETTINGS*, the following must be taken into account for the different parameters:

Frequency span	The frequency span must at least cover all channels 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 points on the trace are available for the measurement.
Resolution bandwidth (RBW)	To ensure an acceptable measurement speed and also the necessary selectivity (to reject spectral components outside the channel you want to measure, especially the adjacent channels), the resolution bandwidth must be neither too small nor too large. As a rule of thumb, the resolution bandwidth should be set to between 1 and 4% of the channel bandwidth. A larger resolution bandwidth can be set if the spectrum within and around the channel you want to measure has a flat characteristic.
Video bandwidth (VBW)	For a correct power measurement, the video signal must not be limited in terms of bandwidth. A restricted band of the logarithmic video signal would result in averaging and thus in too small an indication of the power (-2.51 dB for very small video bandwidths). So the video bandwidth should be at least three times the resolution bandwidth. The <i>ADJUST SETTINGS</i> softkey sets the video bandwidth (VBW) as a function of the channel bandwidth as follows: $VBW \geq 3 \times RBW$
Detector	The <i>ADJUST SETTINGS</i> 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. In principle, even the sample detector would be possible. However, this would lead to more unstable results due to the limited number of trace pixels for calculating the power in the channel. Averaging, frequently performed to stabilize measurement results, leads to the level indication being too low and should therefore be avoided. The reduction in the displayed power depends on the number of averages and the signal characteristics in the channel you want to measure.



The *SWEEP TIME* softkey activates entry of the sweep time. When the RMS detector is used, a longer sweep time yields more stable results. This setting is identical to the *SWEEP TIME MANUAL* setting in the *BW* menu.

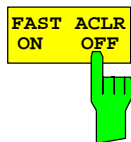
IEC/IEEE bus command: : *SWE:TIME* <value>



If the *NOISE CORR ON / OFF* softkey is activated, the results are corrected by the instrument's own inherent noise, which increases the dynamic range.

When the function is switched on, a reference measurement of the instrument's inherent noise is first made. The measured noise power is then subtracted from the power in the channel examined. The inherent noise of the instrument depends on the selected center frequency, resolution bandwidth and level setting. So correction is disabled whenever one of these parameters is changed, and an appropriate message appears on the screen. To reactivate correction of the inherent noise with the changed setting, press the softkey once more. A new reference measurement is then made.

IEC/IEEE bus command: : *SENS:POW:NCOR ON*



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

For *FAST ACLR ON* the power is measured in the various channels in the time domain. The analyzer sets 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 RBW filters suitable for the selected standard and frequency offset are used automatically.

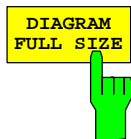
The RMS detector is used for correct power measurement. Software correction factors are not required in this case.

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

The selected sweep time (= measurement time) depends on the desired reproducibility of measurement results. The longer the selected sweep time, the better the reproducibility of results, because power is measured over a longer period of time.

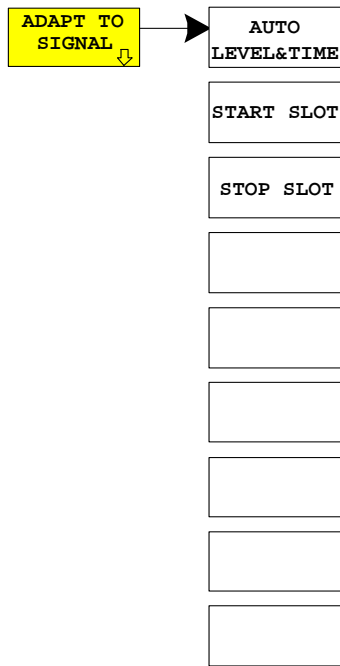
As a rule of thumb it can be assumed that approx. 500 uncorrelated values are required for reproducibility of 0.5 dB, i.e. 99% of measurements are within 0.5 dB of the true measured value (applies to white noise). Measured values are considered uncorrelated if their time spacing corresponds to the reciprocal of the measurement bandwidth (1/BW).

IEC/IEEE bus command: : *SENS:POW:HSP ON*



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

IEC/IEEE bus command: : *DISP:WIND1:SIZE LARG*
 : *DISP:WIND1:SIZE SMAL*



The *ADAPT TO SIGNAL* softkey opens a submenu for matching the reference level of the analyzer and configuration of gated sweep mode.

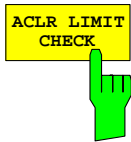
The *AUTO LEVEL & TIME* softkey starts the autorange routine for the reference level. This also creates the relationship between trigger and subframe start. Using an RF/IF power trigger, the trigger threshold is optimal adjusted.

The *START SLOT* softkey allows entry of the start slot for gated sweep mode. The gated mode is on between START SLOT and STOP SLOT. For the remaining slots of a subframe the gated mode is off.

The *STOP SLOT* softkey allows entry of the stop slot for gated sweep mode. The gated mode is on between START SLOT and STOP SLOT. For the remaining slots of a subframe the gated mode is off.

The softkeys START SLOT and STOP SLOT are selectable with external trigger only.

IEC/IEEE bus command:
 :[SENSe:]POWer:ACHannel:AUTO:LTIME
 :[SENSe:]POWer:ACHannel:SLOT:START 1...7
 :[SENSe:]POWer:ACHannel:SLOT:STOP 1...7



The *ACLR LIMIT CHECK* softkey switches the limit check for the ACLR measurement on or off.

IEC/IEEE bus command: :CALC:LIM:ACP ON
 :CALC:LIM:ACP:ACH:RES?
 :CALC:LIM:ACP:ALT:RES?



The default setting of the limits when starting adjacent channel power measurement is defined as in the table on page 31. A table can be opened in ACLR measurement by the *EDIT ACLR LIMIT* softkey in which limits for ACLR measurement can be modified..

ACP LIMITS				
CHAN	RELATIVE LIMIT CHECK		ABSOLUTE LIMIT CHECK	
	VALUE	ON	VALUE	ON
ADJ	-33 dBc	*	0 dBm	
ALT1	-43 dBc	*	0 dBm	
ALT2	0 dBc		0 dBm	

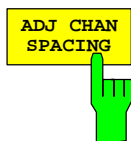
The following rules apply for limit values:

- A limit value can be defined for each of the adjacent channels. The limit value applies to both the upper and lower adjacent channel.
- A relative limit and/or an absolute limit can be defined. The check can be activated separately for the two limit values.
- Compliance with active limit values is checked irrespective of whether absolute or relative limits are specified or whether the measurement itself is performed with absolute levels or a relative level ratio. If the two checks are active and the higher of the two levels is exceeded, the respective value will be marked.

Note: Measured values violating the limit are printed red and preceded by an asterisk.

IEC/IEEE 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: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 *ADJ CHAN SPACING* softkey opens a table for defining the channel spacings.

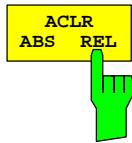
CHANNEL SPACING	
CHAN	SPACING
ADJ	1.6 MHz
ALT1	3.2 MHz
ALT2	4.8 MHz

Adjacent channels frequently have identical spacings, so entering the adjacent channel spacing ADJ sets channel ALT1 to twice and channel ALT2 to three times the channel spacing of the adjacent channel. This means that only one value has to be entered when channel spacings are identical. The same applies to the ALT2 channel when entering the spacing of the ALT1 channel.

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

IEC/IEEE bus command:

```
:SENS:POW:ACH:SPAC:ACH 1.6MHz
:SENS:POW:ACH:SPAC:ALT1 3.2MHz
:SENS:POW:ACH:SPAC:ALT2 4.8MHz
```



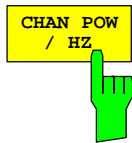
The *ACLR ABS / REL* softkey toggles between absolute and relative measurement of the channel power.

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

ACLR REL In 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 $10 \cdot \lg(CP/CP_{ref})$ is displayed. This means that the relative channel power measurement can also be used for general adjacent channel power measurements. Each channel is measured separately in this latter instance.

IEC/IEEE bus command: `:SENS:POW:ACH:MODE ABS`



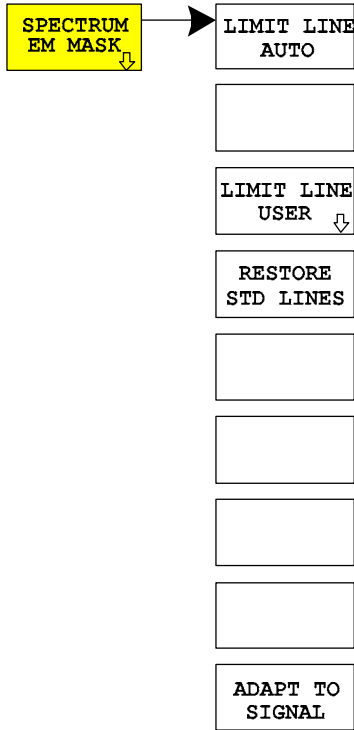
The *CHAN POW / HZ* softkey toggles between measurement of the total power in the channel and power measurement referred to 1 Hz bandwidth.

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

IEC/IEEE bus command: `:CALC:MARK:FUNC:POW:RES:PHZ ON|OFF`

Checking signal power – SPECTRUM EM MASK

MEAS key or MEAS hotkey



The *SPECTRUM EM MASK* (spectrum emission mask) softkey starts determination of the power of selected slots of the TD-SCDMA signal at defined offsets from the carrier and compares the power with the spectrum emission mask of TD-SCDMA specifications in the near-carrier range from -4 MHz to 4 MHz.

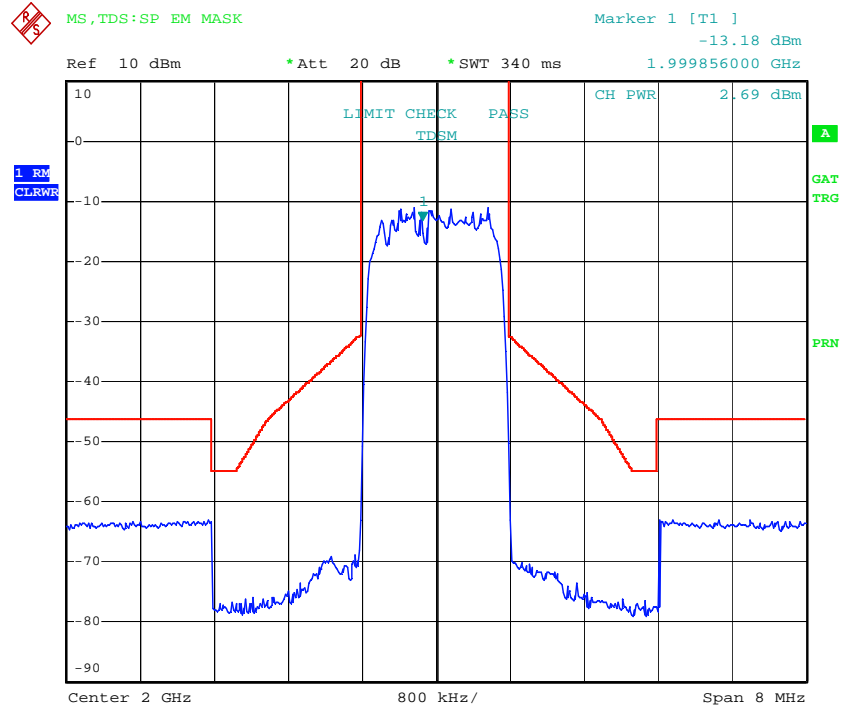


Fig. 5-3 Measurement of spectrum emission mask

The softkey activates spectrum mode with defined settings:

The following user-specific settings are not modified, so the matching to the device under test is preserved:

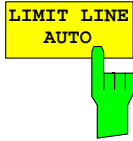
- Reference Level + Rev Level Offset
- Center Frequency + Frequency Offset
- Input Attenuation + Mixer Level

ADJACENT CHAN POWER	ON
ACP STANDARD	TD-SCDMA
NO. OF ADJ. CHANNELS	0
FREQUENCY SPAN	8 MHz
DETECTOR	RMS
EXT GATE	ON

Proceeding from these settings, the analyzer can be operated in many functions featured in *SPECTRUM* mode. Changing of the RBW and VBW is limited because they are set by the definition of the limits.

IEC/IEEE bus command: :CONFigure:CDPower:MEASurement ESpectrum

Result poll: :CALCulate:LIMit:FAIL? and visual evaluation



The *LIMIT LINE AUTO* softkey automatically selects the limit line according to the TD-SCDMA standard

The softkey is activated when you enter spectrum emission mask measurement.

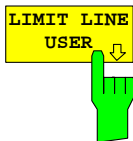
IEC/IEEE bus command: :CALC:LIM:ESP:MODE AUTO

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

Table 5-2 Spectrum Emission Mask

Offset frequency	Limit	Type/name TDSBCA.LIM	RBW
0.8 MHz	-35 dBc	Relativ	30 kHz
0.8 MHz – 1.8 MHz	$\left\{ -35 - 14 \cdot \left(\frac{\Delta f}{MHz} - 0.8 \right) \right\} dBc$	Relativ	30 kHz
1.8 MHz – 2.4 MHz	$\left\{ -49 - 25 \cdot \left(\frac{\Delta f}{MHz} - 1.8 \right) \right\} dBc$	Relativ	30 kHz
2.4 MHz – 4.0 MHz	-49 dBc	Relativ	1 MHz

Changeover of the RBW is necessary in this instance. The 1 MHz channel filter is used for the 1 MHz segments.



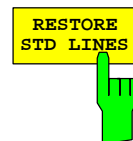
The *LIMIT LINE USER* softkey activates the entry of user-defined limit lines. The softkey opens the menus of the limit line editor, which may be familiar from the basic unit.

The following limit line settings are recommended 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 unit that conform to standard specifications when the analyzer is supplied, a user-specified limit line for the whole frequency range (± 4.0 MHz from the carrier) can only be either relative (to the reference level) or absolute.

IEC/IEEE bus command: see Table of softkeys with assignment of IEC/IEEE bus commands



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

IEC/IEEE bus command: :CALC:LIM:ESP:RESTore



The *ADAPT TO SIGNAL* softkey opens a submenu for matching the reference level of the analyzer and configuration of gated sweep mode.

The *AUTO LEVEL & TIME* softkey starts the autorange routine for the reference level. This also creates the relationship between trigger and subframe start. Using an RF/IF power trigger, the trigger threshold is optimal adjusted.

The *START SLOT* softkey allows entry of the start slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*. For the remaining slots of a subframe the gated mode is off.

The *STOP SLOT* softkey allows entry of the stop slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*. For the remaining slots of a subframe the gated mode is off.

The softkeys *START SLOT* and *STOP SLOT* are selectable with external trigger only.

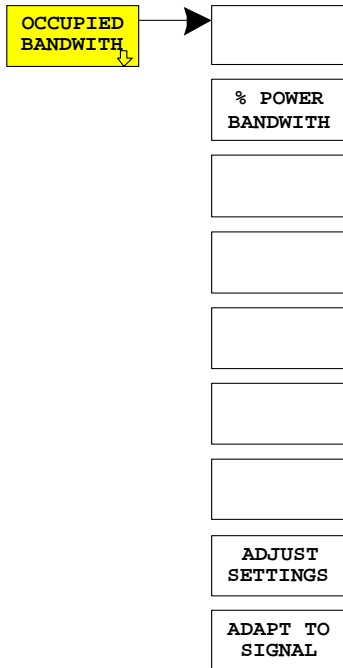
IEC/IEEE bus commands:

```

:[SENSe:]POWer:ACHannel:AUTO:LTIME
:[SENSe:]POWer:ACHannel:SLOT:START 1...7
:[SENSe:]POWer:ACHannel:SLOT:STOP 1...7
  
```

Measurement of bandwidth occupied by signal – OCCUPIED BANDWIDTH

MEAS key or MEAS hotkey



The *OCCUPIED BANDWIDTH* softkey activates measurement of the bandwidth occupied by the signal in selected slots. This measurement determines the bandwidth in which - in the initial state - 99% of the signal power is found. The percentage signal power to be included in the bandwidth measurement can be modified. The bandwidth and the frequency markers for measurement are shown in the marker field in the top right corner of the display.

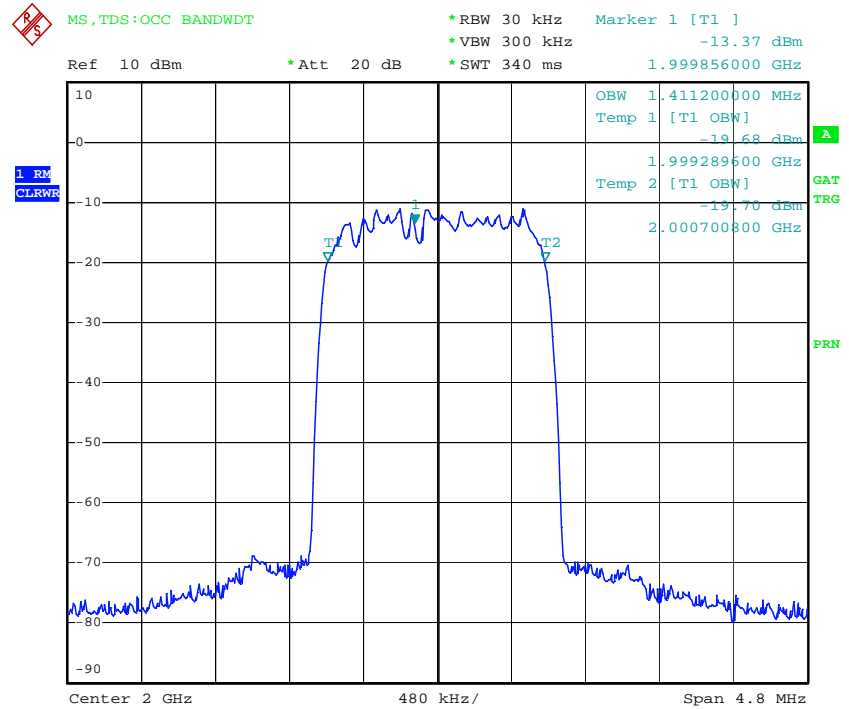


Fig. 5-4 Measuring occupied bandwidth

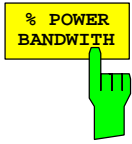
The softkey activates *SPECTRUM* mode with defined settings:

The following user-specific settings are not modified, so the matching to the device under test is preserved:
 Reference Level + Ref Level Offset
 Center Frequency + Frequency Offset
 Input Attenuation + Mixer Level

OCCUPIED BANDWIDTH	ON
FREQUENCY SPAN	4.8 MHz
RBW	30 kHz
VBW	300 kHz
DETECTOR	RMS
EXT GATE	ON

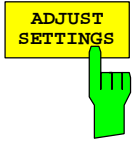
IEC/IEEE bus command: :CONFigure:CDPower:MEASurement OBANdwidth

Result poll: :CALCulate:MARKer:FUNCTion:POWer:RESult? OBANdwidth



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

IEC/IEEE bus command: `:SENS:POW:BWID 99PCT`



The *ADJUST SETTINGS* softkey matches the analyzer unit settings to the specified channel bandwidth for measurement of the occupied bandwidth.
All analyzer settings relevant to power measurement within a certain frequency range (channel bandwidth) such as:
• Frequency span $3 \times$ channel width

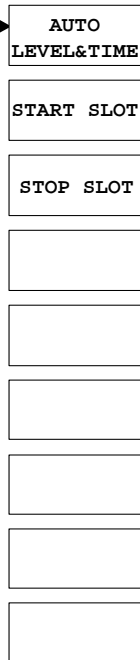
- Resolution bandwidth $RBW \leq 1/40$ of channel bandwidth
- Video bandwidth $VBW \geq 3 \times RBW$
- Detector RMS

are optimized.

The reference level is not influenced by *ADJUST SETTINGS*. It must be set for optimum dynamic range so that the maximum signal is close to the reference level.

Adjustment is performed only once but, if necessary, the unit settings may be changed afterwards.

IEC/IEEE bus command: `:SENS:POW:PRES OBW`



The *ADAPT TO SIGNAL* softkey opens a submenu for matching the reference level of the analyzer and configuration of gated sweep mode.

The *AUTO LEVEL & TIME* softkey starts the autorange routine for the reference level. This also creates the relationship between trigger and subframe start. Using an RF/IF power trigger, the trigger threshold is optimal adjusted.

The *START SLOT* softkey allows entry of the start slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*. For the remaining slots of a subframe the gated mode is off.

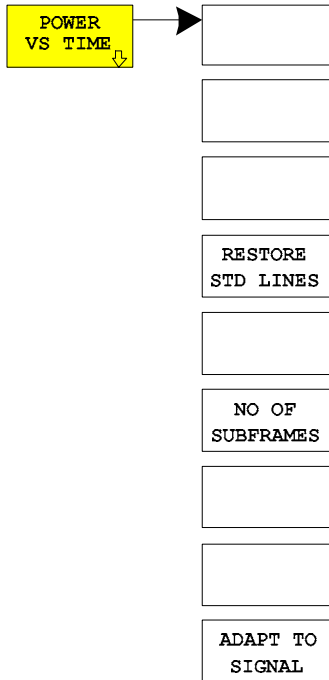
The *STOP SLOT* softkey allows entry of the stop slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*. For the remaining slots of a subframe the gated mode is off.

The softkeys *START SLOT* and *STOP SLOT* are selectable with external trigger only.

IEC/IEEE bus commands:
`: [SENSe:]POWer:ACHannel:AUTO:LTIME`
`: [SENSe:]POWer:ACHannel:SLOT:START 1...7`
`: [SENSe:]POWer:ACHannel:SLOT:STOP 1...7`

Signal power versus time – POWER VS TIME

MEAS key or MEAS hotkey



The *POWER VS TIME* softkey activates measurement of signal power versus time.

In this measurement the subframe start is determined and the signal power versus time compared with the transmit on/off template of TD-SCDMA specifications. With external subframe trigger the displayed slots can be selected by the *ADAPT TO SIGNAL* menu. Using RF/IF power trigger, only one slot is allowed to be active and the measurement is performed over this slot automatically.

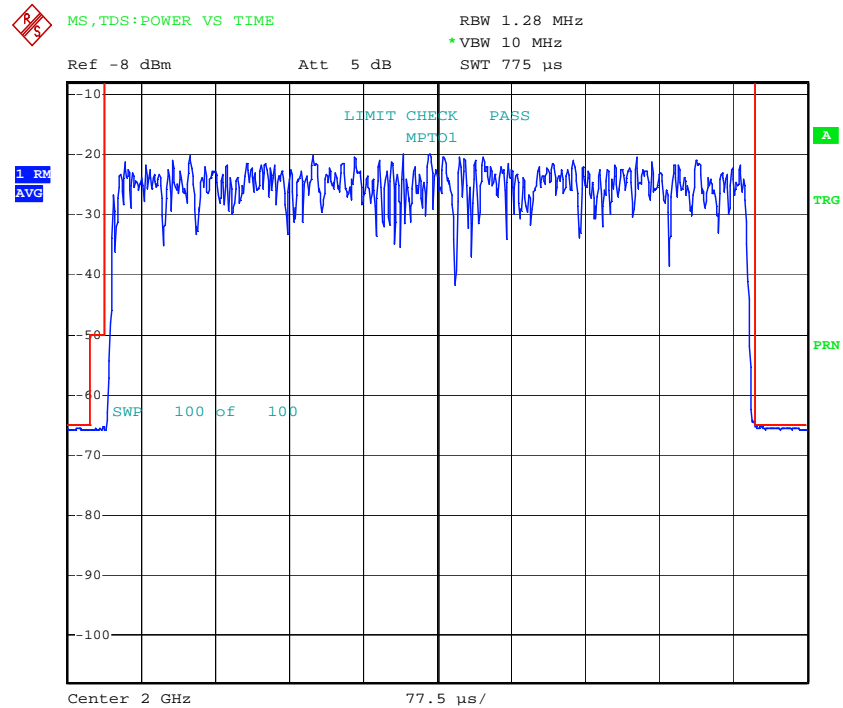


Fig. 5-5 Measuring signal power versus time

The softkey activates *SPECTRUM* mode with defined settings:

The following user-specific settings are not modified, so the matching to the device under test is preserved:

- Reference Level + Ref Level Offset
- Center Frequency + Frequency Offset
- Input Attenuation + Mixer Level

SWEEP TIME	2.4 ms
RBW	1.28 MHz RRC]
VBW	10 MHz
DETECTOR	RMS
EXT GATE	ON

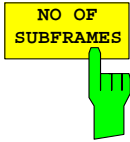
IEC/IEEE bus command:

:CONFigure:CDPower:MEASurement PVTime



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

IEC/IEEE bus command: :CALC:LIM:PVTime:RESTore



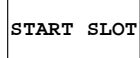
The *NO. OF SUBFRAMES* softkey opens an entry box for the number of subframes to be recorded for the averaging functions.

IEC/IEEE bus command:

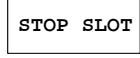
```
:CONFigure:CDPower:PVTime:SFRames
<num_value>
```



The *ADAPT TO SIGNAL* softkey opens a submenu for matching the reference level of the analyzer and configuration of gated sweep mode.



The *AUTO LEVEL & TIME* softkey starts the autorange routine for the reference level. This also creates the relationship between trigger and subframe start. Using an RF/IF power trigger, the trigger threshold is optimal adjusted.



The *START SLOT* softkey allows entry of the start slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*. For the remaining slots of a subframe the gated mode is off.



The *STOP SLOT* softkey allows entry of the stop slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*. For the remaining slots of a subframe the gated mode is off.

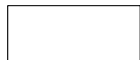


The softkeys *START SLOT* and *STOP SLOT* are selectable with external trigger only.



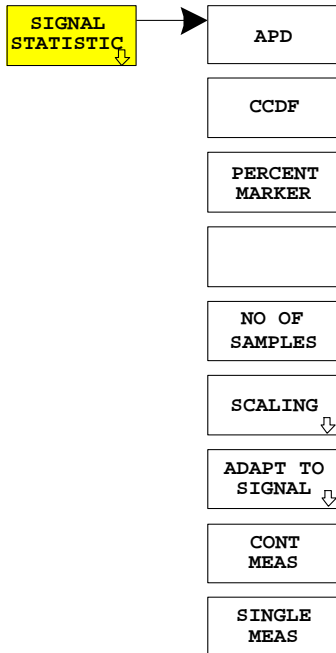
IEC/IEEE bus commands:

```
:[SENSe:]POWer:ACHannel:AUTO:LTime
:[SENSe:]POWer:ACHannel:SLOT:START 1...7
:[SENSe:]POWer:ACHannel:SLOT:STOP 1...7
```



Signal statistic

MEAS key or MEAS hot key



The *SIGNAL STATISTIC* 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 a zero span, and the distribution of the signal amplitudes is evaluated. The recorded 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 displayed in dB.

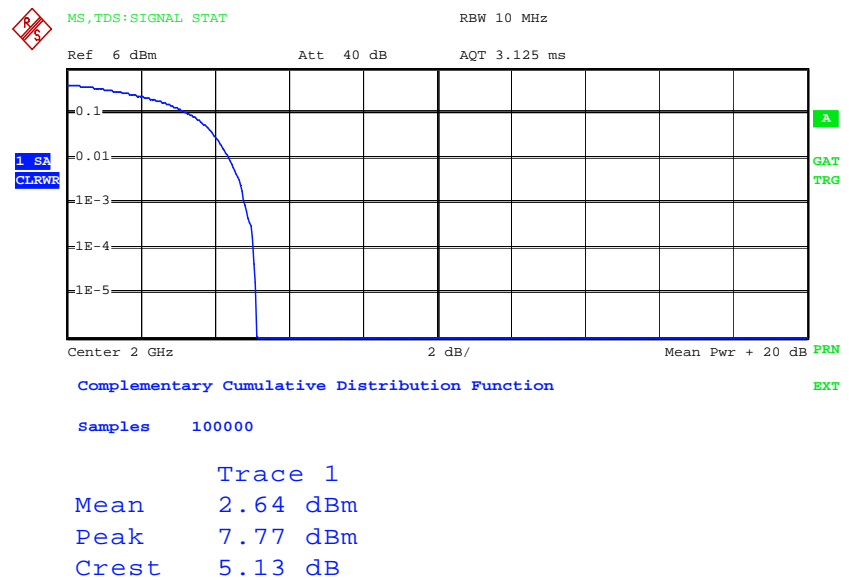


Fig. 5-6 CCDF of TD-SCDMA signal.

The softkey enables SPECTRUM mode with predefined settings:

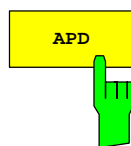
The following user-specific settings are not modified so that the adaptation to the device under test is preserved:	
Reference Level + Rev Level Offset	
Center Frequency + Frequency Offset	
Input Attenuation + Mixer Level	
CCDF	ON
RBW	10 MHz
DETECTOR	SAMPLE

Departing from this setting, the analyzer can be operated in all the functions it features in SPECTRUM mode, i.e. all measurement parameters can be adapted to a specific measurement.

IEC/IEEE bus command: :CONFigure:CDPower:MEASurement CCDF
or
:CALCulate:STATistics:CCDF ON

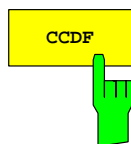
Query of results:

```
:CALCulate:MARKer:X?
:CALCulate:STATistics:RESults? MEAN |
                                PEAK |CFactor | ALL
MEAN  mean (r.m.s) 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 measure-
      ments, separated by a comma:
      <mean pow>, <peak pow>,
      <crest factor>
```



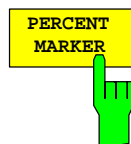
The *APD ON/OFF* softkey enables the amplitude probability distribution function .

IEC/IEEE bus command: CALC:STAT:APD ON



The *CCDF ON/OFF* softkey enables the complementary distribution function (complementary cumulative distribution function).

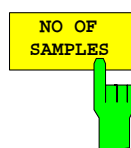
IEC/IEEE bus command: :CALC:STAT:CCDF ON



When the CCDF function is enabled, the *PERCENT MARKER* softkey supports positioning of marker 1 by entering a sought probability. In this way the power which exceeds a specified probability can be determined in a simple manner.

If marker 1 is disabled, it is enabled automatically.

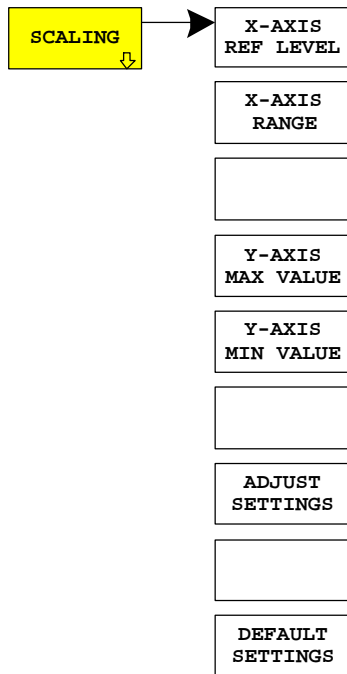
IEC/IEEE bus command: :CALC:MARK:Y:PERC 0...100%



The *NO OF SAMPLES* softkey sets the number of power measured values to be taken into account for the calculation of the distribution 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/IEEE bus command: :CALC:STAT:NSAM <value>



The *SCALING* softkey opens a menu on which the scaling parameters for the X-axis and the Y-axis can be modified.

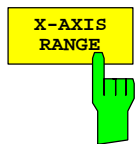


The *X-AXIS REF LEVEL* softkey changes the level settings of the unit and sets the maximum measurable power.

The function is identical to that of the *REF LEVEL* softkey on 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*.

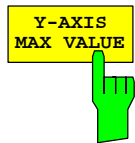
IEC/IEEE bus command: `:CALC:STAT:SCAL:X:RLEV <value>`



The *X-AXIS RANGE* softkey changes the level range that is to be covered by the distribution sampling function.

The function is identical to that of the *RANGE LOG MANUAL* softkey on the *AMPT* menu.

IEC/IEEE bus command: `CALC:STAT:SCAL:X:RANG <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 scaling is logarithmic, the spacing between the maximum and minimum values must be at least one decade.

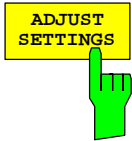
IEC/IEEE bus command: `CALC:STAT:SCAL:Y:UPP <value>`



The *Y-AXIS MIN VALUE* softkey sets the lower limit of the displayed probability range.

Since the Y-axis scaling is logarithmic, the spacing between the maximum and minimum values must be at least one decade. Permissible range $0 < \text{value} < 1$.

IEC/IEEE bus command: `:CALC:STAT:SCAL:Y:LOW <value>`

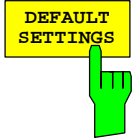


The *ADJUST SETTINGS* softkey optimizes the analyzer level settings according to the measured peak power in order to gain maximum sensitivity of the unit.

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

In addition, the probability scale is adapted to the selected number of samples.

IEC/IEEE bus command: `CALC:STAT:SCAL:AUTO ONCE`



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/IEEE bus command: `:CALC:STAT:PRES`



AUTO
LEVEL&TIME

The *ADAPT TO SIGNAL* softkey opens a submenu for matching the reference level of the analyzer and configuration of gated sweep mode.

START SLOT

The *AUTO LEVEL & TIME* softkey starts the autorange routine for the reference level. This also creates the relationship between trigger and subframe start. Using an RF/IF power trigger, the trigger threshold is optimal adjusted.

STOP SLOT

The *START SLOT* softkey allows entry of the start slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*. For the remaining slots of a subframe the gated mode is off.

The *STOP SLOT* softkey allows entry of the stop slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*. For the remaining slots of a subframe the gated mode is off.

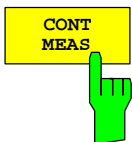
The softkeys *START SLOT* and *STOP SLOT* are selectable with external trigger only.

IEC/IEEE bus commands:

`: [SENSE:]POWER:ACHannel:AUTO:LTIME`

`: [SENSE:]POWER:ACHannel:SLOT:START 1...7`

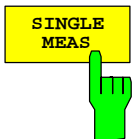
`: [SENSE:]POWER:ACHannel:SLOT:STOP 1...7`



The *CONT MEAS* softkey starts the collection 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 samples has been reached ("CONTinuous MEASurement").

IEC/IEEE bus command: `:INIT:CONT ON;`

`: INIT: IMM`



The *SINGLE MEAS* softkey starts the collection of one new sequence of sample data and the calculation of the APD or CCDF trace, depending on the selected measurement. The measurement terminates when the indicated number of samples is reached.

IEC/IEEE bus command: `:INIT:CONT OFF;`

`: INIT: IMM`

Code domain measurements on TD-SCDMA signals

The Application Firmware R&S FS-K77 features a code domain analyzer. This can be used for the measurements required by TD-SCDMA specifications for the power of the various codes and code channels (concentrated codes). In addition, the modulation quality (EVM and RHO factor), frequency errors, chip timing errors and peak code domain errors are determined. Constellation and bit stream evaluations are also available.

Use of an external trigger signal enables determination of the trigger-to-subframe time. The number of observed slots can be set with the *CAPTURE LENGTH* softkey.

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

- Results that consider the total signal over the whole observation period (all slots).
- Results that consider the total signal over one slot.
- Results that consider one channel over the whole observation period (all slots).
- Results that consider one channel over one slot.

The evaluations of the code domain analyzer are performed on a split screen. The screen is divided into two halves for this purpose.

The upper half of the screen (screen A) displays evaluations that vary by code. The lower half of the screen (screen B) displays all other evaluations.

Table 5-3 Evaluation on screen A

Evaluation on screen A	All channels	One channel	All slots	One slot
Code domain power	✓			✓
Code domain error power	✓			✓
Channel table	✓			✓

Table 5-4 Evaluation on screen B

Evaluation on screen B	All channels	One channel	All slots	One slot
Result summary	✓	✓	✓	✓
Power versus slot		✓	✓	
Power versus symbol		✓		✓
Composite EVM (modulation accuracy)	✓		✓	
Composite Constellation	✓			✓
Peak code domain error	✓		✓	
Symbol constellation		✓		✓
Symbol EVM		✓		✓
Bit stream		✓		✓

Depending on the symbol rate of a code channel, it has a different spreading factor and a different number of symbols per slot. The relationship can be seen in the table below.

Table 5-5 Relationship between spreading factor and symbol count plus data rate

Spreading factor	Symbols per slot	Data rate [kbps] QPSK	Data rate [kbps] 8PSK
16	44	17.6	26.4
8	88	35.2	52.8
4	176	70.4	105.6
2	352	140.8	211.2
1	704	281.6	422.4

The data rates in the table result from the bits per slot referred to a subframe length of 5 ms. In evaluation on the bottom screen, which uses symbols on the X axis, the maximum number of symbols varies with the symbol rate of the selected code channel.

Using the *SELECT CHANNEL* and *SELECT SLOT* softkeys, you can select the code channel and slot for which you want to display a result. In an example, code channel 1.16 is selected (code number 1 for spreading factor 16) and slot 2. Evaluation of code domain power is active on screen A and symbol EVM evaluation on screen B. So screen A shows the code domain power evaluation of slot 2. Code channel 1.16 is selected and shown in red. On the lower half of the screen you can see the symbol EVM evaluation of code channel 1.16 in slot 2 with 44 corresponding values.

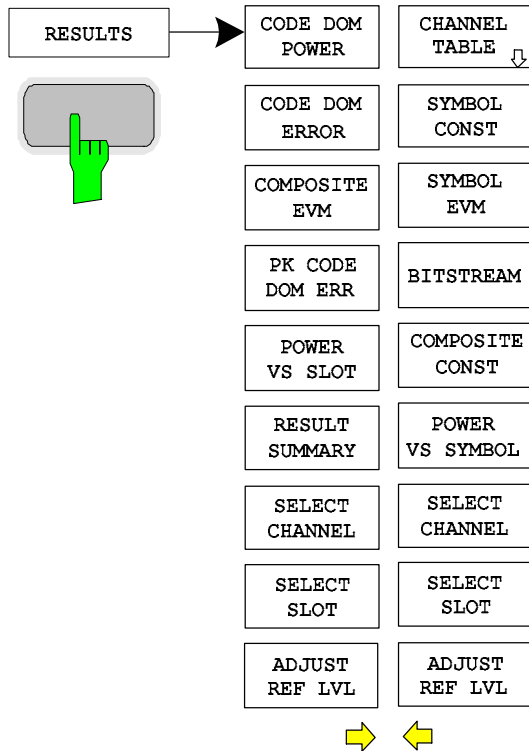
The code domain analyzer can work in two modes. In *CODE CHAN AUTOSEARCH* mode it automatically searches for active channels in the whole code domain.

In the other mode, *CODE CHAN PREDEFINED*, you can determine the active code channels of a random slot by selectable and editable tables. The automatic channel search is then replaced by this user entry in the selected slot.

The code domain analyzer requires an arbitrary channel and a valid midamble in an uplink slot for synchronization. The parameters *SCRAMBLING CODE* and *MA SHIFTS CELL* must comply with the mobile station.

Presentation of evaluations – RESULTS

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



The *RESULTS* hotkey opens the submenu for choosing evaluation. The main menu shows the major evaluations for fast access; more detailed evaluations are available in the page menu.

You can choose from the following evaluations:

- CODE DOM POWER** Code domain power evaluation, depending on the *CODE PWR ABS / REL* softkey in relative or absolute scaling
- CODE DOM ERROR** Code domain error power evaluation
- COMPOSITE EVM** Error vector magnitude evaluation for each slot
- PK CODE DOM ERR** Peak of code domain error power evaluation for each slot
- POWER VS SLOT** Power of selected channel over all slots, depending on the *CODE PWR ABS / REL* softkey in relative or absolute scaling
- RESULT SUMMARY** Results in tabular form
- CHANNEL TABLE** Channel occupancy table in code order or midamble order
- SYMBOL CONST** Symbol constellation evaluation
- SYMBOL EVM** Error vector magnitude evaluation for each symbol of a slot
- BIT STREAM** Display of decided bits
- COMPOSITE CONST** Composite constellation evaluation
- POWER VS SYMBOL** Power of selected channel and selected slot over all symbols

By entering a channel number (*SELECT CHANNEL* softkey) you can select a channel for the evaluations *POWER VS SLOT*, *SYMBOL CONST*, *SYMBOL EVM*, *BIT STREAM* and *POWER VS SYMBOL*.

With the *SELECT SLOT* softkey you can select a slot for the evaluations *CODE DOM POWER*, *CODE DOM ERROR*, *CHANNEL TABLE*, *SYMBOL CONST*, *SYMBOL EVM*, *BIT STREAM*, *COMPOSITE CONST* and *POWER VS SYMBOL*.

With *ADJUST REF LVL* you can optimally match the reference level of the unit to the signal level.

The following user-specific settings are not modified, so the matching to the device under test is preserved:
 Reference Level + Ref Level Offset
 Center Frequency + Frequency Offset
 Input Attenuation + Mixer Level

The following user-specific settings are adopted as follows:
 External and IF/RF power trigger are kept, all other trigger sources result in free run mode.
 Additional trigger settings are preserved.

The major measurement settings on which displays are based are summarized at the top of the diagram:

MS, TDS	:CODE POWER	DR	17.6 kbps
		Chan	1.16
dB TOT	CF 2.01000 GHz	Slot	1

Fig. 5-7 Function fields of diagrams

The meanings are as follows:

1. Column: Mobile radio system (mobile station TD-SCDMA)

Name of selected evaluation:
 (blank line)
 Unit of Y axis

MS, TDS
 e.g. CODE POWER

e.g. dB TOT for relative power to total power

2. Column: (blank line)
 (blank line)

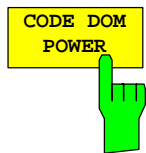
Center frequency of signal:

e.g. CF 2.01000 GHz

3. Column: Data rate of selected channel:

Code number and spreading factor of selected channel:
 Number of selected slot:

e.g. DR 17.6 kbps
 e.g. Chan 1.16
 Slot 1



The *CODE DOM POWER* softkey selects evaluation of the code domain power (CDP).

In code domain power evaluation, the total signal is considered over one slot. 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 a logarithmic level axis. The number of codes corresponds to the maximum spreading factor 16. You can set the slot to be evaluated with the *SELECT SLOT* softkey.

With the *CODE PWR ABS / REL* softkey you can switch between absolute and relative power readout. In relative power readout, the code power is referred to the mean total power of the data fields of the selected slot. The units of the Y axis are consequently dBm for absolute and dB TOT for relative evaluation.

The power values of the active and the unoccupied channels are shown in different colours. The following colours are defined:

- Yellow active channel
- Cyan unoccupied
- Red selected channel

A channel in *CODE CHAN AUTOSEARCH* mode (automatic channel search mode) is referred to as active if the minimum relative power you enter (see *INACT CHAN THRESHOLD* softkey) is exceeded and there is adequate signal/noise ratio. In *CODE CHAN PREDEFINED* mode, each code channel in the user-defined channel table is identified as active.

The results of code domain power evaluation are sorted and shown in ascending order of code numbers. All codes are projected to the spreading factor 16 for sorting. So channel 2.8 is between channels 3.16 and 6.16 for example.

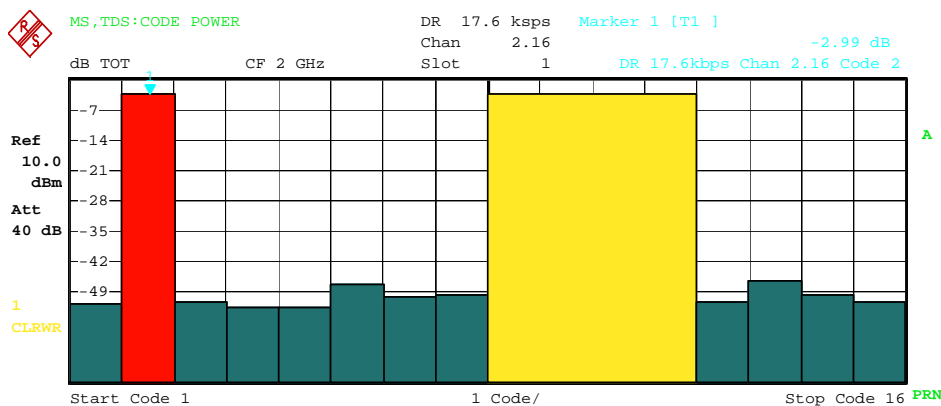


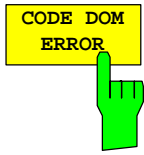
Fig. 5-8 CDP diagram

By entering a channel number (see *SELECT CHANNEL* softkey), you can select a channel for more detailed display. The codes of this channel are shown in red.

Selection of more detailed evaluations (e.g. *SYMBOL CONST*) for unoccupied codes is possible but not meaningful since the results are not valid.

IEC/IEEE bus command:

```
:CALCulate<1>:FEED "XPOW:CDP:RAT" (relative)
:CALCulate<1>:FEED "XPOW:CDP" (absolute)
```



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

The code domain error power measurement reads out the difference in power between a measured and an ideally generated reference signal for each code in dB. This is an error power, so active and inactive channels can be judged jointly at a glance in this evaluation. Analysis is solely in spreading factor 16.

In code domain error power evaluation, the total signal is considered over one slot, the error power of the different codes is determined and plotted in a diagram. In this diagram, the X axis is the code number and the Y axis a logarithmic level axis with units of dB. The number of codes on the X axis corresponds to the maximum spreading factor 16. You can set the slot to be evaluated with the *SELECT SLOT* softkey.

The power values of the active and the unoccupied channels are shown in different colours. The following colours are defined:

- Yellow active channel
- Cyan unoccupied
- Red selected channel

A channel in *CODE CHAN AUTOSEARCH* mode (automatic channel search mode) is referred to as active if the minimum relative power you enter (see *INACT CHAN THRESHOLD* softkey) is exceeded and there is adequate signal/noise ratio. In *CODE CHAN PREDEFINED* mode, each code channel in the user-defined channel table is identified as active.

The results of code domain error power evaluation are sorted and shown in ascending order of code numbers in spreading factor 16.

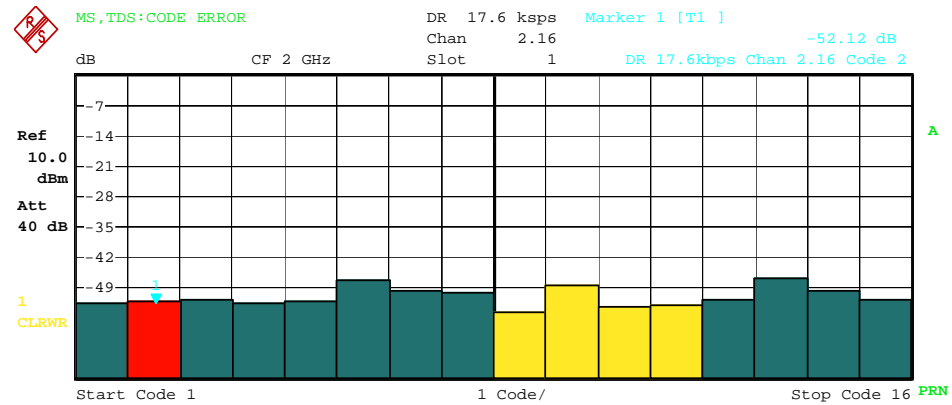


Fig. 5-9 CDEP diagram

By entering a channel number (see *SELECT CHANNEL* softkey), you can select a channel for more detailed display. The codes of this channel are shown in red.

IEC/IEEE bus command: :CALCulate1:FEED "XPOW:CDEP"



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

In composite EVM measurement, the square root is calculated from the squared error between the real and imaginary parts of the test signal and an ideally generated reference signal and normalized to the square root of the mean power of the reference signal.

The measured result consists of one composite EVM value per slot. You can set the number of slots by the *CAPTURE LENGTH* softkey. Subsequently, composite EVM evaluation considers the total signal over the entire period of observation. No EVM value is output for inactive slots because there is no reference power present.

Only the channels detected as active are used to generate the ideal reference signal. In the case of a channel that is not detected as active because of low power for instance, the difference between the test signal and the reference signal and the composite EVM is therefore very large (see figure).

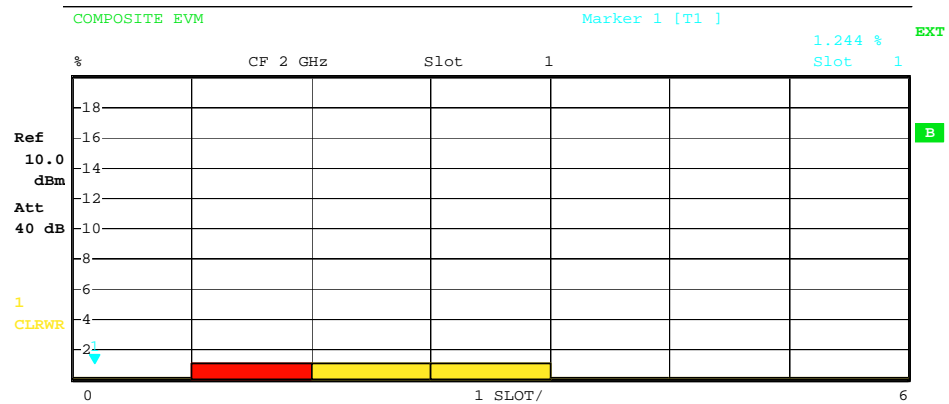


Fig. 5-10 Composite EVM diagram

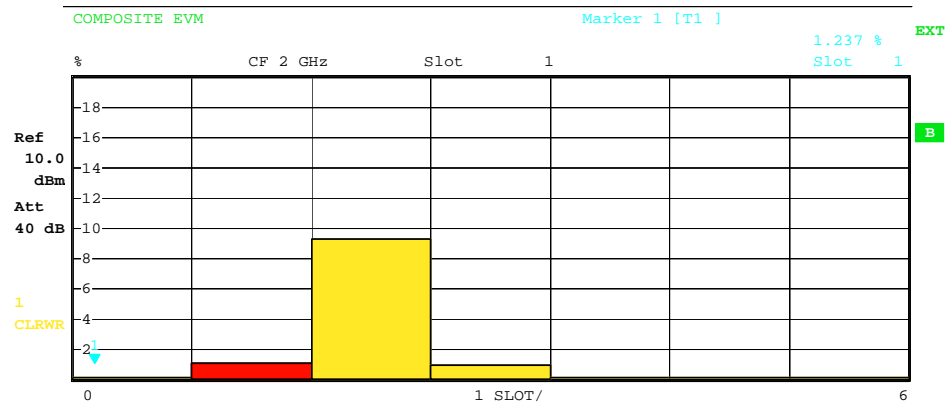
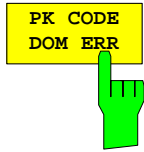


Fig. 5-11 Composite EVM diagram with unrecognized channels

Similar to selecting a code channel in the CDP or CDEP diagram, there is the option in the composite EVM diagram of selecting a slot. You select by entering the slot number (see *SELECT SLOT* softkey). The selected slot appears as a red bar.

IEC/IEEE bus command:

```
:CALCulate<2>:FEED "XTIM:CDP:MACCuracy"
```

The *PK CODE DOM ERR* softkey selects peak code domain error evaluation.

The peak code domain error measurement reads out the maximum of the code domain error power measurement for each slot. This determines the difference in power between a measured and an ideally generated reference signal for each code in dB. Analysis is solely in spreading factor 16.

The measured result consists of a numeric value per slot for the peak code domain error. You can set the number of slots by the *CAPTURE LENGTH* softkey. Subsequently, peak code domain error evaluation considers the total signal over the entire period of observation. No peak code domain error value is output for inactive slots because there is no reference power present.

Only the channels detected as active are used to generate the ideal reference signal for peak code domain error. If an occupied code is not detected as active because of low power, the difference between the test signal and the reference signal is very large. The R&S FS-K77 therefore shows a peak code domain error that is too high (see figure).

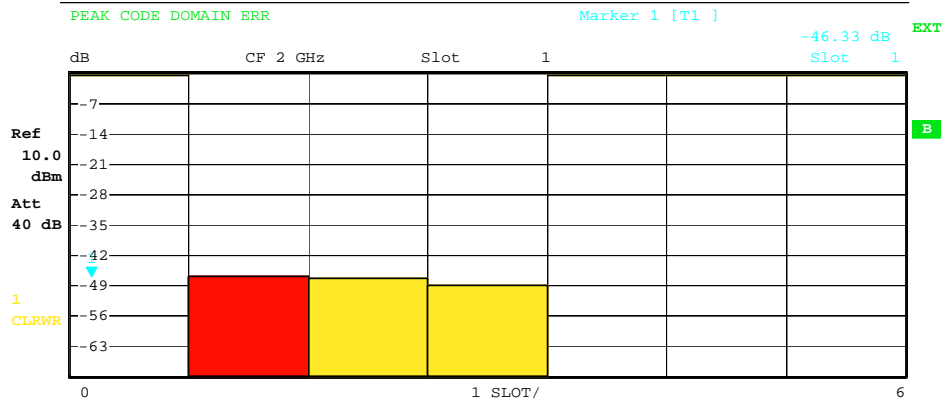


Fig. 5-12 Peak code domain error diagram

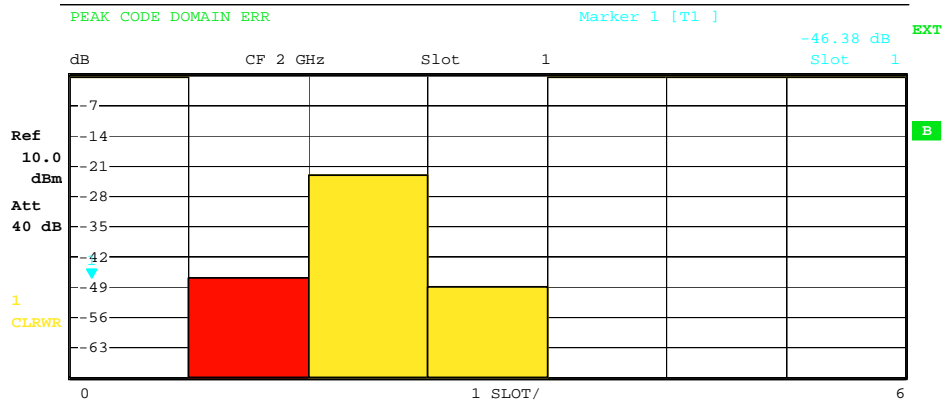
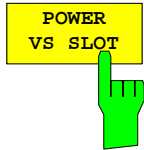


Fig. 5-13 Peak code domain error diagram with unrecognized channels

Similar to selecting a code channel in the CDP or CDEP diagram, there is the option in the peak code domain error diagram of selecting a slot. You select by entering the slot number (see *SELECT SLOT* softkey). The selected slot appears as a red bar.

IEC/IEEE bus command:

```
:CALCulate<2>:FEED "XTIM:CDP:ERR:PCDomain"
```



The *POWER VS SLOT* softkey activates power versus slot evaluation.

The power of the selected channel for each slot is averaged. With the *CODE PWR ABS / REL* softkey you can switch between absolute and relative power readout. In relative power readout, the code power in each slot is referred to the mean total power of the data fields of the slot. The units of the Y axis are consequently dBm for absolute and dB TOT for relative evaluation.

Note: *In relative power readout, the noise power in inactive slots of the selected channel is normalized to the total noise power. This produces relative power of typically -12 dB in inactive slots.*

Colours indicate whether the selected channel in the particular slot is active, inactive or alias power of another channel. Alias power is indicated if there is a channel with a different spreading factor in the place of the selected channel. The following colours are defined:

- Yellow active channel
- Cyan unoccupied
- Green alias power
- Red selected channel

The measured result consists of a numeric value per slot for the power value. You can set the number of slots by the *CAPTURE LENGTH* softkey. Subsequently, power versus slot evaluation considers one code channel over the entire period of observation.

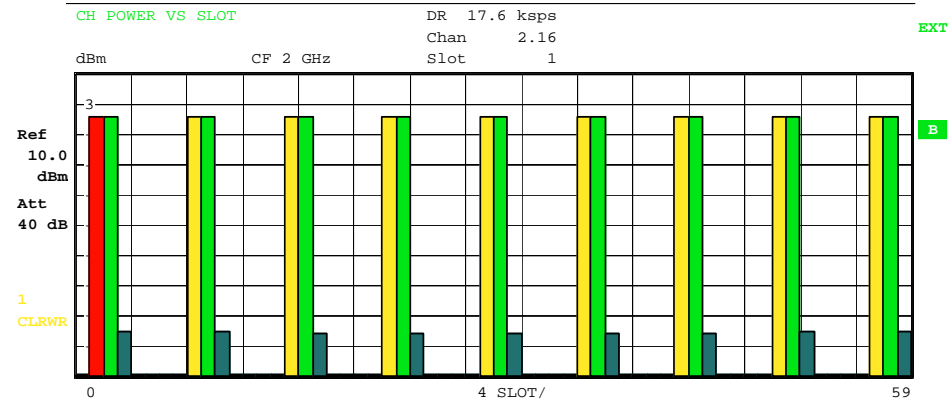


Fig. 5-14 Peak versus slot diagram with absolute power readout

Similar to selecting a code channel in the CDP or CDEP diagram, there is the option in the power versus slot diagram of selecting a slot. You select by entering the slot number (see *SELECT SLOT* softkey). The selected slot appears as a red bar.

IEC/IEEE bus command:

```
:CALCulate<2>:FEED "XTIM:CDP:PVSlot:RAT" (relative)
:CALCulate<2>:FEED "XTIM:CDP:PVSlot" (absolute)
```



The *RESULT SUMMARY* softkey selects numeric evaluation of all measured results. Evaluation is subdivided as follows:

RESULT SUMMARY TABLE		DR 17.6 kbps	EXT	
CF 2 GHz		Chan 2.16		
		Slot 1		
GLOBAL RESULTS				
Ref	Chip Rate Error	0.08 ppm	Trg to Frame	-174 ns
6.00 dBm	SLOT RESULTS			
Att 40 dB	P Data	2.67 dBm	Carr Freq Err	25.25 mHz
	P D1	2.67 dBm	IQ Imbal/Offs	0.05/0.17 %
	P D2	2.67 dBm	RHO	0.9998
	P Midamble	2.66 dBm	Composite EVM	1.28 %
	Active Channels	2	Pk CDE(SF 16)	-45.51 dB
1 CLRWR	CHANNEL RESULTS			
	Channel.SF	2.16	Data Rate	17.6 kbps
	ChannelPwr Rel	-3.00 dB	ChannelPwr Abs	-0.33 dBm
	Symbol EVM	0.32 %rms	Symbol EVM	0.68 %Pk

Fig. 5-15 Result summary

The first part shows measured results relating to the total signal:

Chip Rate Error: Chip rate error (1.28 Mcps) in ppm. A high chip rate error results in symbol errors and possibly in the CDP measurement not being able to synchronize.

Trg to Frame: Time offset from start of recorded signal segment to start of first slot. In the case of triggered data recording, this corresponds to the time offset from trigger to subframe start (+ trigger offset). If the analyzer was unable to synchronize to the TD-SCDMA signal, the value of Trg to Frame is meaningless. If the *FREE RUN* trigger is selected, dashes (--) are shown.

The second part shows measured results relating to all channels for the slot selected with the *SELECT SLOT* softkey:

- P Data:** Total power of data fields for selected slot
- PD1/PD2:** Power of data fields 1 and 2 for selected slot
- P Midamble:** Power of midamble field for selected slot
- Active Channels:** Number of active channels for selected slot
- Carr Freq Err:** Frequency error for selected slot. This is the sum of the frequency error of the analyzer and that of the device under test.
- IQ Imbal/Offs:** IQ imbalance and IQ DC offset
- RHO:** Quality parameter RHO for selected slot
- Composite EVM:** Total signal error vector magnitude for selected slot.
- Pk CDE (SF 16) :** Peak code domain error in spreading factor 16 for selected slot

The third part of *RESULT SUMMARY* shows the results of measurements on the selected channel in the selected slot.

- Data Rate:** Data rate as a function of spreading factor and modulation class of channel
- Channel SF:** Number of channel and its spreading factor
- Channel Power Rel:** Relative channel power referred to mean power of data fields

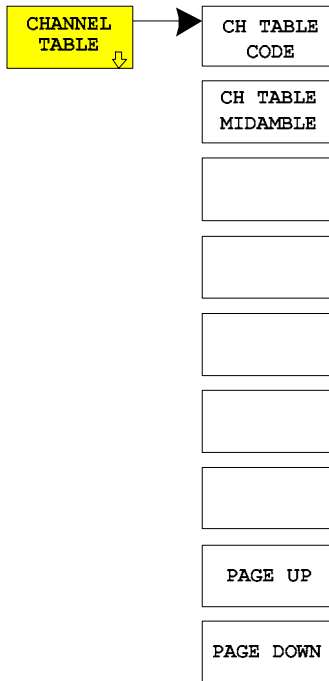
of selected slot

Channel Power Abs: Absolute channel power

Symbol EVM: Peak and mean EVM for selected channel in selected slot

IEC/IEEE bus command:

```
:CALCulate<2>:FEED "XTIM:CDP:ERR:SUMM"
:CALCulate<1|2>:MARKer<1>:FUNction:CDPower[:BTS]:RESult?
SLOT | PDATA | PD1 | PD2 | PMIDamble |
RHO | MACCuracy | PCDerror | FERRor |
CERRor | TFRame | IQIMBalance | IQOFFset |
ACTive | SRATE | CHANnel | SFACtor |
CDPRelative | CDPabsolute | EVMRms | EVMPeak
```



The CHANNEL TABLE softkey selects channel occupancy table evaluation.

The channel occupancy table can hold a maximum of 32 entries, corresponding to 16 midambles and 16 code channels. Channel occupancy table evaluation considers the total signal over precisely one slot. You set the slot to be evaluated by the SELECT SLOT softkey.

A data channel in CODE CHAN AUTOSEARCH mode is identified as active if it exhibits minimum power (see INACT CHAN THRESHOLD softkey) and adequate signal/noise ratio. In CODE CHAN PREDEFINED mode, all active code channels contained in the predefined channel table are identified as active in the selected slot. You can select the sorting of the channel table with the CH TABLE CODE and CH TABLE MIDAMBLE softkeys.

The midambles are listed first in code order. The midambles are sorted in ascending order by their midamble shift. They are followed by the active channels. The active channels are projected to the spreading factor 16 and sorted in ascending order of code numbers.

The inactive channels come at the end.

MS, TDS: CHANNEL TAB


Chan 2.16
Slot 1

		CF 2 GHz		Chan		Slot				
	Type	Chan. SF	Data Rate	Mod	Pwr. Abs	Pwr. Rel	MA. shift	ΔMid1	ΔMid2	
			kbps	Type	dBm	dB		dB	dB	
Ref	Midamble	---	---	---	0.17	-3.02	2	-0.03	-0.02	A
10.0 dBm	Midamble	---	---	---	0.17	-3.01	9	0.01	0.01	
Att	DPCH	2.16	17.60	QPSK	0.19	-3.00	2	---	---	TRG
40 dB	DPCH	3.4	70.40	QPSK	0.16	-3.02	9	---	---	
	---	1.16	---	---	-47.28	-50.47	---	---	---	
	---	3.16	---	---	-47.63	-50.82	---	---	---	
	---	4.16	---	---	-47.58	-50.76	---	---	---	
1	---	5.16	---	---	-46.71	-49.90	---	---	---	
CLRWR	---	6.16	---	---	-43.61	-46.79	---	---	---	
	---	7.16	---	---	-47.13	-50.32	---	---	---	

PRN

Fig. 5-16 Channel table in code order

In midamble order the codes are listed after each midamble. A default midamble allocation is automatically searched. The allocation of codes to midambles for default midamble allocation can be taken from TD-SCDMA specifications. If no default midamble allocation is found, sorting is in code order.

 MS, TDS: CHANNEL TAB

Chan 2.16
Slot 1

CF 2 GHz

Ref	Type	Chan. SF	Data Rate	Mod	Pwr. Abs	Pwr. Rel	MA. shift	ΔMiD1	ΔMiD2	A
			kbps	Type	dBm	dB		dB	dB	
10.0	Midamble	---	---	---	0.15	-3.02	2	-0.03	-0.02	SGL
	DPCH	2.16	17.60	QPSK	0.18	-3.00	2	---	---	
dBm	Midamble	---	---	---	0.16	-3.02	9	0.01	0.01	TRG
Att	DPCH	3.4	70.40	QPSK	0.15	-3.02	9	---	---	
40 dB	---	1.16	---	---	-47.43	-50.61	--	---	---	
	---	3.16	---	---	-47.83	-51.00	--	---	---	
	---	4.16	---	---	-48.02	-51.19	--	---	---	
1	---	5.16	---	---	-46.69	-49.86	--	---	---	
CLRWR	---	6.16	---	---	-43.68	-46.85	--	---	---	
	---	7.16	---	---	-47.18	-50.35	--	---	---	

PRN

Fig. 5-17 Channel table in midamble order

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

- Type: Type of channel (midamble, DPCH or special channel)
- Chan SF: Channel number (1 to spreading factor) including spreading factor of channel in Notation Chan SF
- Data Rate: Data rate at which channel is transmitted
- Mod Type: Modulation method of channel (QPSK or 8PSK)
- Pwr Abs/Pwr Rel: Absolute and relative power of channel (referred to total power of data fields)
- Ma Shift: Midamble shift. For code channels, this is the shift of the associated midamble if a common or default midamble allocation is detected.

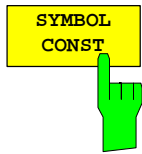
TD-SCDMA specifications state that a midamble and its code channels must exhibit the same power. The following two parameters are shown if a default midamble allocation is detected.

- ΔMiD1: Power offset between midamble and sum power of its channels in data field 1
- ΔMiD2: Power offset between midamble and sum power of its channels in data field 2

A data channel in *CODE CHAN AUTOSEARCH* mode is identified as active if it exhibits minimum power (see *INACT CHAN THRESHOLD* softkey) and adequate signal/noise ratio. In *CODE CHAN PREDEFINED* mode, all active code channels contained in the predefined channel table are identified as active.

IEC/IEEE bus commands:

```
:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABLE"
:CONFigure:CDPower:CTABLE:ORDER CODE
:CONFigure:CDPower:CTABLE:ORDER MIDamble
```



The *SYMBOL CONST* softkey selects evaluation of the constellation diagram at symbol level. The diagram is normalized by the square root of the mean signal power.

Evaluation of the symbols is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected slot (*SELECT SLOT* softkey). This evaluation consequently considers results of one channel for one slot.

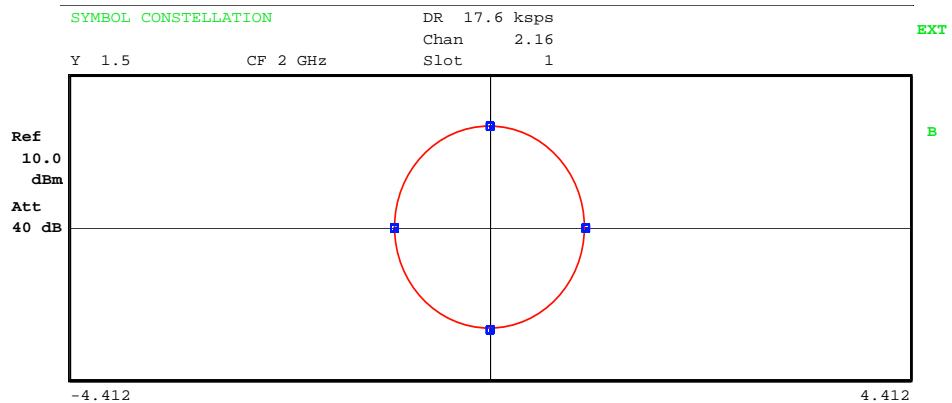
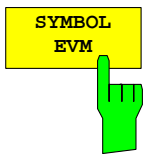


Fig. 5-18 Symbol constellation diagram for QPSK modulation

IEC/IEEE bus command:

```
:CALCulate<2>:FEED "XTIM:CDP:SYMB:CONS"
```



The *SYMBOL EVM* softkey selects symbol error vector magnitude evaluation. Evaluation of the EVM is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected slot (*SELECT SLOT* softkey). This evaluation consequently considers results of one channel for one slot.

Evaluation of symbol error vector magnitude for unoccupied codes is not meaningful, since the results are not valid.

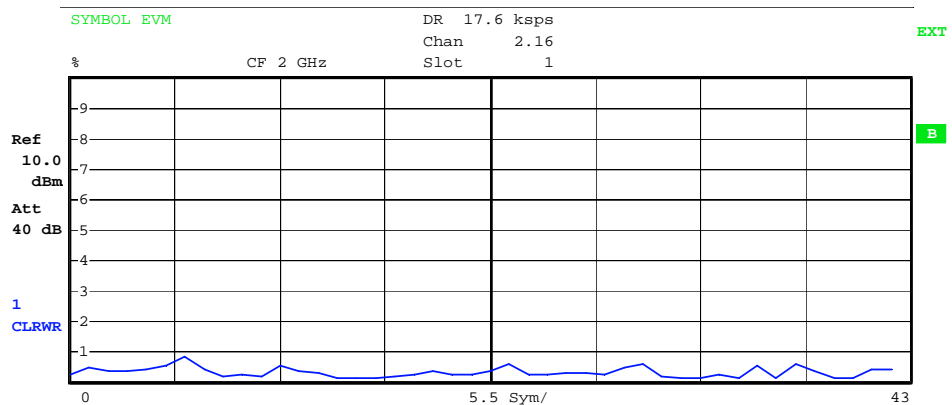


Fig. 5-19 Error vector magnitude for one channel of slot

IEC/IEEE bus command:

```
:CALCulate<2>:FEED "XTIM:CDP:SYMB:EVM"
```



The *BIT STREAM* softkey selects evaluation of the bit stream from the demodulated received signal.

Evaluation of the decided bits is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected slot (*SELECT SLOT* softkey). This evaluation consequently considers results of one channel for one slot.

Depending on the spreading factor of the channel, a slot may contain between 44 and 704 symbols. In QPSK modulated channels, a symbol always consists of two bits. In 8PSK modulated channels, a symbol always consists of three bits. The allocation of symbols to bits is according to TD-SCDMA specifications.

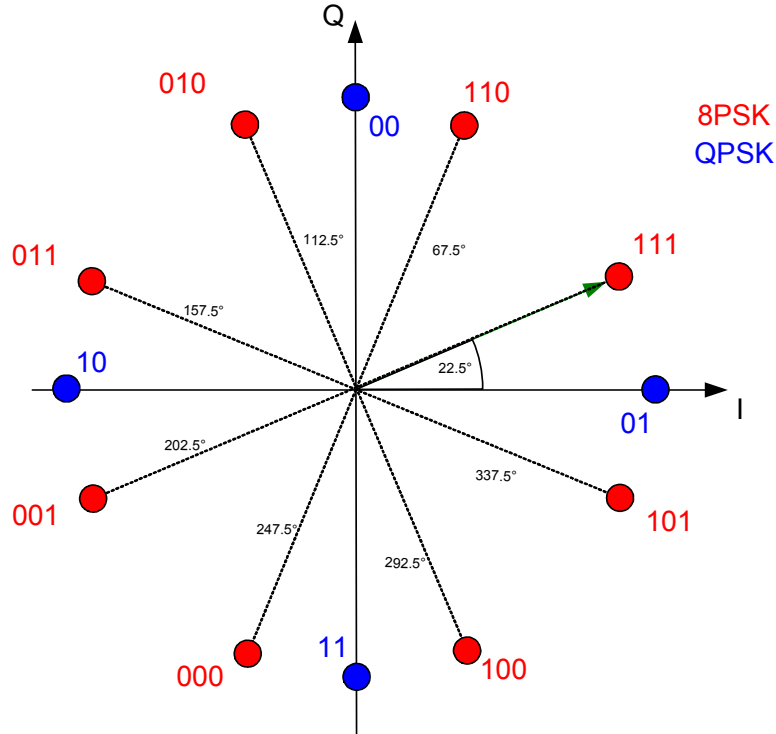


Fig. 5-20 Phasor diagram for QPSK and 8PSK including bit values

The marker can be used to scroll in the bit stream.

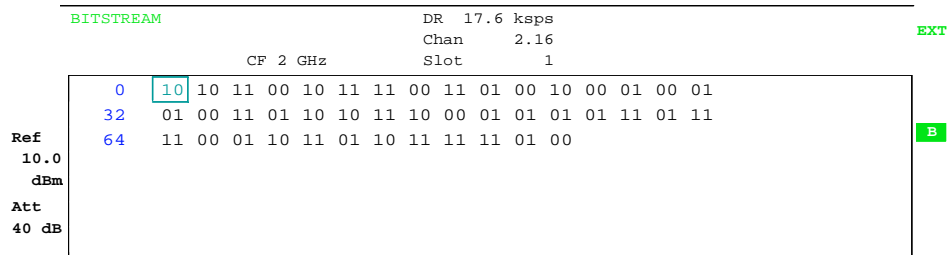
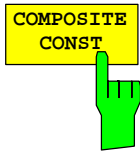


Fig. 5-21 Demodulated bits for channel with QPSK modulation

IEC/IEEE bus command: :CALCulate<2>:FEED "XTIM:CDP:BSTream"



The *COMPOSITE CONST* softkey selects the evaluation of the constellation diagram at chip level. With *COMPOSITE CONST*, the total signal is taken into account over the selected slot (*SELECT SLOT* softkey). A point is plotted in the diagram for each of the 704 data chips. The diagram is normalized by the square root of the mean chip power.

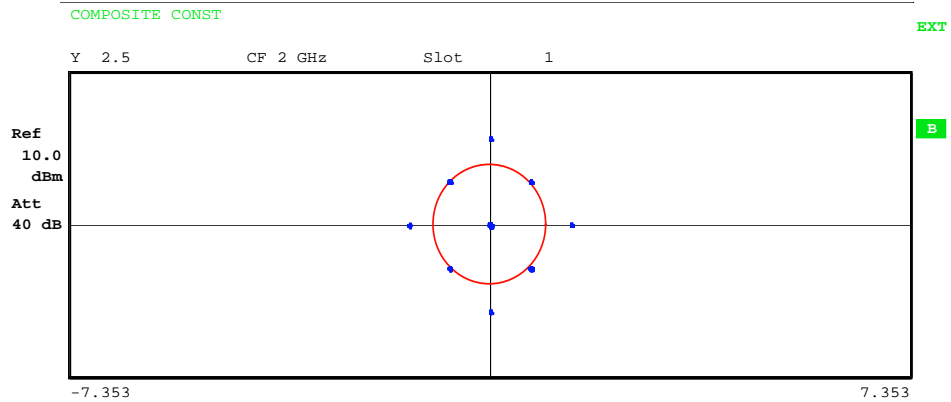
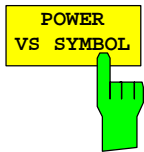


Bild 5-22 Composite Constellation Diagram

Note: *If only one channel is active in the selected slot, all constellation points are situated on the unit circle and occupy one display pixel, if noise is low. If so, it would be reasonable to switch to symbol constellation for a better view.*

IEC/IEEE bus command:

```
:CALCulate<2>:FEED"XTIM:CDP:COMP:CONS"
```



The *POWER VS SYMBOL* softkey selects power versus symbol evaluation. Evaluation outputs the absolute power in dBm at every symbol time for the selected channel (*SELECT CHANNEL* softkey) in the selected slot (*SELECT SLOT* softkey). This evaluation consequently considers results of one channel for one slot.

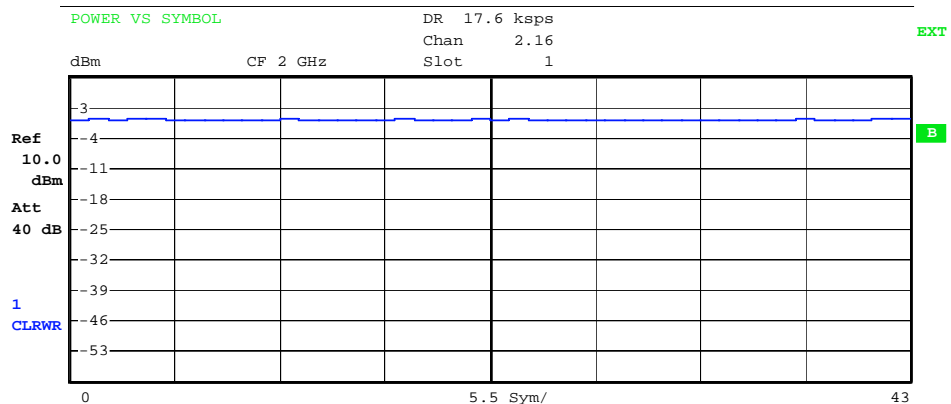
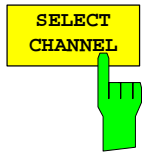


Fig. 5-23 Power versus symbol for one channel of one slot

IEC/IEEE bus command:

```
:CALCulate<2>:FEED "XTIM:CDP:PVSY"
```

You can use the *SELECT CHANNEL* softkey to select a channel. All evaluations that consider results for a channel specify the results for the newly selected channel: *POWER VS SLOT*, *POWER VS SYMBOL*, *RESULT SUMMARY*, *BIT STREAM*, *SYMBOL CONST* and *SYMBOL EVM*.

In the evaluations *CODE DOM POWER*, *CODE DOM ERROR* and *CHANNEL TABLE* (all on screen A), the selected channel is marked red.

Entry of a channel is decimal in the form <Channel number>.<Spreading factor> with a decimal point as the demarcator. Instead of a channel number, you can enter a code number without any decimal point and spreading factor. This is referred to the spreading factor 16.

If the current channel table contains a concentrated channel to which the selected channel belongs, this concentrated channel is displayed with the associated channel number and spreading factor in the function field and marked red in the evaluations.

Example 1:

Entry of channel 5.8

Channel 3.4 is active in the channel table and also includes channels 5.8 and 6.8.

Channel 3.4 is shown in the entry box and marked red on screen A.

Example 2:

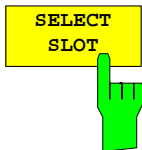
Entry of code number 9

Channel 3.4 is active in the channel table and includes code numbers 9, 10, 11 and 12.

Channel 3.4 is shown in the entry box and marked red on screen A.

The rotating wheel action depends on the evaluation on screen A and is geared to the graphic display. The rotating wheel always selects the adjacent channel. In the channel table, the rotating wheel is used to scroll through the list.

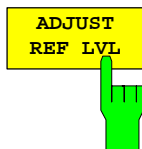
IEC/IEEE bus command: : [SENSe:]CDPower:CODE 1...16



The *SELECT SLOT* softkey serves for selecting a slot. Entry of the slot is decimal. Here the range is from 0 to (IQ capture length - 1) (see *CAPTURE LENGTH* softkey). All evaluations that consider results for a slot specify the results for the newly selected slot: *CODE DOM POWER*, *CODE DOM ERROR*, *CHANNEL TABLE*, *POWER VS SYMBOL*, *RESULT SUMMARY*, *BIT STREAM*, *SYMBOL CONST* and *SYMBOL EVM*.

In the evaluations *POWER VS SLOT*, *COMPOSITE EVM* and *PK CODE DOM ERR* the selected slot is marked red.

IEC/IEEE bus command: : [SENSe:]CDPower:SLOT 0 ...
(IQ_CAPTURE_LENGTH-1)



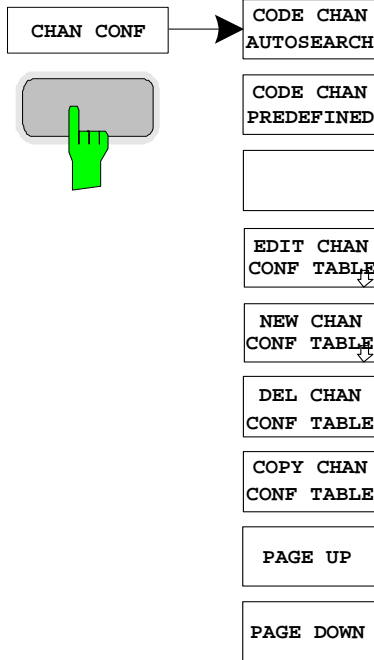
The *ADJUST REF LVL* softkey matches the reference level of the analyzer to the measured channel power. This ensures that the RF attenuation and reference level settings are optimally matched to the signal level without the analyzer being overloaded or the dynamic response limited by too low a signal/noise ratio.

Using an RF/IF power trigger, the trigger threshold is optimal adjusted.

IEC/IEEE bus command: SENS:POW:ACH:PRES:RLEV
Result poll: SENS:POW:ACH:PRES:RLEV?

Configuration of measurements

CHAN CONF hotkey

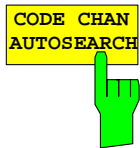


The *CHAN CONF* hotkey opens a submenu with configuration options for the channel search. In this submenu you can select predefined channel tables that are then taken as a basis for measurements by the code domain analyzer.

When you first press the hotkey, a table opens with the channel tables stored on the harddisk of the instrument. The table is merely an overview; to select one of the tables for a measurement, you must first press the *CODE CHAN PREDEFINED* softkey. The *RECENT* entry is the channel table of the last code domain power analysis that was performed.

IEC/IEEE bus command:

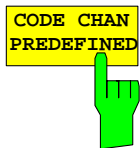
```
:CONFigure:CDPower:CTABLE:CATalog?
```



The *CODE CHAN AUTOSEARCH* softkey supports measurements of the code domain power analyzer in automatic search mode. This mode searches the whole code domain (all permissible symbol rates and channel numbers) for active channels. A channel is active when the minimum power you enter, referred to the total power, is exceeded (see *INACT CHAN THRESHOLD* softkey) and there is adequate signal/noise ratio.

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

IEC/IEEE bus command::CONFigure:CDPower:CTable[:STATE] OFF



The *CODE CHAN PREDEFINED* softkey switches 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 for the selected slot, instead the channels of a table defined prior to a measurement are assumed to be active.

When you press the softkey, a table opens with all channel tables stored on the instrument. CDP analysis is switched to predefined channel table mode. The last table of the automatic search mode is initially taken as a basis for the measurement. This table is available under *RECENT*.

You switch to one of the predefined channel tables by selecting the appropriate table entry and pressing one of the unit keys or Enter. From the next measurement onwards, the selected channel table is taken as a basis for evaluation for the selected slot. A tick marks the selected channel table.

IEC/IEEE bus command::

```
CONFigure:CDPower:CTable[:STATE] ON
:CONFigure:CDPower:CTable:SElect "MY_FIRST_CH_TAB"
```

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

EDIT CHANNEL TABLE						
NAME:	My First Channel Table			MA SHIFTS CELL	16	
COMMENT:	Mobile Station Test 1					
TYPE	CHAN.SF	Modulation Type	Data Rate [kbps]	Midamble Shift	STATUS	
MIDAMBLE	--	--	--	1	ACTIVE	
DPCH	2.16	QPSK	17.6	--	ACTIVE	

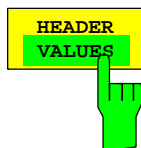
Fig. 5-24 Table for editing channel configuration

Basically any of the channel tables stored on the instrument can be edited as you wish. The edited table is not stored automatically on the harddisk of the instrument, first you must press the *SAVE TABLE* softkey. This avoids accidental overwriting of a table.

If a table is edited that is currently the basis for code domain power analysis, the edited table is used for the next measurement immediately after it is saved. So the effects of the changes in the table are immediately visible. Here again, the edited table is not saved on the harddisk of the instrument until you press the *SAVE TABLE* softkey.

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

If you change the channel number or spreading factor, a check for code domain conflicts is made after you press the unit key. If a code domain conflict is detected, the channels causing the conflict are identified by an asterisk. This allows you to eliminate any code domain conflicts. If a table with code domain conflicts is used for CDP analysis, the results are invalid.



The *HEADER / VALUES* softkey sets the focus of the edit option either on the table entries or the table header.

Editing table header (*HEADER*):

This means editing values for the whole channel table. The following

entries are available (confirm an entry with the help of the unit keys):

NAME: Name of the channel table. Overwriting of ready saved tables can be avoided by changing the name of a table. A table name must not consist of more than eight characters.

COMMENT: Comment on the channel table, e.g. description of slot allocation.

MA SHIFTS CELL: Maximum number of usable midambles of the mobile station. In mode *CODE CHAN PREDEFINED* this entry replaces the value in the *SETTINGS* menu. (see softkey *SETTINGS, MA SHIFTS CELL*).

Fernsteuerbefehle

```
CONFigure:CDPower:CTABLE:NAME "NEW_TAB"
CONFigure:CDPower:CTABLE:COMMENT "comment"
CONFigure:CDPower:CTABLE:MSHift <numeric>
```

Editing table entries (VALUES):

This means editing the actual data of the channel table. The following entries are available for each of the channels in the table (confirm an entry with the help of the unit keys):

TYPE: Channel type. Midamble or code channel can be selected. Special channels are identified by their names (PRACH, PUSCH). All other channels are entered as DPCH (dedicated physical channel) for normal data channels.

CHAN SF: The channel number and the spreading factor are entered for the channel in this column. For an entry without a decimal point the spreading factor is 16. Invalid entries are rejected.

MODULATION TYPE: Modulation type of the channel. You can choose between QPSK and 8PSK.

DATA RATE: Data rate of the channel. This is a direct function of the spreading factor and modulation type of the channel, so it cannot be edited.

MIDAMBLE SHIFT: Here you can enter the midamble shift number for a midamble channel type. Possible entries are from 1 to the maximum number of midambles (see *SETTINGS*).

STATUS: The entry can be set active or inactive. Inactive entries are not used in measurements.

IEC/IEEE bus commands

```
:CONFigure:CDPower:CTABLE:DATA
    2,4,1,1,1,1,0,0,
    2,4,2,1,1,1,0,0
'Defines two data channels with QPSK modulation
```

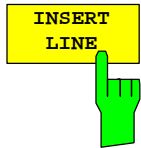


The *ADD SPECIAL* softkey allows you to add special channels to the channel table.

ADD SPECIAL
PRACH
PUSCH
MIDAMBLE

Fig. 5-25 Table of special channels

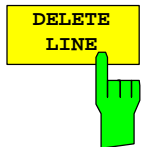
All channels not listed are entered as DPCH by the *INSERT LINE* softkey. Stating special data channels only serves for the purpose of an overview in R&S FS-K77. Code domain measurements do not distinguish between special channels and data channels with the same parameters.



IEC/IEEE bus command: -- (integrated in command
:CONFigure:CDPower:CTABLE:DATA)

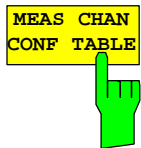
The *INSERT LINE* softkey adds a new entry to the table. Entries can be made in any order. A channel is only included in CDP analysis if all required entries are present in the list.

IEC/IEEE bus command: --



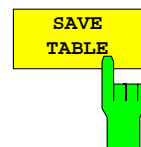
The *DELETE LINE* softkey deletes the selected line from the table.

IEC/IEEE bus command: --



The *MEAS CHAN CONF TABLE* softkey starts a measurement in *CODE CHAN AUTOSEARCH* mode. The measurement results are adopted in the opened channel table.

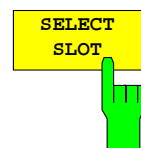
IEC/IEEE bus command: --



The *SAVE TABLE* softkey saves the table with its specified name.

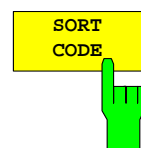
Caution: Editing channel models and saving them under the original name will result in the models being overwritten.

IEC/IEEE bus command: -- (automatic with remote control)



The *SELECT SLOT* softkey serves for selecting the slot on which the channel table is applied. At the same time this is the slot on which the slot-dependent evaluations are made.

IEC/IEEE bus command: --



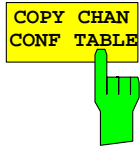
The *SORT CODE* softkey sorts the channel table in code order. First, all midambles are sorted in ascending order by their midamble shift. Then the code channels are sorted in ascending order by their spreading factors and in ascending order by their code numbers within the same spreading factor.

IEC/IEEE bus command: --



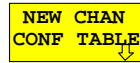
The *DEL CHAN CONF TABLE* softkey deletes the selected table. The currently active table in *CODE CHAN PREDEFINED* mode cannot be deleted.

IEC/IEEE bus command: :CONFigure:CDPower:CTable:DElete



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

IEC/IEEE bus command:
:CONFigure:CDPower:CTable:COpy "CTAB2"



- HEADER VALUES
- ADD SPECIAL
- INSERT LINE
- DELETE LINE
- MEAS CHAN CONF TABLE
- SAVE TABLE
- SELECT SLOT
- SORT CODE
-

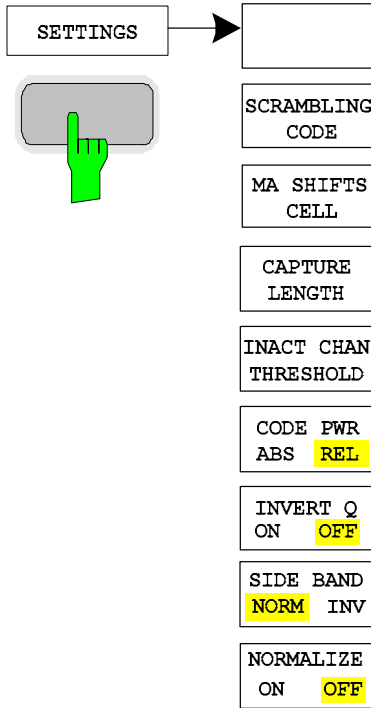
The *NEW CHAN CONF TABLE* softkey opens a submenu that is identical to the one for the *EDIT CHAN CONF TABLE* softkey. Unlike with *EDIT CHAN CONF TABLE*, a blank table is presented:

EDIT CHANNEL TABLE					
NAME:	default			MA SHIFTS CELL	16
COMMENT:	default				
TYPE	CHAN.SF	Modulation Type	Data Rate [kbps]	Midamble Shift	STATUS

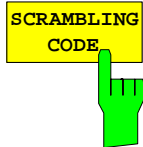
Fig. 5-26 Creating new channel configuration

Configuration of application firmware – SETTINGS

SETTINGS hotkey

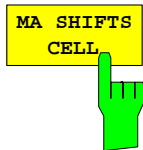


The *SETTINGS* hotkey opens a submenu for setting the measurement parameters of the application firmware.



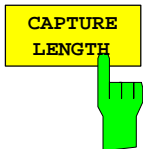
The *SCRAMBLING CODE* softkey allows entry of the scrambling code of the mobile station. Entry of the scrambling code is decimal.

IEC/IEEE bus command: `: [SENSe:]CDPower:SCODE 0...127`



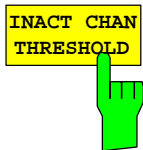
The *MA SHIFTS CELL* softkey allows entry of the maximum number of usable midamble shifts of the mobile station. In the mode *CODE CHAN PREDEFINED* this value will be replaced by the entry in the channel table.

IEC/IEEE bus command: `: [SENSe:]CDPower:MSHift 2...16`



The *CAPTURE LENGTH* softkey allows entry of the number of slots to be captured. The range is from 2 to 63. For all evaluations with one value per slot on the X axis, the maximum value on the X axis is the set *CAPTURE LENGTH* - 1.

IEC/IEEE bus command: `: [SENSe:]CDPower:IQLength 2...63`



The *INACT CHAN THRESHOLD* softkey allows entry of the minimum relative power that a single channel must have compared to the total signal in order to be regarded as an active channel.

Channels below the specified threshold are regarded as inactive.

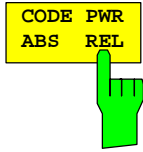
The two measurements *COMPOSITE EVM* and *PK CODE DOM ERR*, which are specified as measurements on the total signal, are performed using the list of active channels. Corruption of these two measurements always occurs when active channels are not detected as active and unoccupied channels are wrongly given the status of occupied. *INACT CHAN TRHESHOLD* can therefore be used to influence the results of the two measurements.

The default is -40 dB. If not all channels contained in the signal are detected

automatically, *INACT CHAN THRESHOLD* must be decremented. If non-existent channels are detected, *INACT CHAN THRESHOLD* must be incremented.

IEC/IEEE bus command:

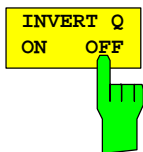
```
: [SENSe:]CDPower:ICTReshold -100 dB ... 0 dB
```



The *CODE PWR ABS / REL* softkey selects for *CODE DOM POWER* and *POWER VS SLOT* evaluation whether the Y values should be displayed absolute (dBm) or relative (dB). Relative is referred to the mean total power of the data fields of the selected slot.

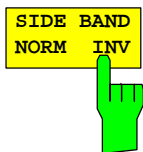
IEC/IEEE bus command:

```
:CALCulate<1>:FEED "XPOW:CDP:RAT" (relative)
:CALCulate<1>:FEED "XPOW:CDP" (absolute)
:CALCulate<1>:FEED "XTIM:CDP:PVSL:RAT"
(relative)
:CALCulate<1>:FEED "XTIM:CDP: PVSL "
(absolute)
```



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

IEC/IEEE bus command: : [SENSe:]CDP:QINVert OFF



The *SIDE BAND NORM / INV* softkey chooses between measurement of the signal in a normal and an inverted spectrum.

NORM This allows measurement of mobile station RF signals.

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

The default setting is *NORM*.

IEC/IEEE bus command: : [SENSe:]CDPower:SBAND NORMal | INVert



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

IEC/IEEE bus command: : [SENSe:]CDP:NORMAlize OFF

Frequency setting – *FREQ* key

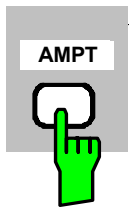


FREQ	→	CENTER	The <i>FREQ</i> key opens a submenu for changing the measurement frequency.
CF- STEPSIZE			The <i>CENTER</i> softkey opens the input window for manual entry of the center frequency. The permissible input range of the center frequency is $\text{Minspan}/2 \leq f_{\text{center}} \leq f_{\text{max}} - \text{Minspan}/2$
			f_{center} center frequency
			Minspan smallest selectable span > 0 Hz (10 Hz)
			f_{max} maximum frequency
			IEC/IEEE bus command: :FREQ:CENT 100MHz
FREQUENCY OFFSET			<i>CF STEPSIZE</i> opens a submenu for setting incrementation of the center frequency. There is an option of entering the step size manually (<i>MANUAL</i> softkey) or using the current measurement frequency (<i>CENTER</i> softkey). The softkeys are described in the manual for the basic unit.
			The <i>FREQUENCY OFFSET</i> softkey enables entry of an arithmetic frequency offset that is added to the frequency axis labelling. The range for the offset is -100 GHz to 100 GHz. The default setting is 0 Hz.
			IEC/IEEE bus command: :FREQ:OFFS 10 MHz

Span settings – *SPAN* key

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

Level settings – AMPT key



REF LEVEL

The *AMPT* key opens a submenu for setting the reference level.

ADJUST
REF LEVEL

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

IEC/IEEE bus command: `:DISP:WIND:TRAC:Y:RLEV -60dBm`

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

Y PER DIV

IEC/IEEE bus command: `: [SENSe<1 | 2> :]CDPower:LEVel:ADJust`

REF VALUE
POSITION

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

IEC/IEEE bus command:

`:DISPlay[:WINDow<1 | 2>]:TRACe<1..3>:Y[:SCALE]:RPOSition`

RF ATTEN
MANUAL

REF VALUE POSITION allows entry of the position of the Y axis reference value on the axis (0 to 100%).

RF ATTEN
AUTO

IEC/IEEE bus command:

`:DISPlay[:WINDow<1 | 2>]:TRACe<1..3>:Y[:SCALE]:PDIVision`

The *RF ATTEN MANUAL* softkey activates entry of attenuation independently of reference level.

The attenuation can be altered in 10 dB increments from 0 to 70 dB. Other entries are rounded to the next lowest integral. If the specified reference level can no longer be set for the given RF attenuation, it is matched and the "Limit reached" message appears.

IEC/IEEE bus command: `INP:ATT 40 DB`

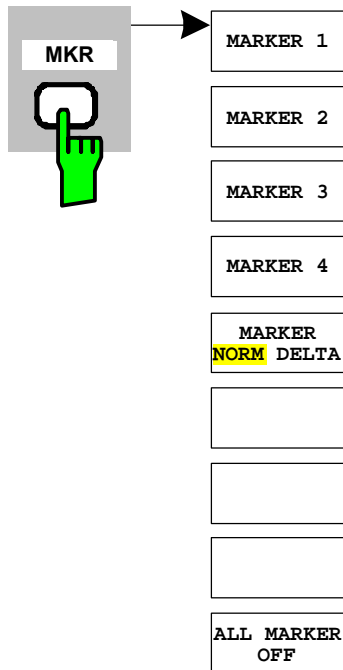
The *RF ATTEN AUTO* softkey sets the RF attenuation automatically as a function of the set reference level.

This ensures that the optimum attenuation you wish is always used.

RF ATTEN AUTO is the default setting.

IEC/IEEE bus command: `INP:ATT:AUTO ON`

Marker settings - MKR key



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

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

The *MARKER 1-4* softkeys select and enable the particular marker. *MARKER 1* is always the normal marker after it is enabled, while *MARKER 2* through *4* are delta markers referred to *MARKER 1* after they are enabled. The *MARKER NORM / DELTA* softkey can be used to transform these markers into markers with absolute measured value indication. If *MARKER 1* is the active marker, *MARKER NORM / DELTA* is used to enable an additional delta marker.

Press the *MARKER 1-4* softkeys again to disable the selected marker.

IEC/IEEE 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/IEEE bus command: :CALC:MARK:AOFF

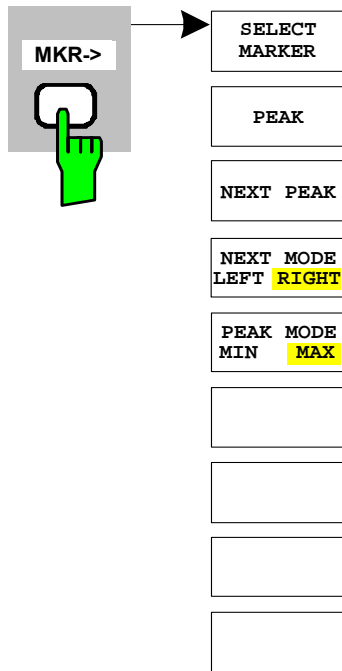
The parameters relating to an enabled marker are read out above the diagrams:

```
Marker 1 [T1]
                -5.00 dB
DR 70.4kbps Chan 1.4 Code 3
```

Fig. 5-27 Marker field of CDP measurement

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

Marker settings – MKR→ key



The *MKR* → key opens a submenu for marker functions:

The *SELECT MARKER* softkey selects the required marker in a data entry box. If the marker is disabled, it is enabled and can then be moved. The entry is numeric. Delta marker 1 is selected by entering '0'.

IEC/IEEE 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 was activated before opening the *MKR->* menu, marker 1 is automatically enabled and the *PEAK* function is executed.

IEC/IEEE 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 lowest maximum/minimum value of the associated trace. The search direction is specified by the setting in the *NEXT MODE LEFT / RIGHT* submenu.

IEC/IEEE bus command: :CALC:MARK:MAX:NEXT
 :CALC:DELT:MAX:NEXT
 :CALC:MARK:MIN:NEXT
 :CALC:DELT:MIN:NEXT

The *NEXT MODE LEFT / RIGHT* softkey sets the direction for searching for the next maximum/minimum value. *SEARCH NEXT LEFT / RIGHT* searches for the next signal maximum left/right from the active marker, i.e. only signal segments smaller/greater than the current marker position enter the search.

IEC/IEEE bus commands: CALC:MARK:MAX:LEFT
 CALC:DELT:MAX:LEFT
 CALC:MARK:MIN:LEFT
 CALC:DELT:MIN:LEFT
 CALC:MARK:MAX:RIGH
 CALC:DELT:MAX:RIGH
 CALC:MARK:MIN:RIGH
 CALC:DELT:MIN:RIGH

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 response of the *PEAK* and *NEXT PEAK* softkeys.

IEC/IEEE bus command: --

Marker functions – MKR FCTN key

The *MKR FCTN* key is disabled for all measurements of the code domain analyzer. The softkeys of the menu are described in the manual of the basic unit for all other measurements of the R&S FS-K77.

Bandwidth setting – BW key

The *BW* key is disabled for all measurements of the code domain analyzer. The softkeys associated with the menu are described in the manual of the basic unit for all other measurements of the R&S FS-K77.

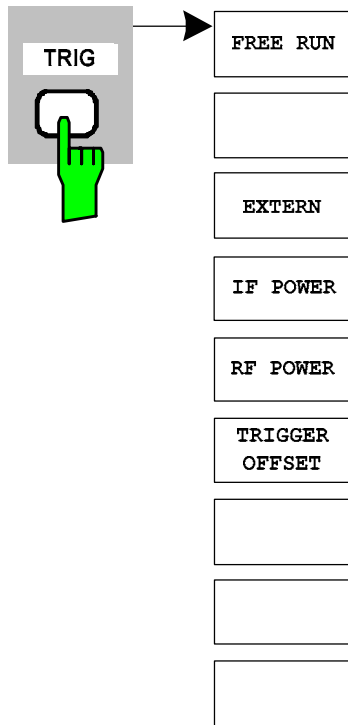
Measurement control – SWEEP key

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

Measurement selection – MEAS key

The menu of the *MEAS* key contains all the measurements that can be selected at the pressing of a key in the R&S FS-K77. The menu and its submenus are described at the beginning of Chapter 5.

Trigger settings – TRIG key



The *TRIG* key opens a submenu for selection of the various trigger sources. All softkeys associated with the menu are described in the manual of the basic unit.

Contrary to downlink signals with DwPTS, there is normally no permanent pilot slot in uplink. The UpPTS is used for the initial cell search and handover only. This impacts the synchronisation and trigger of uplink signals.

For measurement of TD-SCDMA uplink signals the following trigger settings are available:

- Free Run (Code Domain Analyser only)
- Extern
- IF Power
- RF Power (FSP with Option FSP-B6 only)

As an external trigger a subframe trigger is expected. An unambiguous slot assignment is possible with subframe trigger only. When using IF or RF power trigger, only **one** slot is allowed to be active. This slot is always assumed to be slot 1 (first slot after UpPTS).

Within the code domain analyser the free run trigger can be used. In free run mode a valid slot allocation will be searched, so that the first active uplink slot of a subframe is placed on slot 1. If an UpPTS is found within the captured signal, it will be used as timing reference for slot allocation.

Example for free run trigger mode:

A TD-SCDMA uplink signal uses slots 2 and 3 and there is no UpPTS. The code domain analyser will show an occupancy of slots 1 and 2.

Trace settings – TRACE key



[]

The *TRACE* key opens the following submenu:

CLEAR/
WRITE

The *CLEAR / WRITE* softkey activates overwrite mode for the acquired measured values, i.e. the trace is rewritten for each sweep. After every actuation of the *CLEAR / WRITE* softkey, the unit deletes the selected trace memory and restarts the measurement.

MAX HOLD

IEC/IEEE bus command: :DISP:WIND:TRAC:MODE WRIT

MIN HOLD

The *MAX HOLD* softkey activates the peak value detector. On every sweep, the analyzer only accepts the new measured value into the saved trace data if it is larger than the previous one.

AVERAGE

Pressing the *MAX HOLD* softkey a second time deletes the trace memory and starts peak value detection from the beginning again.

[]

IEC/IEEE bus command: :DISP:WIND:TRAC:MODE MAXH

SWEEP
COUNT

The *MIN HOLD* softkey activates the minimum value detector. On every sweep, the analyzer only accepts the new measured value into 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 peak detection from the beginning again.

[]

IEC/IEEE bus command: :DISP:WIND:TRAC:MODE MINH

The *AVERAGE* softkey enables the trace averaging function. The average is formed over several sweeps. Averaging is performed as a function of the *AVG MODE LOG / LIN* setting on the logarithmized level values or the measured power/voltage values.

Averaging is restarted every time the *AVERAGE* softkey is pressed. The trace memory is always cleared.

IEC/IEEE bus command: :DISP:WIND:TRAC:MODE AVER

For measurements in the code domain analyzer, an *AVERAGE*, *MAX HOLD* or *MIN HOLD* is possible.

In channel occupancy table evaluation, the channel configuration measured on the first sweep is kept for the trace statistics.

If the signal is reconfigured, you must again press the *SINGLE SWEEP* softkey (and possibly *CONTINUOUS SWEEP*).

The evaluations *RESULT SUMMARY*, *BIT STREAM* and the *CONSTELLATION* diagrams only support *CLEAR / WRITE* mode.

The *SWEEP COUNT* softkey sets the number of sweeps used for averaging. The permissible range is 0 to 30000, though the following should be noted:

Sweep count = 0 means sliding averaging with averaging length of 10.

Sweep count = 1 means no averaging.

Sweep count > 1 means averaging over the specified number of sweeps; in a continuous sweep the averaging changes to sliding averaging once this number has been reached.

The default is sliding 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/IEEE bus command: :SWE:COUN 64

Display lines – *LINES* key

The *LINES* keys are 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 unit. The respective softkeys are described in the manual for the basic unit.

Measurement screen settings – *DISP* key

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

Storing and loading unit data – *FILE* key

The *FILE* menu 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.

'XTIM:CDP:PVSymbol'	Result display of power versus symbol (CALCulate<2>)
'XTIM:CDP:BSTream'	Result display of bit stream (CALCulate<2>)
'XTIM:CDP:SYMB:CONStellation'	Result display of symbol constellation (CALCulate<2>)
'XTIM:CDP:SYMB:EVM'	Result display of error vector magnitude (CALCulate<2>)
'XTIM:CDP:COMP:CONStellation'	Result display of composite constellation (CALCulate<2>)

Example:	"INST:SEL MTDS "	'Activate TD-SCDMA MS
	"INIT:CONT OFF "	'Select single sweep
	"CALC2:FEED `XTIM:CDP:MACC` "	'Select COMP EVM evaluation
	"INIT;*WAI "	'Start measurement with synchronization
	"TRAC? TRACE2 "	'Poll COMP EVM data

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

Note: Code domain power measurements are always shown in split screen mode and the allocation of the evaluation to the measurement window is fixed. The necessary or allowed numerical suffix in CALCulate is therefore specified in brackets in every evaluation.

CALCulate:LIMit: ESPectrum subsystem

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

COMMAND	PARAMETER	UNITS	REMARKS
CALCulate<1 2> LIMit<1...8> :ESPectrum :MODE :RESTore :CHECK :X? :Y?	AUTO MANual USER		Result poll only Result poll only

:CALCulate:LIMit:ESPectrum:MODE AUTO | USER

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

Parameters: AUTO The limit line sets itself according to the measured channel power.
USER Poll only, user-defined limit lines are enabled (refer to the details of limit lines in the manual for the unit).

Example: "INST:SEL MTDS " 'Activate TD-SCDMA MS
"INIT:CONT OFF " 'Select single sweep
"CONF:CDP:MEAS ESP " 'Select spectrum emission mask
'measurement
"CALC:LIM:ESP:MODE AUTO " 'Activates automatic selection of
'limit line
"INIT;*WAI " 'Start measurement with
synchronization
"CALC:LIM:FAIL? " 'Poll result of limit check

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

:CALCulate:LIMit:ESPectrum:RESTore

This command restores the standard limit lines for spectrum emission mask measurement. All changes to the standard limit lines are thus lost and they are again as when delivered.

Example: "INST MTDS " 'Switches unit to TD-SCDMA MS
'mode
"CALC:LIM:ESP:REST " 'Resets spectrum emission mask
'limit lines to default

Features: *RST value: SCPI: instrument-specific

This command is an event, so it has neither a poll nor an *RST value.

CALCulate:MARKer subsystem

COMMAND	PARAMETER	UNITS	REMARKS
CALCulate<1 2> :MARKer<1...4> :FUNction :CDPower :RESult?	SLOT PDATa PD1 PD2 PMIDamble RHO MACCuracy PCDerror FERRor CERRor TFRame IQOFFset IQIMbalance ACTive SRATe CHANnel SFACTor CDPabsolute CDPRelative EVMRms EVMPeak		Poll only

:CALCulate<1|2>:MARKer<1>:FUNction:CDPower:RESult?

SLOT | PDATa | PD1 | PD2 | PMIDamble | RHO | MACCuracy | PCDerror |
FERRor | CERRor | TFRame | IQOFFset | IQIMbalance | ACTive | SRATe |
CHANnel | SFACTor | CDPabsolute | CDPRelative | EVMRms | EVMPeak

This command polls the measured and calculated values of code domain power analysis. The results are provided for the channel to which the code selected by the `CDPower:CODE` command belongs.

Parameters:

Global results of selected slot:

SLOT	Slot number		
PDATa	Power data fields in dBm	FERRor	Frequency error in Hz
PD1	Power data field 1 in dBm	CERRor	Chip rate error in ppm
PD2	Power data field 2 in dBm	TFRame	Trigger to frame
PMIDamble	Power midamble in dBm	IQIMbalance	IQ imbalance in %
RHO	RHO	IQOFFset	IQ offset in %
MACCuracy	Composite EVM in %	ACTive	Number of active channels
PCDerror	Peak code domain error in dB		

Channel results:

SRATe	Data rate in kbps
CHANnel	Channel number
SFACTor	Spreading factor of channel
CDPRelative	Channel power relative in dB
CDPabsolute	Channel power absolute in dBm
EVMRms	Error vector magnitude RMS in %
EVMPeak	Error vector magnitude Peak in %

Note: The trigger to frame (*TFRame*) value produces a "9" if the trigger is set to *FREE RUN*.

Example:	"INST:SEL MTDS"	'Activate TD-SCDMA MS meaning
		'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? PDAT"	'Read out power of data fields
	"CDP:SLOT 5"	'Selects slot 5
	"CDP:CODE 11"	'Select code number 11
	"CALC:MARK:FUNC:CDP:RES? EVMR"	'Read out EVM RMS of code with
		'number 11 in slot 5

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

CONFigure:CDPower subsystem

This subsystem contains the commands for selecting and configuring measurements in the TD-SCDMA application firmware. Only the numeric suffix 1 is allowed for CONFigure. You will find further settings for code domain power analysis under the :[SENSE]:CDPower command.

Further settings for spectrum emission mask measurement can be found under the CALCulate:LIMit:ESpectrum command.

BEFEHL	PARAMETER	EINHEIT	KOMMENTAR
CONFigure :CDPower			Option FS-K77
:MEASurement	POWer ACLR ESpectrum OBANdwidth OBWidth PVTime CDPower CCDF		
:CTABLE			
:ORDER	CODE MIDamble		
[: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?			
:PVTime			
:SPOINT	<numeric_value>		
:SFRAMES	<numeric_value>		

CONFigure<1>:CDPower:MEASurement POWER | ACLR | ESpectrum | OBANdwidth | OBWidth | CDPower | CCDF

This command selects the measurement of the Application Firmware R&S FS-K77, TD-SCDMA mobile station test. The predefined settings of the different measurements are described in Chapter 6.

Parameters:	POWER	Channel power measurement (TD-SCDMA UE standard) with predefined settings
	ACLR	Adjacent channel power measurement (TD-SCDMA UE standard) with predefined settings
	ESpectrum	Check of signal power (spectrum emission mask)
	OBANdwidth OBWidth	Measurement of occupied bandwidth
	PVTime	Measurement of power versus time
	CDPower	Code domain analyzer measurement
	CCDF	Signal statistic measurements

Example:

```

"INST:SEL MTDS"           'Activate TD-SCDMA 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:       instrument-specific
    
```

:CONFigure<1>:CDPower:CTABLE:ORDER CODE | MIDamble

This command selects sorting of the channel table in code order or midamble order.

Features: *RST value: CODE
SCPI: instrument-specific

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

This command enables and disables the channel table. Enabling results in the measured channel table being saved as *RECENT* and enabled. After the *RECENT* channel table is enabled, another channel table can be selected with the `CONF:CDP:CTABLE:SElect` command.

Note: You must always enable the *RECENT* channel table first with the `CONF:CDP:CTAB:STAT` command and then use the `CONF:CDP:CTAB:SElect` command to select the channel table you require.

Example:

<pre>"INST:SEL MTDS "</pre> <pre>"INIT:CONT OFF "</pre> <pre>"INIT;*WAI "</pre> <pre>"CONF:CDP:CTAB ON "</pre> <pre>"CONF:CDP:CTAB:SEL 'CTAB_1' "</pre> <pre>"INIT;*WAI "</pre>	<pre>'Activate TD-SCDMA MS meaning</pre> <pre>'CDP relative on screen A and</pre> <pre>'Result Summary active on screen B</pre> <pre>'Select single sweep</pre> <pre>'Start measurement with synchronization</pre> <pre>'so that channel table can be enabled</pre> <pre>'Use predefined channel table</pre> <pre>'Select channel table</pre> <pre>'Start measurement with</pre> <pre>'synchronization</pre>
---	--

Example:

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

:CONFigure<1>:CDPower:CTABLE:SElect <string>

This command selects a predefined channel table file. Before using this command, you must have enabled the *RECENT* channel table by the `CONF:CDP:CTAB ON` command.

Example:

<pre>"INST:SEL MTDS "</pre> <pre>"INIT:CONT OFF "</pre> <pre>"INIT;*WAI "</pre> <pre>"CONF:CDP:CTAB ON "</pre> <pre>"CONF:CDP:CTAB:SEL 'CTAB_1' "</pre> <pre>"INIT;*WAI "</pre>	<pre>'Activate TD-SCDMA MS meaning</pre> <pre>'CDP relative on screen A and</pre> <pre>'Result Summary active on screen B</pre> <pre>'Select single sweep</pre> <pre>'Start measurement with synchronization</pre> <pre>'so that channel table can be enabled</pre> <pre>'Use predefined channel table</pre> <pre>'Select channel table</pre> <pre>'Start measurement with</pre> <pre>'synchronization</pre>
---	--

Features: *RST value: "RECENT"
SCPI: instrument-specific

:CONFigure:CDPower:CTABLE:NAME <file_name>

This command selects a channel table to edit or create. It is *not* used for analysis. In this context, see commands `CONF:CDP:CTAB:STAT` and `CONF:CDP:CTAB:SEL`.

Example:

<pre>"INST:SEL MTDS "</pre> <pre>"CONF:CDP:CTAB:NAME 'NEW_TAB' "</pre>	<pre>'Activate TD-SCDMA MS</pre> <pre>'Select table to edit</pre>
--	---

Features: *RST value: ""
SCPI: instrument-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 `CONF:CDP:CTAB:DATA`.

Example:

```
"INST:SEL MTDS" "Activate TD-SCDMA MS"
"CONF:CDP:CTAB:NAME 'NEW_TAB'" "Select table to edit"
"CONF:CDP:CTAB:COMM 'Comment for NEW_TAB'"
```

Features:

```
*RST value: ""
SCPI: instrument-specific
```

:CONFigure:CDPower:CTABLE:MSHift 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16

This command defines the maximum number of midamble shifts in the channel table.

Beispiel:

```
"INST:SEL MTDS" "TD-SCDMA MS aktivieren"
"CONF:CDP:CTAB:NAME 'NEW_TAB'" "Tabelle zum Bearbeiten wählen"
"CONF:CDP:CTAB:MSHift 14" "14 Midamble-Shifts zulassen"
```

Eigenschaften:

```
*RST-Wert: 16
SCPI: gerätespezifisch
```

:CONFigure:CDPower:CTABLE:DATA 1|2|8|9, 0..4, 1..16, 0..2, 1..16, 0 | 1, 0, 0..

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

< Channel type >, <Code class>, <Code number>, <Modulation type>, <Midamble shift>, <Status>, <Reserved 1>, <Reserved 2>,

Channel type:	The channel type is coded with numbers as follows:
	1 = Midamble
	2 = DPCH
	8 = PRACH
	9 = PUSCH
Code class:	0-4
Code number:	1-16
Modulation type:	0 = invalid (for midamble)
	1 = QPSK
	2 = 8PSK
Midamble shift:	1-16
Status:	0: inactive, 1: active
	Can be used in a setting command to disable a channel temporarily.
Reserved 1:	Always 0, reserved for additions
Reserved 2:	Always 0, reserved for additions

Before using this command, you must set the name of the channel table using the `CONF:CDP:CTAB:NAME` command.

Example:

```
"INST:SEL MTDS" "Activate TD-SCDMA MS"
"CONF:CDP:CTAB:NAME 'NEW_TAB'" "Select table to edit"
"CONF:CDP:CTAB:DATA 2,4,1,1,1,1,0,0,
2,4,2,1,1,1,0,0" "Defines two data channels with QPSK
modulation"
```

Features:

```
*RST value: -
SCPI: instrument-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 the `CONF:CDP:CTAB:NAME` command.

Parameters: <file_name> ::= name of new channel table

Example:

```
"INST:SEL MTDS"           'Activate TD-SCDMA MS
"CONF:CDP:CTAB:NAME 'CTAB_1'" 'Select table to edit
"CONF:CDP:CTAB:COpy 'CTAB_2'" 'Copies CTAB_1 to C_TAB2
```

Features:

```
*RST value:  --
SCPI:        instrument-specific
```

The name of the channel table may consist of up to eight characters. This command is an event, so it has neither an *RST value nor a poll function.

:CONFigure:CDPower:CTABLE:DELeTe

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

Example:

```
"INST:SEL MTDS"           'Activate TD-SCDMA MS
"CONF:CDP:CTAB:NAME 'CTAB_2'" 'Select table to edit
"CONF:CDP:CTAB:DEL"       'Deletes CTAB_2
```

Features:

```
*RST value:  --
SCPI:        instrument-specific
```

This command is an event, so it has neither an *RST value nor a poll function.

:CONFigure:CDPower:CTABLE:CATalog?

This command polls the names of all channel tables saved on harddisk for TD-SCDMA MS.

The syntax of the output format is as follows:

```
<Sum of sizes of all subsequent files>,<Spare capacity on harddisk>,
<1st file name>,<1st file size>,<2nd file name>,,<2nd file size>,,...,<nth file name>,,
<nth file size>,,
```

Example:

```
"INST:SEL MTDS"           'Activate TD-SCDMA MS
"CONF:CDP:CTAB:CAT?"      'Poll catalog
```

Features:

```
*RST value:  --
SCPI:        instrument-specific
```

:CONFigure:CDPower:PVTime:SFRames

This command defines the number of subframes for averaging..

Example:

```
"INST:SEL MTDS"           'Activate TD-SCDMA MS
"CONF:CDP:MEAS PVT"       'Select Power Vs Time
"CONF:CDP:PVT:SFR 50"     'Set number of subframes
```

Features:

```
*RST-Wert:   100
SCPI:        instrument-specific
```

INSTrument subsystem

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

COMMAND	PARAMETER	UNITS	REMARKS
INSTrument [:SElect] :NSElect	SANalyzer MTDScdma <numeric_value>		

:INSTrument[:SElect] SANalyzer | MTDScdma

This command toggles between the operating modes by text parameters.

TD-SCDMA MS (MTDScdma) sets the unit to a defined status. The preset values are explained in Chapter 2, section "Basic settings in TD-SCDMA MS mode".

Example: "INST MTDS " 'Activate TD-SCDMA MS
Features: *RST value: SANalyzer
 SCPI: compliant

Switching to MTDS requires the option TD-SCDMA REV (MS) R&S FS-K77.

:INSTrument:NSElect 1 | 18

This command toggles between the operating modes by numbers.

Parameters: 1: spectral analysis mode
 18: TD-SCDMA REV (MS) mode

Example: "INST:NSEL 18 " 'Activate TD-SCDMA MS
Features: *RST value: 1
 SCPI: compliant

Switching to 18 requires the option TD-SCDMA REV (MS) R&S FS-K77.

SENSe:Power subsystem

In addition to the settings available in the basic unit, the autorange and timing routines can be started and the success can be polled within this subsystem. The numeric suffix for SENSE<1|2> is meaningless for this subsystem.

COMMAND	PARAMETER	EINHEIT	REMARKS
[SENSe<1 2>] :Power :ACHannel :AUTO :LTIMe :LTIMe? :SLOT:START :SLOT:STOP :PRESet :RLEVel :RLEVel?			result poll result poll

[SENSe<1|2>:]POWer:ACHannel:AUTO:LTIMe

This command starts the autorange routine for the reference level. This also creates the relationship between trigger and subframe start. Using an RF/IF power trigger, the trigger threshold is optimal adjusted.

Note: *Subsequent commands have to be synchronized with *WAI, *OPC or *OPC? to the end of the autorange process which would otherwise be aborted.*

Example: " :POW:ACH:AUTO:LTIM;*WAI " 'starts the autorange and timing routine

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

[SENSe<1|2>:]POWer:ACHannel:AUTO:LTIMe?

This command returns **PASSED,<trigger to frame in seconds>,0.000** on successful level adjustment or **FAILED,0.000,0.000** if no optimum settings could be found.

Example: " :POW:ACH:AUTO:LTIM? " 'returns PASSED, 8.002e-004, 0.000

[SENSe<1|2>:]POWer:ACHannel:SLOT:START 1 ... 7

This command allows entry of the start slot for gated sweep mode. The gated mode is on between *START SLOT* and *STOP SLOT*.

Beispiel: " :POW:ACH:SLOT:STAR 3 " 'set slot 3 as start slot

Features: *RST-value: 4
SCPI: instrument-specific

SENSe:CDPower subsystem

This subsystem sets the parameters for code domain measurement mode. The numeric suffix for SENSE<1|2> is meaningless for this subsystem.

COMMAND	PARAMETER	UNITS	REMARKS
[SENSe<1 2>] :CDPower :SCODE :MSHift :IQLength :ICTReshold :QINVert :SBANd :NORMalize :LEVel :ADJust :CODE :SLOT	<numeric_value> <numeric_value> <numeric_value> <numeric_value> ON OFF NORMAl INVert ON OFF <numeric_value> <numeric_value>	DB	

:[SENSe:]CDPower:SCODE 0...127

This command sets the scrambling code of the mobile station.

Example:

```
"INST:SEL MTDS"
"INIT:CONT OFF"
"CDP:SCOD 51"
"INIT;*WAI"
```

'Activate TD-SCDMA MS meaning
'CDP relative on screen A and
'Result Summary active on screen B
'Select single sweep
'Set scrambling code
'Start measurement with
synchronization

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

:[SENSe:]CDPower:MSHift 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16

This command sets the maximum number of midamble shifts.

Example:

```
"INST:SEL MTDS"
"CDP:MSH 10"
```

'Activate TD-SCDMA MS
'Maximum midamble shift of 10

Features: *RST value: 16
SCPI: instrument-specific

:[SENSe:]CDPower:IQLength 2...63

This command sets the IQ capture length in multiples of slots. The range is from 2 to 63.

Example:

```
"INST:SEL MTDS"
"INIT:CONT OFF"
"CDP:IQL 8"
"INIT;*WAI"
```

'Activate TD-SCDMA MS meaning
'CDP relative on screen A and
'Result Summary active on screen B
'Select single sweep
'8 slots capture length
'Start measurement with synchronization

Features: *RST value: 7
SCPI: instrument-specific

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

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

Example:

"INST:SEL MTDS"	'Activate TD-SCDMA MS meaning
	'CDP relative on screen A and
	'Result Summary active on screen B
"INIT:CONT OFF"	'Select single sweep
"CDP:ICTR -10DB"	'Threshold on -10 dB
"INIT;*WAI"	'Start measurement with
	'synchronization

Features:

*RST value:	-40 dB
SCPI:	instrument-specific

:[SENSe:]CDPower:QINVert ON | OFF

This command inverts the sign of the signal Q component.

Example:

"INST:SEL MTDS"	'Activate TD-SCDMA MS meaning
	'CDP relative on screen A and
	'Result Summary active on screen B
"INIT:CONT OFF"	'Select single sweep
"CDP:QINV ON"	'Enable invert Q component
"INIT;*WAI"	'Start measurement with
	'synchronization

Features:

*RST value:	OFF
SCPI:	instrument-specific

:[SENSe:]CDPower:SBANd NORMal | INVert

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

Example:

"INST:SEL MTDS"	'Activate TD-SCDMA MS meaning
	'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:	instrument-specific

:[SENSe:]CDPower:NORMalize ON | OFF

This command enables and disables elimination of the IQ offset.

Example:

"INST:SEL MTDS"	'Activate TD-SCDMA MS meaning
	'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 disabled
"INIT;*WAI"	'Start measurement with
	'synchronization

Features:

*RST value:	OFF
SCPI:	instrument-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 unit is put into *RF ATTEN MANUAL* mode to optimize RF attenuation and IF gain independently of each other. This mode is retained after changing from TD-SCDMA MS mode to *SPECTRUM* mode.

Example:

"INST:SEL MTDS"	'Activate TD-SCDMA MS meaning
	'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:	instrument-specific

This command is an event, so it has neither an *RST value nor a poll function.

:[SENSe<1|2>:]CDPower:CODE 1..16

This command selects the code number.

Example:

"INST:SEL MTDS"	'Activate TD-SCDMA MS meaning
	'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:	instrument-specific

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

The command selects the slot.

Example:

"INST:SEL MTDS"	'Activate TD-SCDMA MS meaning
	'CDP relative on screen A and
	'Result Summary active on screen B
"INIT:CONT OFF"	'Select single sweep
"CDP:SLOT 4"	'Selects slot 4
"INIT;*WAI"	'Start measurement with
	'synchronization

Features:

*RST value:	0
SCPI:	instrument-specific

TRACe subsystem**:TRACe[:DATA]** TRACE1 | TRACE2

This command transfers trace data from the controller to the unit, the poll command reads trace data from the unit.

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

The trace data (TRACE1 | TRACE2) are formatted as follows for the different displays:

CODE DOMAIN POWER ABSOLUTE / CODE DOMAIN POWER RELATIVE (TRACE1)

The following is output for each channel:

Code class	Code class of channel, values between 0 and 4
Code number	Code number of channel, values between 1 and 16
Level	- For <i>CODE POWER ABS</i> in dBm - For <i>CODE POWER REL</i> in dB
Power detection	0 - inactive channel 1 - active channel

Thus four values are transferred for all channels:

<Code class>, <Code number>, <Level>, <Power detection>

A maximum of 16 channels are read out, channels belonging together are read out as one channel.

Example: The example shows the results of the poll for three active channels with the following configuration:

DPCH	1.16	(CC 4)	-7.0 dB
DPCH	2.8	(CC 3)	-7.3 dB
DPCH	3.4	(CC 2)	-8.0 dB

"INST:SEL MTDS"

'Activate TD-SCDMA MS meaning
'CDP relative on screen A and
'Result Summary active on screen B
'Select single sweep
'Start measurement with
'synchronization
'Read out CDP relative

"INIT:CONT OFF"

"INIT;*WAI"

"TRAC? TRACE1"

```
4, 1, -7.0, 1,
4, 2, -55.1, 0,
3, 2, -7.3, 1,
4, 5, -56.3, 0,
4, 6, -55.8, 0,
4, 7, -57.0, 0,
4, 8, -56.7, 0,
2, 3, -8.0, 1,
4, 13, -55.8, 0,
4, 14, -56.3, 0,
4, 15, -55.9, 0,
4, 16, -57.3, 0
```


CODE DOMAIN ERROR POWER (TRACE1)

The following is output for each channel:

Code class	Code class of channel, values between 0 and 4
Code number	Code number of channel, values between 1 and 16
Error power	in dB
Power detection	0 - inactive channel 1 - active channel

Thus four values are transferred for all channels:

<Code class>, <Code number>, <Level>, <Power detection>

An error power is output for the CDEP, so consolidation of the power values is not meaningful. The number of output codes therefore generally corresponds to the spreading factor 16.

Example:

The example shows the results of the poll for three active channels with the following configuration:

DPCH	1.16	(CC 4)	-7.0 dB
DPCH	2.8	(CC 3)	-7.3 dB
DPCH	3.4	(CC 2)	-8.0 dB

"INST:SEL MTDS"

'Activate TD-SCDMA MS meaning

'CDP relative on screen A and

'Result Summary active on screen B

"INIT:CONT OFF"

'Select single sweep

"CALC2:FEED `XTIM:CDEP'"

'Code domain error power evaluation

"INIT;*WAI"

'Start measurement with

'synchronization

"TRAC? TRACE1"

'Read out CDP relative

```
4, 1, -54.5, 1,
4, 2, -55.1, 0,
4, 3, -56.3, 1,
4, 4, -56.2, 1,
4, 5, -56.3, 0,
4, 6, -55.8, 0,
4, 7, -57.0, 0,
4, 8, -56.7, 0,
4, 9, -56.2, 1,
4, 10, -56.5, 1,
4, 11, -55.8, 1,
4, 12, -55.9, 1,
4, 13, -55.8, 0,
4, 14, -56.3, 0,
4, 15, -55.9, 0,
4, 16, -57.3, 0
```

CHANNEL TABLE (TRACE1)

The following is output for each channel:

Channel type	The channel type is coded by numbers as follows: 0 = inactive 1 = midamble 2 = DPCH 8 = PRACH 9 = PUSCH
Code class	Code class of channel, values between 0 and 4
Code number	Code number of channel, values between 1 and 16
Modulation type	Modulation type of channel 0 = invalid (for midamble) 1 = QPSK 2 = 8PSK
Absolute level	In dBm
Relative level	In dB
Midamble shift	Values between 1 and 16
Δ MidD1	Power offset between sum power of channels (belonging to midamble(k), only data field 1) and midamble(k) Power
Δ MidD2	Power offset between sum power of channels (belonging to midamble(k), only data field 2) and midamble(k) Power
reserved 1	Reserved for additions
reserved 2	Reserved for additions

The class specifies the spreading factor of the channel

Class 4 is the highest spreading factor (16, data rate 17.6 kbps for QPSK, data rate 26.4 kbps for 8PSK), class 0 is the lowest spreading factor (1, data rate 281.6 kbps for QPSK, data rate 422.4 kbps for 8PSK).

Thus 11 values are transferred for all channels:

<Channel type>, <Code class>, <Code number>, <Modulation type>, <Absolute level in dBm>, <Relative level in dB>, <Midamble shift>, < Δ MidD1>, < Δ MidD2>, <Reserved 1>, <Reserved 2>

In code sorting (CONF:CDP:CTAB:ORD CODE), first all midambles are output, then the control channels, and finally the data channels in ascending order of code number.

In midamble sorting (CONF:CDP:CTAB:ORD MID), first the midamble is output and then its control and data channels.

Example:

The example shows the results of the poll for three channels in common midamble allocation with the following configuration:

```

Midamble m(3)          -3.0 dBm
DPCH  1.16             QPSK          -7.78 dBm
DPCH  2.8              QPSK          -7.78 dBm
DPCH  3.4             8PSK          -7.78 dBm

"INST:SEL MTDS"       'Activate TD-SCDMA MS meaning
                      'CDP relative on screen A and
                      'Result Summary active on screen B

"INIT:CONT OFF"      'Select single sweep

"CALC2:FEED `XTIM:CDP:ERR:CTAB`"
                      'Channel table evaluation

"INIT;*WAI"          'Start measurement with synchronization

"TRAC? TRACE1"      'Read out channel table

```

```

1, 0, 0, 0, -3.0, 0, 3, 0.005, 0.005, 0, 0
2 , 4, 1, 1, -7.78, -4.78, 3, 0, 0, 0, 0
2 , 3, 2, 1, -7.78, -4.78, 3, 0, 0, 0, 0
2 , 2, 3, 2, -7.78, -4.78, 3, 0, 0, 0, 0
0 , 4, 2, 1, -46.9, -43.9, 3, 0, 0, 0, 0
0 , 4, 5, 1, -46.9, -43.9, 3, 0, 0, 0, 0
0 , 4, 6, 1, -46.9, -43.9, 3, 0, 0, 0, 0
0 , 4, 7, 1, -46.9, -43.9, 3, 0, 0, 0, 0
0 , 4, 8, 1, -46.9, -43.9, 3, 0, 0, 0, 0
0 , 4, 13, 1, -46.9, -43.9, 3, 0, 0, 0, 0
0 , 4, 14, 1, -46.9, -43.9, 3, 0, 0, 0, 0
0 , 4, 15, 1, -46.9, -43.9, 3, 0, 0, 0, 0
0 , 4, 16, 1, -46.9, -43.9, 3, 0, 0, 0, 0

```

RESULT SUMMARY (TRACE2)

This command polls the measured and calculated values of code domain power analysis. The results are provided for the channel to which the code selected by the `CDPower:CODE` command belongs.

Parameters:

Global results of selected slot:

SLOT	Slot number		
PDATA	Power data fields in dBm	FERRor	Frequency error in Hz
PD1	Power data field 25.40 mm dBm	CERRor	Chip rate error in ppm
PD2	Power data field 2 in dBm	TFRame	Trigger to frame
PMIDamble	Power midamble in dBm	IQIMbalance	IQ imbalance in %
RHO	RHO	IQOFset	IQ offset in %
MACCuracy	Composite EVM in %	ACTive	Number of active channels
PCDerror	Peak code domain error in dB		

Channel results:

SRATe	Data rate in kbps
CHANnel	Channel number
SFACTor	Spreading factor of channel
CDPRelative	Channel power relative in dB
CDPabsolute	Channel power absolute in dBm
EVMRms	Error vector magnitude RMS in %
EVMPeak	Error vector magnitude Peak in %

The results of *RESULT SUMMARY* are output in the following order:

```

<SLOT>, <PDATa>, <PD1>, <PD2>, <PMIDamble>, <RHO>, <MACCuracy>, <PCDerror>,
<FERRor>, <CERRor>, <TFRame>, <IQIMbalance>, <IQOFset>, <ACTive>, <SRATe>,
<CHANnel>, <SFACTor>, <CDPRelative>, <CDPabsolute>, <EVMRms>,
<EVMPeak>, <Reserved 1>, <Reserved 2>, <Reserved 3>, <Reserved 4>

```

The results have the following meanings and units:

Global results of selected slot:

SLOT	Slot number		
PDATA	Power data fields in dBm	FERRor	Frequency error in Hz
PD1	Power data field 25.40 mm dBm	CERRor	Chip rate error in ppm
PD2	Power data field 2 in dBm	TFRame	Trigger to frame
PMIDamble	Power midamble in dBm	IQIMbalance	IQ imbalance in %

RHO	RHO	IQOffset	IQ offset in %
MACCuracy	Composite EVM in %	ACTive	Number of active channels
PCDerror	Peak code domain error in dB		

Channel results:

SRATe	Data rate in kbps		
CHANnel	Channel number		
SFACtor	Spreading factor of channel		
CDPRelative	Channel power relative in dB	CDPabsolute	Channel power absolute in dBm
EVMRms	Error vector magnitude RMS in %		
EVMPeak	Error vector magnitude in %		

Note:

The trigger to frame (*TFRame*) value produces a "9" if the trigger is not set to EXTERN.

POWER VS SLOT ABS / REL (TRACE2)

The number of returned value tripels corresponds to the IQ capture length.

(See *CDPower: IQLength* command, range 2 to 63.)

POWER VS SLOT ABS: <Slot number>, <Level in dBm>, <Validity>,.....;

POWER VS SLOT REL: <Slot number>, <Level in dB>, <Validity>,.....;

Validity is coded as follows:

0 = inactive (channel not occupied)

1 = active (channel occupied)

2 = alias (code class of channel < 4, i.e. several channels belong together)

PK CODE DOM ERR and COMPOSITE EVM (TRACE2)

The number of returned value pairs corresponds to the IQ capture length.

(See *CDPower: IQLength* command, range 2 to 63.)

PK CODE DOM ERR: <Slot number>, <Level in dB>,

COMPOSITE EVM: <Slot number>, <Value in %>,

SYMBOL EVM (TRACE2)

The number of values depends on the spreading factor:

Spreading factor 16:	44 values	Spreading factor 8:	88 values
----------------------	-----------	---------------------	-----------

Spreading factor 4:	176 values	Spreading factor 2:	352 values
---------------------	------------	---------------------	------------

Spreading factor 1:	704 values		
---------------------	------------	--	--

<Value in % symbol 0>, <Value in % symbol 1>,.....;

POWER VS SYMBOL (TRACE2)

The number of values depends on the spreading factor:

Spreading factor 16:	44 values	Spreading factor 8:	88 values
----------------------	-----------	---------------------	-----------

Spreading factor 4:	176 values	Spreading factor 2:	352 values
---------------------	------------	---------------------	------------

Spreading factor 1:	704 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 16:	44 values	Spreading factor 8:	88 values
Spreading factor 4:	176 values	Spreading factor 2:	352 values
Spreading factor 1:	704 values		

Real and imaginary parts are transferred as value pairs.

<re 0>, <im 0>, <re 1>, <im 1>, <re n>, <im n>

COMPOSITE CONST (TRACe2):

The number of value pairs corresponds to the chip number of 704 data chips in a slot. Real and imaginary parts are transferred as value pairs:

<re chip 0>, <im chip 0>, <re chip 1>, <im chip 1>,.....;

BIT STREAM (TRACE2)

The bit stream of a channel is output. A value is output for each bit (range 0, 1), each symbol consists of two bits for QPSK channels and three bits for 8PSK channels.

The number of values depends on the spreading factor in QPSK:

Spreading factor 16:	88 values	Spreading factor 2:	704 values
Spreading factor 8:	176 values	Spreading factor 1:	1408 values
Spreading factor 4:	352 values		

In 8PSK:

Spreading factor 16:	132 values	Spreading factor 2:	1056 values
Spreading factor 8:	264 values	Spreading factor 1:	2112 values
Spreading factor 4:	528 values		

STATUS:QUESTIONABLE:SYNC register

This register contains information on the error situation in code domain power analysis of the FS-K77 option.

It can be polled with the commands "STATUS:QUESTIONABLE:SYNC:CONDITION?" and "STATUS:QUESTIONABLE:SYNC[:EVENT]?".

Table 6-1 Meaning of bits in STATUS:QUESTIONABLE:SYNC register

Bit no.	Meaning
0	Not used in FS-K77 application
1	<p>K77 Frame sync failed</p> <p>This bit is set when synchronization is not possible within the application. The reasons for this can be:</p> <ul style="list-style-type: none"> Wrongly set frequency Wrongly set level Wrongly set scrambling code Wrongly set max. number MA Shifts Cell Wrongly set values for <i>INVERT Q</i> or <i>SIDE BAND INV</i> Invalid signal on input
2 to 14	Not used in the FS-K77 application.
15	This bit is always 0.

Table of softkeys with assignment of IEC/IEEE bus commands

MEAS key or MEAS hotkey

POWER	:CONFigure<1>:CDPower:MEASurement PWeR Result poll: :CALCulate<1>:MARKer<1>:FUNction:POWer:RESult? CPOWer
ADAPT TO SIGNAL	
AUTO LEVEL&TIME	:SENS:POW:ACH:AUTO:LTIME Result poll: SENS:POW:ACH:AUTO:LTIME?
START SLOT	:SENS:POW:ACH:SLOT:START <num_value>
STOP SLOT	:SENS:POW:ACH:SLOT:STOP <num_value>
ACLR	:CONFigure<1>:CDPower:MEASurement ACLR Result poll: 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:TIME 1 s
NOISE CORR ON OFF	:SENS:POW:NCORR ON
FAST ACLR ON OFF	:SENS:POW:HSP ON
DIAGRAM FULL SIZE	-
ADAPT TO SIGNAL	
AUTO LEVEL&TIME	:SENS:POW:ACH:AUTO:LTIME Result poll: SENS:POW:ACH:AUTO:LTIME?
START SLOT	:SENS:POW:ACH:SLOT:START <num_value>
STOP SLOT	:SENS:POW:ACH:SLOT:STOP <num_value>
ACLR LIMIT CHECK	:CALC:LIM:ACP ON :CALC:LIM:ACP:ACH:RES? :CALC:LIM:ACP:ALT:RES?

EDIT ACLR LIMIT	<pre>: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</pre>
ADJ CHAN SPACING	<pre>:SENS:POW:ACH:SPAC:ACH 1.6MHz :SENS:POW:ACH:SPAC:ALT1 3.2MHz :SENS:POW:ACH:SPAC:ALT2 4.8MHz</pre>
ACLR ABS REL	<pre>:SENS:POW:ACH:MODE ABS</pre>
CHAN PWR / HZ	<pre>:CALC:MARK:FUNC:POW:RES:PHZ ON OFF</pre>
SPECTRUM EM MASK	<pre>:CONFigure:CKPower:MEASurement ESpectrum</pre> <p>Result poll: CALCulate<1>:LIMit<1>:FAIL?</p>
LIMIT LINE AUTO	<pre>:CALC:LIM:ESP:MODE AUTO</pre>
LIMIT LINE USER	<pre>: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</pre>
	<p>Notes:</p> <ul style="list-style-type: none"> -If the Y values are entered with the command :CALCulate:LIMit<1>:LOWer[:DATA], the limit check is failed if the values are below the limit line. -If a user-defined limit line is enabled, this has priority over limit lines selected with AUTO
RESTORE STD LINES	<pre>:CALC:LIM:ESP:RESTore</pre>
ADAPT TO SIGNAL	
AUTO LEVEL&TIME	<pre>:SENS:POW:ACH:AUTO:LTIME</pre> <p>Result poll: SENS:POW:ACH:AUTO:LTIME?</p>
START SLOT	<pre>:SENS:POW:ACH:SLOT:START <num_value></pre>
STOP SLOT	<pre>:SENS:POW:ACH:SLOT:STOP <num_value></pre>

OCCUPIED BANDWIDTH	:CONFigure<1>:CDPower:MEASurement OBANdwidth Result poll: CALCulate<1>:MARKer<1>:FUNction:POWer:RESult? OBANdwidth
% POWER BANDWIDTH	:SENS:POW:BWID 99PCT
ADJUST SETTINGS	:SENS:POW:PRES OBW
ADAPT TO SIGNAL	
AUTO LEVEL&TIME	:SENS:POW:ACH:AUTO:LTIME Result poll: SENS:POW:ACH:AUTO:LTIME?
START SLOT	:SENS:POW:ACH:SLOT:START <num_value>
STOP SLOT	:SENS:POW:ACH:SLOT:STOP <num_value>
POWER VS TIME	:CONFigure:CDPower:MEASurement PVTime
RESTORE STD LINES	:CALC:LIM:PVTime:RESTore
NO OF SUBFRAMES	:CONFigure:CDPower:PVTime:SFRames <num_value>
ADAPT TO SIGNAL	
CODE DOM ANALYZER	:CONFigure:CDPower:MEASurement CDPower
SIGNAL STATISTIC	:CONFigure:CDPower:MEASurement CCDF oder :CALCulate:STATistics[:BTS]:CCDF[:STATe] ON Result Poll: CALCulate:MARKer:X?
APD	:CALC:STAT:APD ON
CCDF	:CALC:STAT:CCDF ON
PERCENT MARKER	:CALC:MARKr:Y:PERC 0...100%
NO OF SAMPLES	CALC:STAT:NSAM <value>
SCALING	
X-AXIS REF LVL	: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 SETTINGSL	:CALC:STAT:PRES
ADAPT TO SIGNAL	
AUTO LEVEL&TIME	:SENS:POW:ACH:AUTO:LTIME Result poll: SENS:POW:ACH:AUTO:LTIME?
START SLOT	:SENS:POW:ACH:SLOT:START <num_value>
STOP SLOT	:SENS:POW:ACH:SLOT:STOP <num_value>
CONT MEAS	:INIT:CONT ON; :INIT:IMM
SINGLE MEAS	:INIT:CONT OFF; :INIT:IMM

RESULTS hotkey or 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	:CALCulate<2>:FEED "XTIM:CDP:MACCuracy"
PK CODE DOM ERR	:CALCulate<2>:FEED "XTIM:CDP:ERR:PCDomain"
POWER VS SLOT:	:CALCulate<2>:FEED "XTIM:CDP:PVSLOT:RAT" (relative) :CALCulate<2>:FEED "XTIM:CDP:PVSLOT" (absolute)
RESULT SUMMARY	:CALCulate<2>:FEED "XTIM:CDP:ERR:SUMM" Poll result: :CALCulate<1 2>:MARKer<1>:FUNction:CDPower:RESult? SLOT PDATA PD1 PD2 PMIDamble RHO MACCuracy PCDerror FERRor CERRor TFRame IQIMBalance IQOffset ACTive SRATe CHANnel SFACTOR CDPRelative CDPabsolute EVMRms EVMPeak
SELECT CHANNEL	:[SENSe:]CDPower:CODE 0..0.15
SELECT SLOT	:[SENSe:]CDPower:SLOT 0 ... (IQ_CAPTURE_LENGTH-1)
ADJUST REF LVL	:SENS:POW:ACH:PRES:RLEV
CHANNEL TABLE	:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABLE"
CH TABLE CODE	:CONFigure:CDPower:CTABLE:ORDER CODE
CH TABLE MIDAMBLE	:CONFigure:CDPower:CTABLE:ORDER MIDamble
SYMBOL CONST	:CALCulate<2>:FEED "XTIM:CDP:SYMB:CONS"
SYMBOL EVM	:CALCulate<2>:FEED "XTIM:CDP:SYMB:EVM"
BIT STREAM	:CALCulate<2>:FEED "XTIM:CDP:BSTream"
COMPOSITE CONST	:CALCulate<2>:FEED "XTIM:CDP:COMP:CONS"
POWER VS SYMBOL	:CALCulate<2>:FEED "XTIM:CDP:PVSY"
SELECT CHANNEL	:[SENSe:]CDPower:CODE 1...16
SELECT SLOT	:[SENSe:]CDPower:SLOT 0 ... (IQ_CAPTURE_LENGTH-1)

ADJUST
REF LVL

:SENS:POW:ACH:PRES:RLEV

Result poll: :SENS:POW:ACH:PRES:RLEV?

CHAN CONF hotkey

CODE CHAN AUTOSEARCH	:CONFigure:CDPower:CTable[:STate] OFF
CODE CHAN PREDEFINED	:CONFigure:CDPower:CTable[:STate] ON :CONFigure:CDPower:CTable:SElect <channel table name>
EDIT CHAN CONF TABLE	---
NEW CHAN CONF TABLE	---
HEADER VALUES	CONFigure:CDPower:CTable:NAME "NEW_TAB" CONFigure:CDPower:CTable:DATA <numeric>,... CONFigure:CDPower:CTable:COMment "comment" CONFigure:CDPower:CTable:MSHift <numeric> CONFigure:CDPower:CTable:CATalog?
ADD SPECIAL	---
INSERT LINE	---
DELETE LINE	---
MEAS CHAN CONF TABLE	---
SAVE TABLE	---
SELECT SLOT	:[SENSE:]CDPower:SLOT 0 ... (IQ_CAPTURE_LENGTH-1)
SORT CODE	---
SORT MIDAMBLE	---
DEL CHAN CONF TABLE	:CONFigure:CDPower:CTable:DElete
COPY CHAN CONF TABLE	:CONFigure:CDPower:CTable:COPY "CTAB2"

SETTINGS hotkey

SCRAMBLING CODE	:CONFigure:CCDPower:SCODE 0..127
MA SHIFTS CELL	:[SENSe:]CDPower:MSHift 2 4 6 8 10 12 14 16
CAPTURE LENGTH	:[SENSe:]CDPower:IQLength 2..63
INACT CHAN THRESHOLD	:[SENSe:]CDPower:ICTReshold -100 dB ... 0 dB
CODE PWR ABS REL	:CALCulate<1>:FEED "XPOW:CDP:RAT" (relative) :CALCulate<1>:FEED "XPOW:CDP" (absolute) :CALCulate<2>:FEED "XTIM:CDP:PVSL:RAT" (relative) :CALCulate<2>:FEED "XTIM:CDP:PVSL" (absolute)
INVERT Q ON OFF	:[SENSe]:CDP:QINVert ON OFF
SIDE BAND NORN INV	:[SENSe:]CDPower:SBAND NORMAl INVert
NORMALIZE ON OFF	:[SENSe:]CDPower:NORMAlize ON OFF

7 Checking Rated Specifications

- Power off the analyzer before removing or inserting modules.
- Before powering the unit on, check the position of the line voltage selector (230 V).
- Measure the rated specifications after a warmup time of at least 30 min and completion of system error correction of the analyzer and the R&S SMIQ. This is the sole way of ensuring that rated specifications are maintained.
- Unless otherwise specified, all settings are made proceeding 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. [FREQ].

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

[<nn unit>] Enter a value + terminate the entry with the unit, e.g. [12 kHz].

- The values in the following sections are not guaranteed. Only the specifications of the data sheet are binding.

Measuring equipment and accessories

Item	Instrument type	Recommended characteristics	Recommended equipment	R&S order no.	Uses
1	Signal generator	Vector signal generator	R&S SMIQ with options: SMIQB20 SMIQB11 SMIQB60 SMIQK14 SMIQ-Z5 PARADATA	1125.5555.xx 1125.5190.02 1085.4502.04 1136.4390.02 1105.1383.02 1104.8555.02	
2	Controller for generating signals with R&S WinIQSIM A PC that is either connected to the R&S SMIQ by a serial cable or has an IEC/IEEE bus card and is connected to the R&S SMIQ by an IEC/IEEE bus cable. Installed on this PC is the R&S WinIQSIM Software 4.00 or higher. This software can be downloaded from the Rohde & Schwarz Internet site .				

Test sequence

The performance test refers exclusively to results of the code domain analyzer.

There is no need to check the results of POWER, ACLR and SPECTRUM measurements, since they are already covered by the performance test of the basic unit.

If you have not already done so, first generate the WinIQSIM file with the TD-SCDMA signal and transfer it to the R&S SMIQ under the name TDS_UE. This is explained in Chapter "Generating TD-SCDMA signal with R&S WinIQSIM" on page 10.

Default settings on
R&S SMIQ:

```
[PRESET]
[LEVEL:           0 dBm]
[FREQ:           2020.0 MHz]
ARB MOD
  SET SMIQ ACCORDING TO WAVEFORM ...
    SET SMIQ ACCORDING TO WAVEFORM ...    ON
    TRIGGER OUT MODE                      ON
```

(These settings are only needed once after presetting the generator and serve for automatically adopting the trigger setting from the waveform file generated by R&S WinIQSIM in ARB MOD. This is especially convenient when changing between different waveforms.)

```
SELECT WAVEFORM... Select name 'TDS_UE'
STATE:      ON
```

Default settings on
analyzer:

```
[PRESET]
[CENTER:         2020.0 MHz]
[AMPT:           10 dBm]
[TDS UE]
[TRIG             EXTERN]
[RESULTS         SELECT SLOT 1]
[RESULTS         CHANNEL TABLE]
```

Test setup and other
settings:

- Connect the RF output of the R&S SMIQ to the RF input of the analyzer.
- Connect the external trigger input of the analyzer to the TRIG1 port of the Z5 PARADATA BNC Adapter.
- Connect the external reference output of the analyzer to the R&S SMIQ.

```
R&S SMIQ  UTILITIES
          REF OSC
          SOURCE: EXT

Analyzer  [SETUP:           REFERENCE EXT]
```

The measurement result displayed on the screen of the analyzer should now be as follows:



BS,TDS:CHANNEL TAB

		CF 2 GHz		Chan 1.16		Slot 4				
Type	Chan.SF	Data Rate	Mod	Pwr.Abs	Pwr.Rel	MA.shift	ΔMiD1	ΔMiD2		
		kbps	Type	dBm	dB		dB	dB		
Ref	Midamble	---	---	-1.17	0.00	8	0.00	0.00	A	
9.00	DPCH	1.16	QPSK	-10.21	-9.04	8	---	---		
dBm	DPCH	2.16	QPSK	-10.19	-9.02	8	---	---		
Att	DPCH	3.16	QPSK	-10.20	-9.03	8	---	---	TRG	
35 dB	DPCH	4.16	QPSK	-10.20	-9.03	8	---	---		
	DPCH	5.16	QPSK	-10.21	-9.04	8	---	---		
	DPCH	6.16	QPSK	-10.20	-9.03	8	---	---		
1	DPCH	7.16	QPSK	-10.20	-9.03	8	---	---		
CLRWR	DPCH	8.16	QPSK	-10.20	-9.02	8	---	---		
	---	9.16	---	-51.90	-50.73	--	---	---		

PRN

RESULT SUMMARY TABLE

DR 17.6 ksps

Chan 1.16

CF 2 GHz

Slot 4

		GLOBAL RESULTS			
Ref	Chip Rate Error	1.54 ppm	Trg to Frame	82 ns	B
9.00	SLOT RESULTS				
dBm	P Data	-1.17 dBm	Carr Freq Err	-2.72 kHz	
	P D1	-1.17 dBm	IQ Imbal/Offs	0.03/0.22 %	
Att	P D2	-1.17 dBm	RHO	0.9999	
35 dB	P Midamble	-1.17 dBm	Composite EVM	1.21 %	
	Active Channels	8	Pk CDE(SF 16)	-49.30 dB	
1	CHANNEL RESULTS				
CLRWR	Channel.SF	1.16	Data Rate	17.6 kbps	
	ChannelPwr Rel	-9.04 dB	ChannelPwr Abs	-10.21 dBm	
	Symbol EVM	0.72 %rms	Symbol EVM	1.27 %Pk	

8 Glossary

CDEP	Code domain error power
CDP	Code domain power
Composite EVM	According to 3GPP2 specifications, the square root of the squared error between the real and the imaginary parts of the test signal and an ideally generated reference signal is determined (EVM referred to the total signal) in composite EVM measurement
Crest factor	Ratio of peak to average value of the signal
Inactive channel threshold	Minimum power that a single channel must have compared with the total signal to be identified as an active channel
Midamble shift	Number for a segment of a basic midamble
MS	Mobile station. Synonymous to UE.
RRC filter	Root raised cosine filter, for TD-SCDMA with rolloff of 0.22
S-CCPCH	Secondary common control physical channel
SF	Spreading factor
Slot	In TD-SCDMA, name for 864 chips or a time slot of 675 μ s
UE	User Equipment. Synonymous to MS.
x.y	Channel number x.y, where: x is the code number, y is the spreading factor of the channel

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