ROHDE&SCHWARZ

Test and Measurement
Division

Operating Manual

3GPP FDD UE Transmitter Test

Application Firmware Module R&S FS-K73

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Dear Customer,

throughout this manual, FS-K73 is generally used as an abbreviation for the software option R&S FS-K73. The Spectrum Analyzers R&S FSU and R&S FSP are abbreviated as FSU and FSP.

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Contents of Manual for Application Firmware FS-K73

This manual contains all information on the operation of spectrum analyzer FSP/FSU equipped with Application Firmware FS-K73. It includes operation via menus and the remote-control commands for the 3GPP FDD user equipment test.

The manual comprises the data sheet and 10 chapters:

The data sheet   informs on the guaranteed specifications and the firmware characteristics.

Chapter 1   describes how to enable the application firmware module.

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

Chapter 3   describes the measurement setup for user equipment tests.

Chapter 4   describes the channel configurations for user equipments.

Chapter 5   gives a schematic overview of the FS-K73 control menus.

Chapter 6   contains a detailed description of the possible user equipment test measurements as a reference for manual operation. The chapter also presents a list of remote-control commands associated with each function.

Chapter 7   describes all remote-control commands defined for the code domain measurement. An alphabetic list of all remote-control commands and a table of softkeys with the assignment of commands are given at the end of this chapter.

Chapter 8   contains the performance test.

Chapter 9   contains an explanation of terms related to measured quantities of the code domain measurement.

Chapter 10   contains the index of this operating manual.

This manual is a supplement to the FSP/FSU operating manual. It includes exclusively functions of Application Firmware FS-K73. For all other descriptions, please refer to the spectrum analyzers operating manual.

3GPP FDD User Equipment Test - Application Firmware FS-K73

Spectrum analyzers FSP and FSU equipped with Application Firmware FS-K73 perform code domain power measurements on uplink signals according to standard 3GPP (FDD mode). The application firmware is in line with standard 3GPP (Third Generation Partnership Project) with version Release 99. In addition to the code domain measurements prescribed by the standard 3GPP, the application offers measurements with predefined settings in the frequency domain, e.g. power and ACLR measurement.

1   Enabling the Firmware Option

Firmware Option FS-K73 is enabled in the *GENERAL SETUP* menu by entering a keyword. The keyword is delivered with the option. If the option is factory-installed, it is already enabled.

GENERAL SETUP menu:
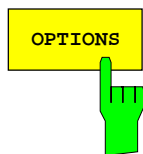
The *OPTIONS* softkey opens a submenu where keywords for new firmware options (application firmware modules) can be entered. Available options are displayed in a table, which is opened when entering the submenu.
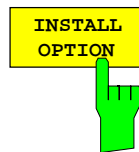
The *INSTALL OPTION* softkey activates the entry of the keyword for a firmware option.

One ore several keywords can be entered in the entry field. On entering a valid keyword, *OPTION KEY OK* is displayed on the message line and the option is entered in the *FIRMWARE OPTIONS* table.

In case of invalid keywords, *OPTION KEY INVALID* is displayed on the message line.

2 Getting Started

The following chapter explains basic 3GPP FDD user equipment tests by means of a setup with signal generator SMIQ. It describes how operating and measurement errors can be avoided using correct presetting.
The measurement screen is presented in chapter 6 for each measurement.

Key settings are shown as examples to avoid measurement errors. Following the correct setting, the effect of an incorrect setting is shown. The following measurements are performed:

- Measurement 1: Measuring the spectrum

- Measurement 2: Measurement of spectrum emission mask

- Measurement 3: Measurement of relative code domain power

    - Setting: Setting the analyzer center frequency to the DUT frequency
    - Setting: Scrambling code of signal

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

- Measurement 5: Measurement of composite EVM

- Measurement 6: Measurement of peak code domain error

The measurements are performed using the following units and accessories:

- Spectrum Analyzer FSU with Application Firmware FS-K73: 3GPP FDD user equipment test (the spectrum analyzer FSP can be used in the same way)
- Vector Signal Generator SMIQ with option SMIQB45: digital standard 3GPP
  (options SMIQB20 and SMIQB11 required)
- 1 coaxial cable, 50 Ω, approx. 1 m, N connector
- 1 coaxial cable, 50 Ω, approx. 1 m, BNC connector

Conventions for displaying settings on FSU:

[*<KEY>*]	Press a key on the front panel, e.g. *[SPAN]*
[<SOFTKEY>]	Press a softkey, e.g. *[MARKER -> PEAK]*
[<nn unit>]	Enter a value and terminate by entering the unit, e.g. *[12 kHz]*

Conventions for displaying settings on SMIQ:

[*<KEY>*]	Press a key on the front panel, e.g. *[FREQ]*
<MENU>	Select a menu, parameter or a setting, e.g. *DIGITAL STD.* The menu level is marked by an indentation.
<nn unit>	Enter a value and terminate by entering the unit, e.g. *12 kHz*

Basic Settings in Code Domain Measurement Mode

In the default setting after PRESET, FSU is in the analyzer mode. The following default settings of the code domain measurement are activated, provided the code domain measurement mode is selected.

Table 2-1 Default settings of the code domain measurement

Parameter	Setting
Digital standard	W-CDMA 3GPP REV
Sweep	CONTINUOUS
CDP mode	CODE CHAN AUTOSEARCH
Trigger settings	FREE RUN
Trigger offset	0
Scrambling code	0
Threshold value	-60 dB
Symbol rate	15 ksps
Code number	0
Slot number	0
I/Q branch	Q
Display	Screen A: CODE PWR RELATIVE Screen B: RESULT SUMMARY

Measurement 1: Measuring the Signal Power

The measurement of the spectrum gives an overview of the 3GPP FDD signal and the spurious emissions close to the carrier.

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

Settings on SMIQ: *[PRESET]*
                          [LEVEL: 0 dBm]
                          [FREQ: 2.1175 GHz]
                          DIGITAL STD
                              WCDMA/3GPP
                                  SET DEFAULT
                                  LINK DIRECTION   UP/REVERSE
                                  TEST MODELS (NOT STANDARDIZED)...
                                      C+D960K
                                          STATE: ON
Settings on FSU: *[PRESET]*
                          [CENTER: 2.1175 GHz]
                          [AMPT: 0 dBm]
                          [3G FDD UE]
                          [MEAS: POWER]

Measurement on FSU: The following is displayed:
                       • The spectrum of the 3GPP FDD signal on the trace
                       • The signal channel power within the 3.84 MHz channel bandwidth

Measurement 2: Measurement of Spectrum Emission Mask

The 3GPP specification defines a measurement, which monitors the compliance with a spectral mask in a range of at least ±12.5 MHz about the 3GPP FDD carrier. To assess the power emissions in the specified range, the signal power is measured in the range near the carrier by means of a 30kHz filter, in the ranges far off the carrier by means of a 1MHz filter. The resulting trace is compared to a limit line defined in the 3GPP specification.

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

Settings on SMIQ: ***[PRESET]***
                                 [LEVEL: *0 dBm**]*
                                 [FREQ: *2.1175 GHz**]*
                                 DIGITAL STD
                                         WCDMA/3GPP
                                              SET DEFAULT
                                              LINK DIRECTION   UP/REVERSE
                                              TEST MODELS (NOT STANDARDIZED)...
                                                        C+D960K
                                                                STATE: ON

Settings on FSU: ***[PRESET]***
                                 [CENTER: *2.1175 GHz**]*
                                 [AMPT: *0 dBm**]*
                                 [3G FDD UE]
                                 [MEAS: *SPECTRUM EM MASK**]*

Measurement on FSU:	The following is displayed:

- Spectrum of the 3GPP FDD signal
- Limit line defined in the standard
- Information on limit line violations (passed/failed)

Measurement 3: Measurement of Relative Code Domain Power

A code domain power measurement on one of the channel configurations is shown in the following. Basic parameters of CDP analysis are changed to demonstate the effects of non-signal-adapted values.

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

Settings on SMIQ:
[PRESET]
[LEVEL: 0 dBm]
[FREQ: 2.1175 GHz]
DIGITAL STD
    WCDMA 3GPP
        LINK DIRECTION   UP/REVERSE
        TEST MODELS (NOT STANDARDIZED)...
            C+D960K
        SELECT BS/MS
            MS 1 ON
                OVERALL SYMBOL RATE... 6*960
        STATE: ON

Settings on FSU:
[PRESET]
[CENTER: 2.1175 GHz]
[AMPT: 10 dBm]
[3G FDD UE]
[SETTINGS: SCRAMBLING CODE 0]

Measurement on FSU:
The following is displayed:
Screen A: Code domain power of signal, branch Q
             (channel configuration with 3 data channels on Q branch)
Screen B: Numeric results of CDP measurement

Setting: Synchronizing the reference frequencies

The synchronization of the reference oscillators both of the DUT and analyzer strongly reduces the measured 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 panel of SMIQ (coaxial cable with BNC connectors).

Settings on SMIQ: *As for measurement 2*

Settings on FSU: *As for measurement 2, plus*
                           [SETUP: REFERENCE EXT]

Measurement on FSU: Frequency error   The displayed frequency error should be < 10 Hz.

The reference frequencies of the analyzer and of the DUT should be synchronized

---

Setting: Behaviour with Deviating Center Frequency Setting

In the following, the behaviour of the DUT and the analyzer with wrong center frequency setting is shown.

Settings on SMIQ: ➢ Tune the center frequency of the signal generator in 0.5 kHz steps and watch the analyzer screen:

Measurement on FSU: • A CDP measurement on the analyzer is still possible with a frequency error of up to approx. 1 kHz. Up to 1 kHz, a frequency error causes no apparent difference in measurement accuracy of the code domain power measurement.
   • Above a frequency error of 1 kHz, the probability of an impaired synchronization increases. With continuous measurements, at times all channels are displayed in blue with almost the same level.
   • Above a frequency error of approx. 2 kHz, a CDP measurement cannot be performed. FSU displays all possible codes in blue with a similar level.

Settings on SMIQ: ➢ Set the signal generator center frequency again to 2.1175 GHz:
   [FREQ: 2.1175 GHz]

The analyzer center frequency should not differ from the DUT frequency by more than 2 kHz.

Setting: Behaviour with Incorrect Scrambling Code

A valid CDP measurement can only be carried out if the scrambling code set on the analyzer is identical to the one of the transmitted signal.

Test setup   *SELECT BS/MS*
   BS 1: ON
   SCRAMBLING CODE: 0001
   (the scrambling code is set to 0000 on the analyzer)

Settings on SMIQ: The CDP display shows all possible codes with approximately the same level.

Settings on FSU: Set scrambling code to new value:
   [SETTINGS: SCRAMBLING CODE 1]

Measurement on FSU: The CDP display again shows the channel configuration.

The scrambling code setting of the analyzer must be identical to that of the measured signal.

Measurement 4: Triggered Measurement of Relative Code Domain Power

If the code domain power measurement is performed without external triggering, a section of approximately 20 ms of the test signal is recorded at an arbitrary moment to detect the start of a 3GPP FDD frame in this section. Depending on the position of the frame start, the required computing time can be quite long. Applying an external (frame) trigger can reduce the computing time.

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

Settings on SMIQ: *As for measurement 3*

Settings on FSU: *As for measurement 3, plus*
                       [TRIG   EXTERN]

Measurement on FSU: The following is displayed:
                       Screen A: Code domain power of signal
                                      (channel configuration with 3 data channels on Q branch)
                       Screen B: Numeric results of CDP measurement

                       Trg to Frame: Offset between trigger event and start of 3GPP FDD frame

                       The repetition rate of the measurement increases considerably compared to the repetition rate of a measurement without external trigger.

Setting: Trigger offset

A delay of the trigger event referred to the start of the 3GPP FDD frame can be compensated by modifying the trigger offset.

Settings on FSU: *MEAS SETTINGS   TRIGGER OFFSET   100 µs]*

Measurement on FSU: The parameter Trg to Frame in the numeric results table (screen B) changes:
                       Trg to Frame   -100 µs

A trigger offset compensates analog delays of the trigger event.

Measurement 5: Measurement of Composite EVM

The 3GPP specification prescribes the composite EVM measurement as the average square deviation of the total signal:
An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The square deviation yields the composite EVM.

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

Settings on SMIQ:
> *[PRESET]*
> *[LEVEL:*   *0 dBm]*
> *[FREQ:*   *2.1175 GHz]*
> *DIGITAL STD*
> > *LINK DIRECTION   UP / REVERSE*
> > *TEST MODELS (NOT STANDARDIZED)...*
> > > *C+D960K*
> > *SELECT BS/MS*
> > > *MS 1 ON*
> > > > *OVERALL SYMBOL RATE... 6*960*
> > *STATE: ON*

Settings on FSU:
> *[PRESET]*
> *[CENTER:*   *2.1175 GHz]*
> *[REF:*   *10 dBm]*
> *[3G FDD UE]*
> *[TRIG*   *EXTERN]*
> *[RESULTS*   *COMPOSITE EVM]*

Measurement on FSU: The following is displayed:
Screen A: Code domain power of signal, branch Q
(channel configuration with 3 data channels on branch Q)
Screen B: Composite EVM (EVM for total signal)

Measurement 6: Measurement of Peak Code Domain Errors

The peak code domain error measurement is defined in the 3GPP specification for FDD signals.
An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The difference of the two signals is projected onto the classes of the different spreading factors. The peak code domain error measurement is obtained by summing up the symbols of each difference signal slot and searching for the maximum error code.

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

Settings on SMIQ:
[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *2.1175 GHz]*
DIGITAL STD
    WCDMA 3GPP
       LINK DIRECTION   UP / REVERSE
       TEST MODELS (NOT STANDARDIZED)...
         C+D960K
      SELECT BS/MS
        MS 1 ON
          *OVERALL SYMBOL RATE... 6*960*
      STATE: ON

Settings on FSU:
[PRESET]
[CENTER: *2.1175 GHz]*
[REF: *0 dBm]*
[3G FDD UE]
[TRIG   *EXTERN]*
[RESULTS   *PEAK CODE DOMAIN ERR]*
          SPREAD FACTOR 256

Measurement on FSU:
The following is displayed:
Screen A: Code domain power of signal, branch Q
(channel configuration with 3 data channels on branch Q)
Screen B: Peak code domain error (projection of the error onto the class with spreading factor 256

3   Setup for User Equipment Tests

> ⚠️ *Caution:*
>
> *Before turning the instrument on, the following conditions must be fulfilled:*
>
> - *Instrument covers are in place and all fasteners are tightened.*
>
> - *Fan openings are free from obstructions.*
>
> - *Signal levels at the input connectors are all below specified maximum values.*
>
> - *Signal outputs are correctly connected and not overloaded.*
>
> ***Non-compliance with these instructions may cause damage to the instrument***.

This section describes how to set up the analyzer for 3GPP FDD user equipment tests. As a prerequisite for starting the test, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the analyzer. Furthermore, the application firmware module must be properly installed following the instructions given in chapter 1 of the present manual.

Standard Test Setup
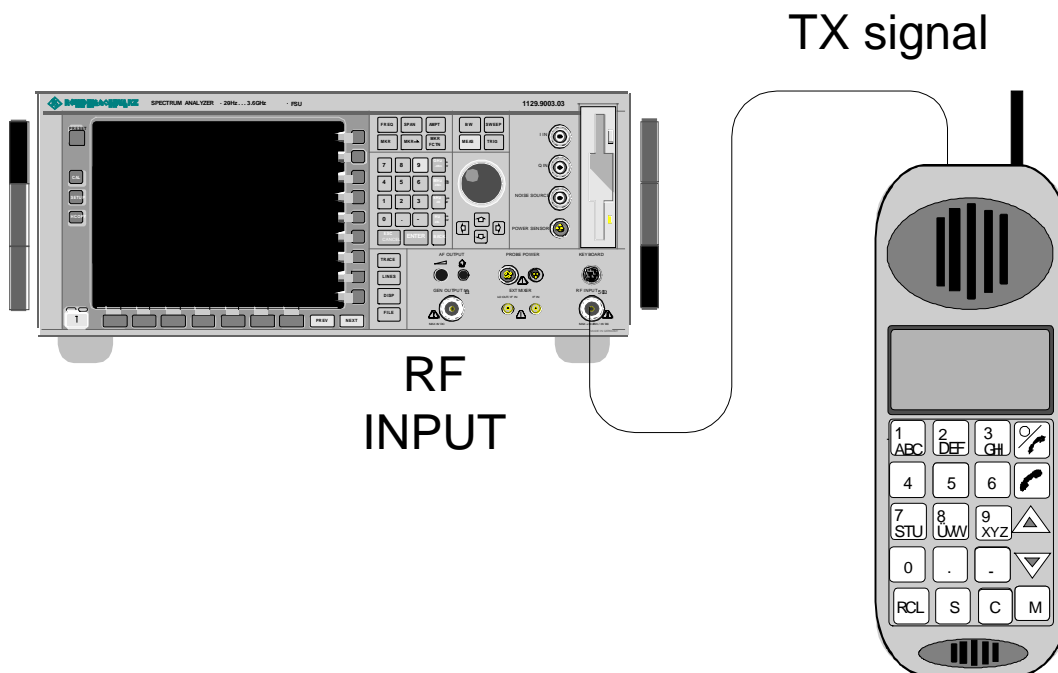
Fig. 3-1   UE test setup

> Connect antenna output (or TX output) of UE to RF input of the analyzer via a power attenuator of suitable attenuation.

   The following values are recommended for the external attenuator to ensure that the RF input of the analyzer is protected and the sensitivity of the analyzer is not reduced too much.

Max. power	Recommended ext. 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 two-port networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (*EXT REF IN/OUT*).

   To ensure that the error limits specified by the 3GPP standard are met, the analyzer should use an external reference frequency for frequency measurements on user equipments. A rubidium frequency standard may be used for instance as a reference source.

> If the user equipment is provided with a trigger output, connect this output to the rear trigger input of the analyzer (*EXT TRIG GATE*).

Presetting

> Enter external attenuation (REF LVL OFFSET)
> Enter reference level
> Enter center frequency
> Set the trigger
> Select standard and measurement

4 3GPP FDD Channel Configurations

The possible channel configurations for the mobile station signal are limited by 3GPP. Only two different configurations are permissible according to the specification. For this reason, the FS-K73 checks for these two channel configurations only during the automatic channel search. Therefore, channels whose parameters do not correspond to one of these configurations are not automatically detected as active channels.

The two possible channel configurations are summarized below:

Table 4-1 Channel configuration 1: DPCCH and 1 DPDCH

Channel type	Number of channels	Symbol rate	Spreading code(s)	Mapping to component
DPCCH	1	15 ksps	0	Q
DPDCH	1	15 ksps – 960 ksps	[spreading-factor / 4]	I

Table 4-2 Channel configuration 2: DPCCH and up to 6 DPDCH

Channel type	Number of channels	Symbol rate	Spreading code(s)	Mapping to component
DPCCH	1	15 ksps	0	Q
DPDCH	1	960 ksps	1	I
DPDCH	1	960 ksps	1	Q
DPDCH	1	960 ksps	3	I
DPDCH	1	960 ksps	3	Q
DPDCH	1	960 ksps	2	I
DPDCH	1	960 ksps	2	Q

5 Menu Overview

Application Firmware Module FS-K73 (3GPP FDD user equipment test) extends the analyzer by the code domain measurement mode for 3GPP FDD standard. Additional softkeys are available which allow overview measurements in the analyzer mode.

The FS-K73 application is started by a click on the 3G FDD UE hotkey:

SPECTRUM				3G FDD UE		SCREEN B
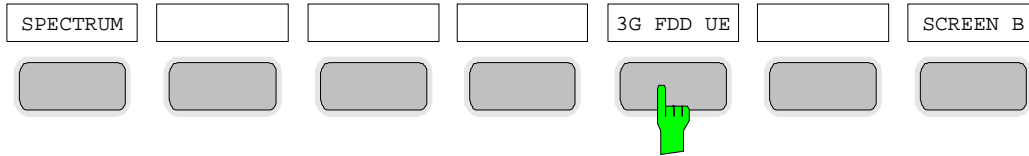
The main settings of the code domain power measurements can be directly selected via the hotkey bar that changes after the application has been started.
When one of the *CHAN CONF*, *SETTINGS*, *RESULTS* hotkeys is selected, the measurement is automatically switched to the Code Domain Power measurement mode.
If the *EXIT 3GPP* hotkey is selected, FS-K73 is exited. The hotkey bar of the basic unit is displayed again.

EXIT 3GPP			CHAN CONF	SETTINGS	RESULTS	SCREEN B

CODE CHAN AUTOSEARCH
CODE CHAN PREDEFINED

EDIT CHAN CONF TABLE
NEW CHAN CONF TABLE
DEL CHAN CONF TABLE
COPY CHAN CONF TABLE

HEADER VALUES

MEAS CHAN CONF TABLE

SAVE TABLE

SCRAMBLING CODE
SCR TYPE LONG SHRT
INACT CHAN THRESHOLD
MEASURE SLOT FRAME

INVERT Q ON OFF
SIDE BAND NORM INV
NORMALIZE ON OFF

CODE PWR RELATIVE
COMPOSITE EVM
PEAK CODE DOMAIN ERR
POWER VS SLOT
RESULT SUMMARY
SELECT I Q
SELECT CHANNEL
SELECT CPICH SLOT
ADJUST REF LVL

CODE PWR ABSOLUTE
CODE PWR OVERVIEW
CHANNEL TABLE
SELECT I Q
SELECT CHANNEL
SELECT CPICH SLOT
ADJUST REF LVL

SYMBOL CONST
SYMBOL EVM
BITSTREAM
SELECT I Q
SELECT CHANNEL
SELECT CPICH SLOT
ADJUST REF LVL

Fig. 5-1   Overview of menus of code domain power

The measurements available in FS-K73 can be selected by means of the MEAS key:
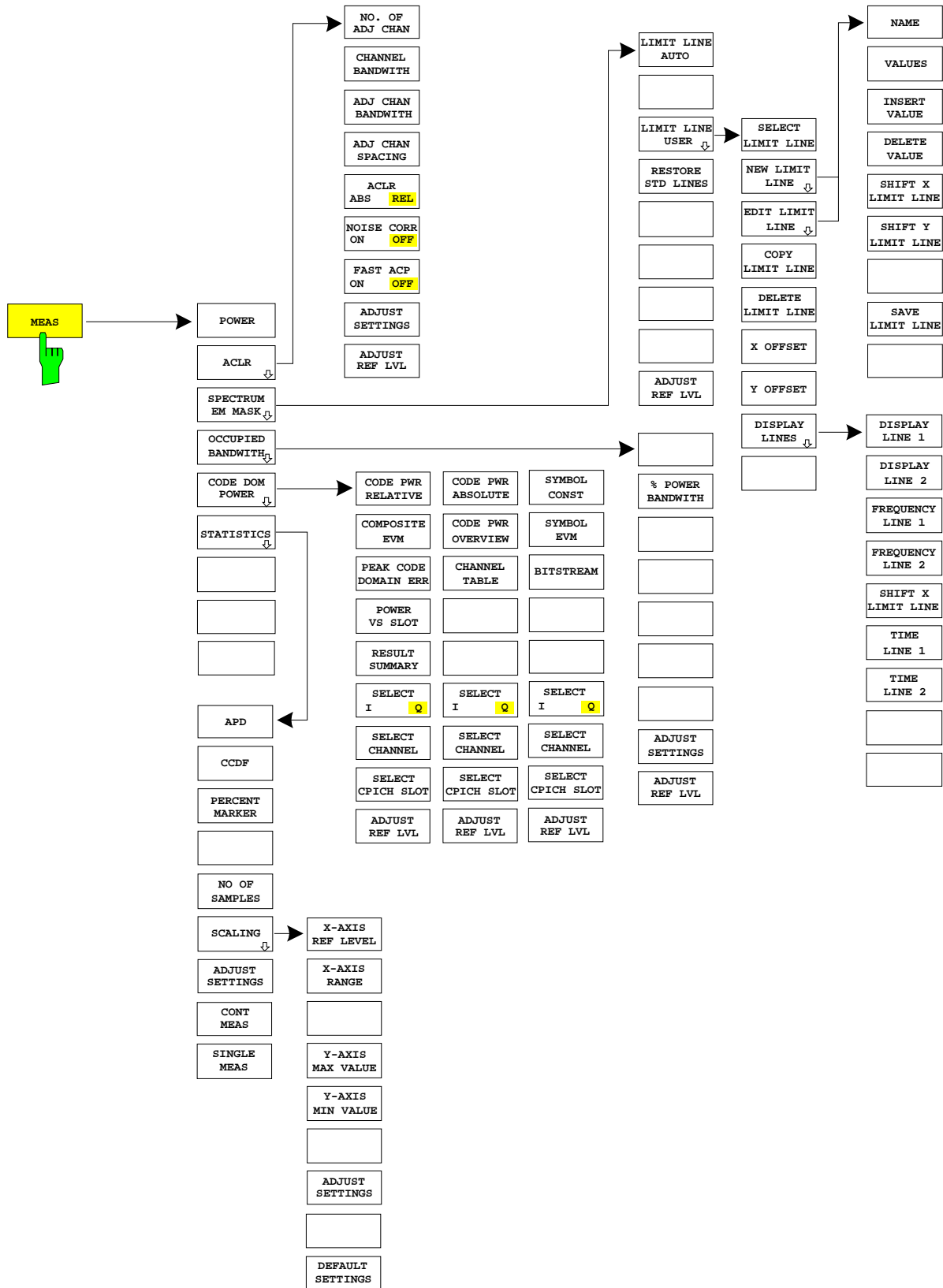
Fig. 5-2   Overview of menus

# 6 Configuration of 3GPP FDD Measurements

The most important parameters for the 3GPP FDD user equipment tests are summarized in the menu of key *MEAS* and are explained below using the softkey functions.

The *CODE DOM POWER* softkey activates the code domain measurement mode and opens the submenus for setting the measurement. A change of the hotkey labels after the application has been started ensures that the most important parameters of the CDP (code domain power) measurements are directly accessible via the hotkey bar.

The softkeys *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH* and *STATISTICS* activate user equipment tests in the analyzer or vector analyzer mode. Pressing the associated softkey performs the settings required by 3GPP specifications. A subsequent modification of settings is possible.

The other menus of the spectrum analyzer correspond to the menus of these modes and are described in the operating manual of the main unit.

CONFIGURATION MODE menu
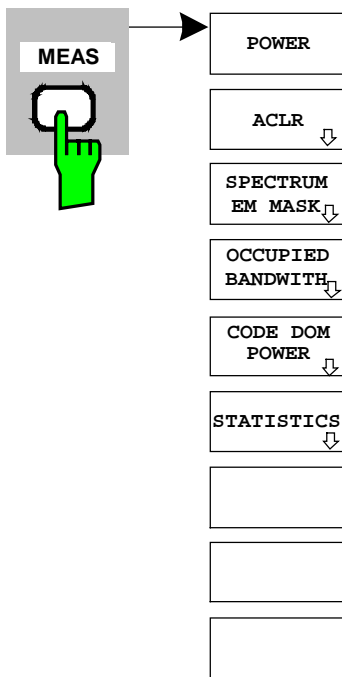
The *MEAS* key opens a submenu for setting the various measurement modes of option FS-K73:

- *POWER* activates the channel power measurement with defined settings in the analyzer mode.
- *ACLR* activates the adjacent channel power measurement with defined settings in the analyzer mode.
- *SPECTRUM EM MASK* compares the signal power in different carrier offset ranges with the maximum values specified by 3GPP.
- *OCCUPIED BANDWIDTH* activates the measurement of the occupied bandwidth (analyzer mode).
- *CODE DOM POWER* activates the code domain measurement mode and opens another submenu for selecting and configuring the parameters. All other menus of the specrtum analyzer are adapted to the functions of the code domain measurement mode.
- *STATISTICS* evaluates the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).

Measurement of Channel Power

Key *MEAS*
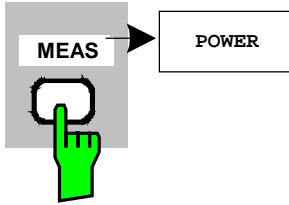
The *POWER* softkey activates the measurement of the 3GPP FDD signal channel power.

The instrument measures the RF signal power in the 3.84 MHz bandwidth. The power is calculated by summing up the values at the trace points. The individual trace points are weighted with the root raised cosine function as specified by the 3GPP standard. The bandwidth and the corresponding channel power is displayed numerically below the screen.
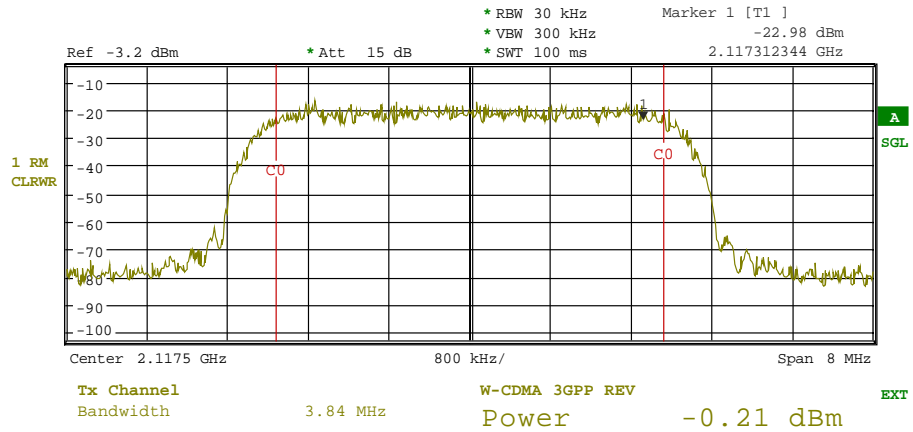

Fig. 6-1   Power measurement in the 3.84 MHz transmission channel

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained:	Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings	
CHAN PWR / ACP	CP / ACP ON	
CP / ACP STANDARD	W-CDMA 3GPP REV	
CP / ACP CONFIG	NO. OF ADJ CHAN	0

Starting from these settings, the instrument can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command:
```
:CONFigure:WCDPower:MEASurement POWer
```

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

Measurement of Adjacent-Channel Power - ACLR

Key *MEAS*

ACLR	→	NO. OF ADJ CHAN

CHANNEL BANDWITH

ADJ CHAN BANDWITH

ADJ CHAN SPACING

ACLR ABS **REL**

NOISE CORR ON **OFF**

FAST ACP ON **OFF**

ADJUST SETTINGS

ADJUST REF LVL
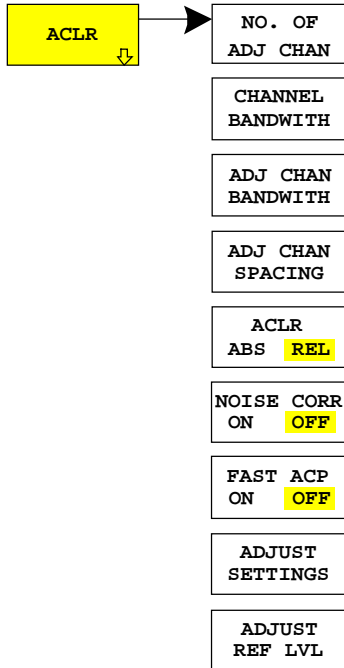
The *ACLR* softkey activates the adjacent-channel power measurement in the default setting according to 3GPP specifications (Adjacent Channel Leakage Power Ratio).

The instrument measures the channel power and the relative power of adjacent channels and of the next channels. The results are displayed below the screen.
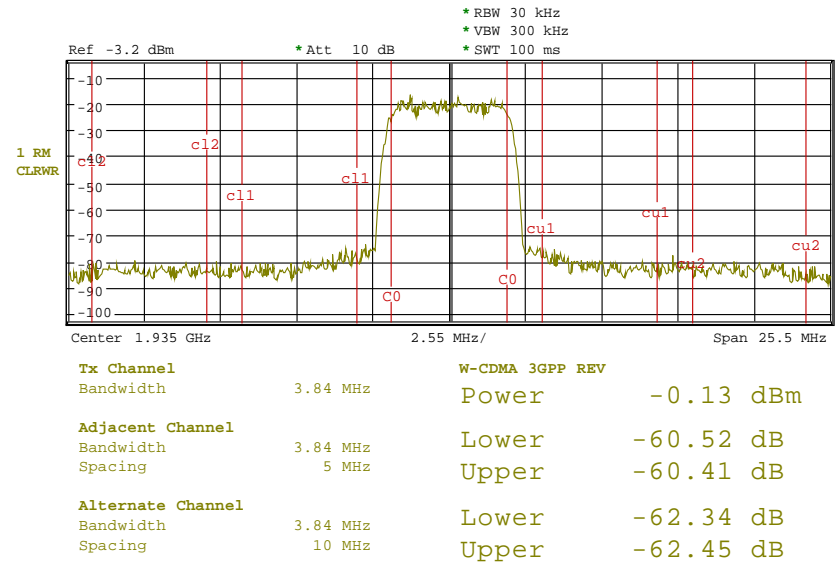
Fig. 6-2   Adjacent-channel power measurement of a 3GPP FDD user equipment.

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained:	Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings	
CHAN PWR / ACP	CP / ACP ON	
CP / ACP STANDARD	W-CDMA 3GPP REV	
CP / ACP CONFIG	NO. OF ADJ CHAN	2

Starting from these settings, the instrument can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command: `:CONFigure:WCDPower:MEASurement ALCR`

Query of results: `:CALCulate:MARKer:FUNCtion:POWer:RESult? ACPower`

NO. OF ADJ CHAN

The *NO. OF ADJ CHAN* softkey activates the entry of the number ±n of adjacent channels to be considered in the adjacent-channel power measurement.
Numbers from 0 to 3 can be entered.

The following measurements are performed depending on the number of the 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 channels power, the power of the upper and lower adjacent channel and of the next higher and lower channel (alternate channel 1) are measured.

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

IEC/IEEE-bus command: `POW:ACH:ACP 2`
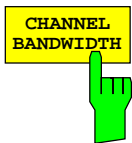
CHANNEL BANDWIDTH

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

The useful channel bandwidth is generally defined by the transmission method. In the 3GPP FDD default setting, measurements are performed with a channel bandwidth of 3.84 MHz.

When measuring according to the IBW method (*FAST ACP OFF)* the channel bandwidth is displayed by two vertical lines to the left and right of the screen center. It can thus be visually checked whether the whole power of the signal to be measured is within the selected channel bandwidth.

With the time domain method (*FAST ACP ON)* the measurement is performed in zero span*.* The channel limits are not marked in this case. The instrument offers all available channel filters for selection of the channel bandwidth. Deviating channel bandwidths cannot be set. If deviating channel bandwidths are required, the IBW method should be used.

The list of available channel filters is included in section "Setting of Bandwidths and Sweep Time – *BW key"*.

The default setting is 14 kHz.

IEC/IEEE-bus command: `SENS:POW:ACH:BWID 5MHz`

**ADJ CHAN
BANDWIDTH**

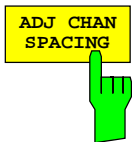The ADJ *CHAN BANDWIDTH* softkey opens a table for defining the channel bandwidths for the adjacent channels.

ACP CHANNEL BW	
CHAN	BANDWIDTH
ADJ	3.84 MHz
ALT1	3.84 MHz
ALT2	3.84 MHz

When measuring according to the IBW method (FAST ACP OFF) the bandwidths of the different adjacent channels are to be entered numerically. Since all adjacent channels often have the same bandwidth, the other channels ALT1 and ALT2 are set to the bandwidth of the adjacent channel on entering the adjacent-channel bandwidth (ADJ). Thus only one value needs to be entered in case of equal adjacent channel bandwidths. The same holds true for the ALT2 channels (alternate channels 2) when the bandwidth of the ALT1 channel (alternate channel 1) is entered.

Note: *The bandwidths can be selected independent from each other by overwriting the table from top to bottom.*

With the time domain method (FAST ACP ON), the adjacent-channel bandwidths are selected from the list of available channel filters. For deviating adjacent-channel bandwidths the IBW method should be used.

IEC-Bus-Befehl: SENS:POW:ACH:BWID:ACH 3.84MHz
                       SENS:POW:ACH:BWID:ALT1 3.84MHz
   SENS:POW:ACH:BWID:ALT2 3.84MHz

**ADJ CHAN
SPACING**

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

ACP CHANNEL SPACING	
CHAN	SPACING
ADJ	5 MHz
ALT1	10 MHz
ALT2	15 MHz

Since all the adjacent channels often have the same distance to each other, the entry of the adjacent-channel spacing (ADJ) causes channel spacing ALT1 to be set to twice and channel spacing ALT2 to three times the adjacent-channel spacing. Thus only one value needs to be entered in case of equal channel spacing. The same holds true for the ALT2 channels when the bandwidth of the ALT1 channel is entered.

Note: *The channel spacings can be set separately by overwriting the table from top to bottom.*

IEC-Bus-Befehl: SENS:POW:ACH:SPAC:ACH 5MHz
                       SENS:POW:ACH:SPAC:ALT1 10MHz
                       SENS:POW:ACH:SPAC:ALT2 15MHz
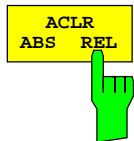
The *CP/ACP ABS/REL* softkey (channel power absolute/relative) switches between absolute and relative power measurement in the channel.

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

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

With linear scaling of the Y-axis, the power of the new channel relative to the reference channel (CP/CP_{ref}) is displayed. With dB scaling, the logarithmic ratio 10lg (CP/CP_{ref}) is displayed.

The relative channel power measurement can thus also be used for universal adjacent-channel power measurements. Each channel can be measured individually.

IEC/IEEE-bus command: `SENS:POW:ACH:MODE ABS`
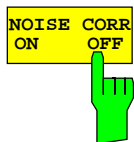
The *NOISE CORR ON/OFF* softkey switches on the correction of results by the inherent noise, thus increasing the dynamic range. On switching on the function a reference measurement of the inherent noise is first performed. The measured noise power is then substracted from the power of the examined channel.
For each modification of center frequency, resolution bandwidth, sweep time and level setting the inherent noise measuremnt is switched off. To repeat the reference measurement at the new setting, the softkey has to be pressed again.

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

The *FAST ACP* softkey switches between the IBW method (*FAST ACP OFF*) and the time domain method (*FAST ACP ON*).
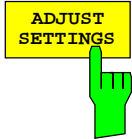
With *FAST ACP ON* the power measurement is performed in the different channels in time domain. The analyzer sets the center frequency consecutively to the different channel center frequencies and measures the power with the selected measurement time (= sweep time/number of channels). The RBW filter suitable for the selected standard and frequency offset are automatically used (eg root raised cos with 3GPP FDD).

The RMS detector is used for obtaining correct power measurement results. Therefore this requires no software correction factors.

The measured values are displayed in a table, the power in the useful channel being displayed in dBm and the power in the adjacent channels in dBm (CP/ACP ABS) or dB (CP/ACP REL).

The sweep time is selected depending on the desired reproducibility of results. Reproducibility increases with sweep time since power measurement is then performed over a longer time period.

IEC/IEEE-bus command   `SENS:POW:HSP ON`

ADJUST SETTINGS

The *ADJUST SETTINGS* softkey automatically optimizes the instrument settings for the selected power measurement (see below).
All instrument settings relevant for a power measurement within a specific frequency range (channel bandwidth) are optimized for the selected channel configuration (channel bandwidth, channel spacing):

- Frequency span:

  The frequency span has to cover at least all channels to be considered.
  When measuring the channel power, 2 x channel bandwidth is set as span.
  The setting of the span during adjacent-channel power measurement is dependent on the channel spacing and channel bandwidth of the adjacent channel ADJ, ALT1 or ALT2 with the largest distance from the transmission channel.

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

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

- Detector   RMS detector

Trace math and trace averaging functions are switched off.
The reference level is not influenced by *ADJUST SETTINGS*. It can be separately adjusted with *ADJUST REF LVL.*

The adjustment is carried out only once; if necessary, the instrument settings can be changed later.

IEC/IEEE-bus command:
                        SENS:POW:ACH:PRES ACP│CPOW│OBW
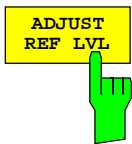
ADJUST REF LVL

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the instrument or limiting the dynamic range by a too small S/N ratio.
Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

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

For manual setting of the test parameters different from the settings made with *ADJUST SETTINGS* the following should be observed:

Frequency span
> The frequency span has to cover at least all channels to be measured.
> For channel power measurement this is the channel bandwidth.
> If the frequency span is large compared to the frequency section (or frequency sections) under test, only a few pixels are available to be measured.

Resolution bandwidth (RBW)
> To ensure both an acceptable measurement speed and the required selection (to suppress spectral components outside the channel to be measured, especially of the adjacent channels), the resolution bandwidth must not be selected too small or too large. As a general approach, the resolution bandwidth is to be set to values between 1% and 4% of the channel bandwidth. A larger resolution bandwidth can be selected if the spectrum within the channel to be measured and around it has a flat characteristic.

Video bandwidth (VBW)
> For a correct power measurement, the video signal must not be limited in bandwidth. A restricted bandwidth of the logarithmic video signal would cause signal averaging and thus result in a too low indication of the power (-2.51 dB at very low video bandwidths). The video bandwidth should therefore be selected at least three times the resolution bandwidth.
>
> The *ADJUST SETTINGS* softkey sets the video bandwidth (VBW) as a function of the channel bandwidth as follows:
>
> $VBW \geq 3 \times RBW$.

Detector
> The *ADJUST SETTINGS* softkey selects the RMS detector.
> The RMS detector is selected since it correctly indicates the power irrespective of the characteristics of the signal to be measured. In principle, the sample detector would be possible as well. Due to the limited number of trace pixels used to calculate the power in the channel, the sample detector would yield less stable results. Averaging, which is often performed to stabilize the measurement results, leads to a too low-level indication and should therefore be avoided. The reduction in the displayed power depends on the number of averages and the signal characteristics in the channel to be measured.

Signal Power Check – SPECTRUM EM MASK

Key *MEAS*
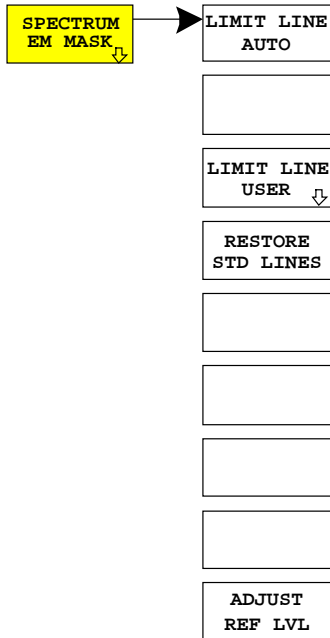
The *SPECTRUM EM MASK* softkey starts the determination of the power of the 3GPP FDD signal in defined offsets from the carrier and compares the power values with a spectral mask specified by 3GPP.
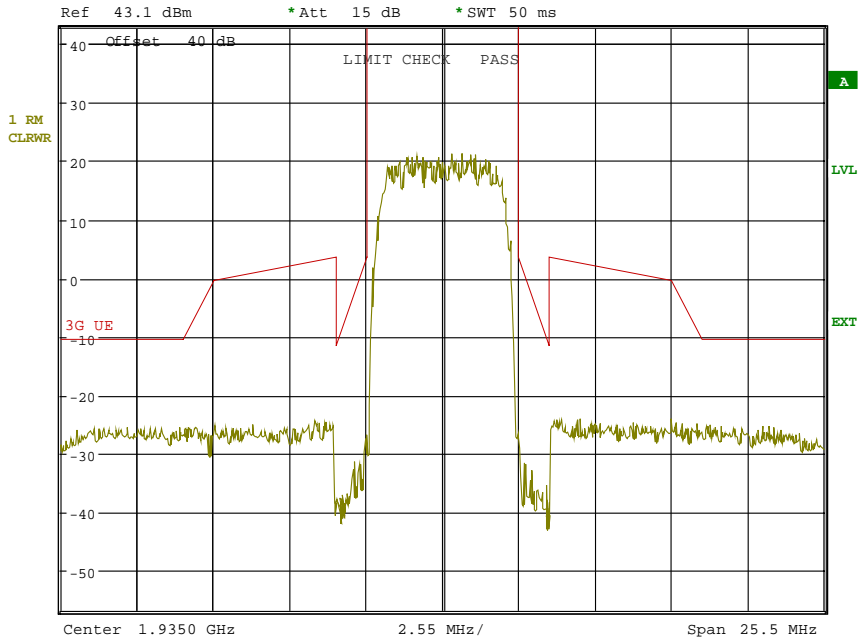

Fig. 6-3   Measurement of Spectrum Emission Mask.

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained:	Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings	
CHAN PWR / ACP	CP / ACP ON	
CP / ACP STANDARD	W-CDMA 3GPP REV	
CP / ACP CONFIG	NO. OF ADJ CHAN	0
SPAN		25.5 MHz
BW	SWEEP TIME MANUAL	50 ms

IEC/IEEE-bus command: `:CONFigure:WCDPower:MEASurement ESPectrum`

Query of results: `:CALCulate:LIMit:FAIL?` and visual evaluation
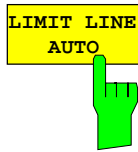
LIMIT LINE
AUTO

The *LIMIT LINE AUTO* softkey automatically calculates the limit line according to power determined in the useful channel. If the measurement is carried out in *CONTINUOUS SWEEP* and the channel power changes from sweep to sweep, this can result in the limit line being continuously redrawn.

The softkey is activated when the spectrum emission mask measurement is entered.

IEC/IEEE-bus command: :CALC:LIM:ESP:MODE AUTO
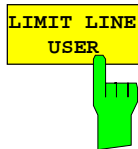
LIMIT LINE
USER

The *LIMIT LINE USER* softkey activates the input of user-defined limit lines. The softkey opens the menus of the limit line editor that are known from the basic unit.

The following limit line settings are useful for user equipment tests:

Trace 1, Domain Frequency, X-Scaling relative, Y-Scaling absolute, Spacing linear, Unit dBm

In contrast to the predefined limit lines supplied with the analyzer which correspond to the standard specifications, the user-defined limit line can be specified for the entire frequency range (±12.5 MHz from carrier) either relatively (referred to the channel power) or absolutely.

IEC/IEEE-bus command: see Table of Softkeys with Assignment of IEC/IEEE Commands

RESTORE
STD LINES

The *RESTORE STD LINES* softkey restores the limit lines defined in the standard to the state they were in when the unit was delivered. This prevents inadvertent overwriting of the standard lines.

IEC-Bus-Befehl: :CALC:LIM:ESP:RESTore
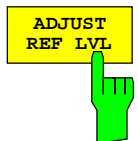
ADJUST
REF LVL

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

The softkey becomes active after the first sweep has been terminated with the measurement of the occupied bandwidth and the total signal power is known.

The adjustment of the reference level ensures that the instrument signal path is not overdriven and that the dynamic range is not limited by a reference level that is too low.

IEC-Bus-Befehl: SENS:POW:ACH:PRES:RLEV

Measurement of Occupied Bandwidth - OCCUPIED BANDWIDTH

Key *MEAS*
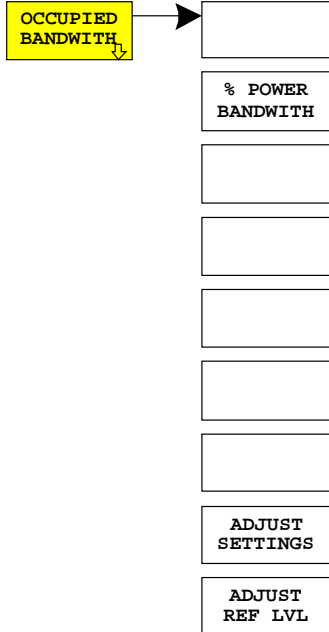
The *OCCUPIED BANDWIDTH* activates the measurement of the bandwidth of the signal.

The occupied bandwidth is defined as the bandwidth in which 99% of the total transmitter power is contained. The percentage of the signal power to be included in the bandwidth measurement can be changed.
The occupied bandwidth and the frequency markers are output in the marker info field at the top right edge of the screen.
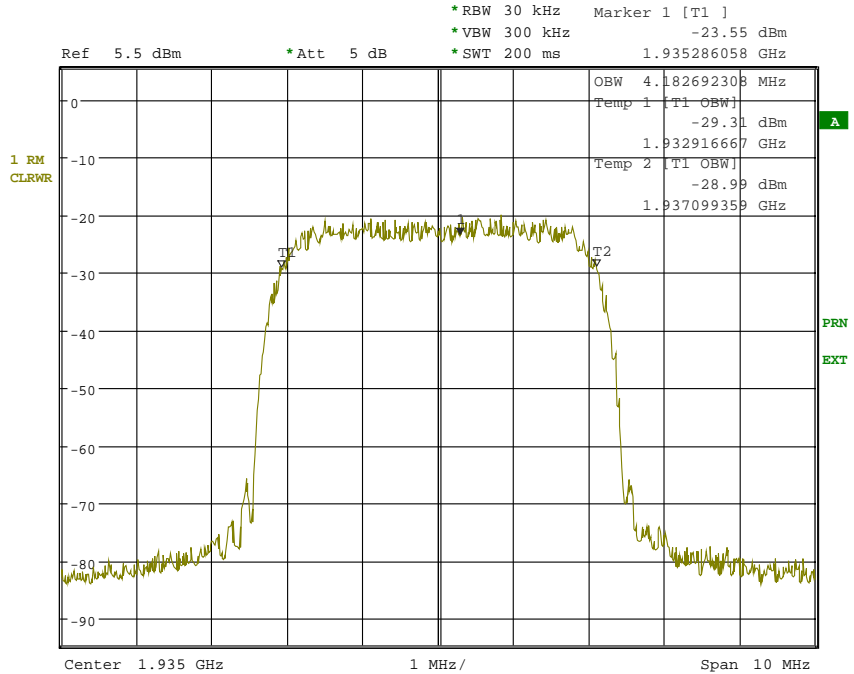

Fig. 6-4   Measurement of occupied bandwidth.

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained:	Reference Level , Reference Level Offset Center Frequency, Frequency Offset Input Attenuation, Mixer Level All trigger settings	
OCCUPIED BANDWITH		
TRACE 1	DETECTOR	RMS

IEC/IEEE-bus command: :CONFigure:WCDPower:MEASurement OBANdwidth

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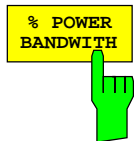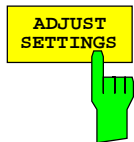
% POWER BANDWITH

The *% POWER BANDWIDTH* softkey opens the entry of the percentage of power related to the total power in the displayed frequency range which defines the occupied bandwidth (percentage of total power).
The valid range of values is 10% to 99.9%.

IEC/IEEE-bus command:
> SENS:POW:BWID 99PCT

ADJUST SETTINGS

The *ADJUST SETTINGS* softkey automatically optimizes the instrument settings for the selected power measurement (see below).
All instrument settings relevant for a power measurement within a specific frequency range (channel bandwidth) are optimized for the selected channel configuration (channel bandwidth, channel spacing):

- Frequency span:

  The frequency span has to cover at least all channels to be considered.
  When measuring the channel power, 2 x channel bandwidth is set as span.
  The setting of the span during adjacent-channel power measurement is dependent on the channel spacing and channel bandwidth of the adjacent channel ADJ, ALT1 or ALT2 with the largest distance from the transmission channel.

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

- Video bandwidth   VBW $\geq 3 \times$ RBW
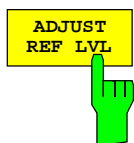
- Detector   RMS detector

Trace math and trace averaging functions are switched off.
The reference level is not influenced by *ADJUST SETTINGS*. It can be separately adjusted with *ADJUST REF LVL.*

The adjustment is carried out only once; if necessary, the instrument settings can be changed later.

IEC/IEEE-bus command:
> SENS:POW:ACH:PRES OBW

ADJUST REF LVL

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the instrument or limiting the dynamic range by a too small S/N ratio.
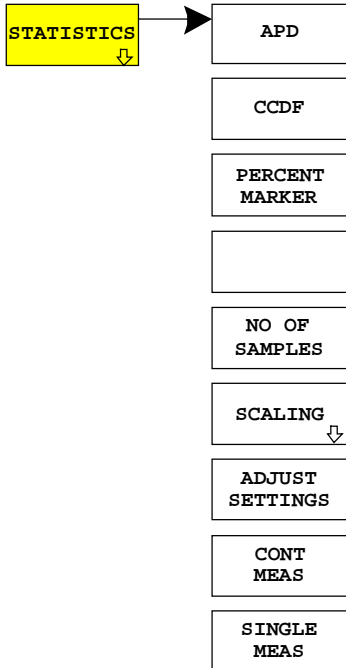Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

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

Measurement of Signal Statistics

Key *MEAS*

STATISTICS ⇩

→

APD
CCDF
PERCENT MARKER
NO OF SAMPLES
SCALING ⇩
ADJUST SETTINGS
CONT MEAS
SINGLE MEAS

The *STATISTICS* softkey starts a measurement of the distribution function of the signal amplitudes (complementary cumulative distribution function). The measurement can be switched to amplitude power distribution (APD) by means of the menu softkeys.

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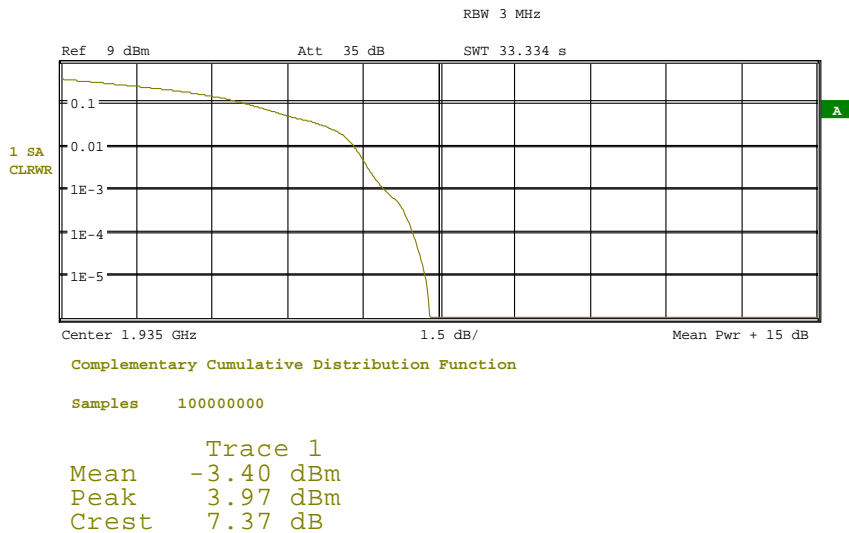

Fig. 6-5   CCDF of 3GPP FDD signal.

Pressing the softkey activates the analyzer mode with defined settings:

| SYSTEM PRESET		

After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset
                                                  Center Frequency, Frequency Offset
                                                Input Attenuation, Mixer Level
                                                All trigger settings		

SIGNAL STATISTIC		
TRACE1	DETECTOR	SAMPLE
BW	RES BW MANUAL	10 MHz
	VIDEO BW MANUAL	5 MHz

Starting from these settings, the instrument can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command:

    :CONFigure:WCDPower:MEASurement CCDF
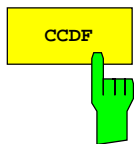   or
    :CALCulate:STATistics:CCDF ON

Query of results:

    :CALCulate:MARKer:X?
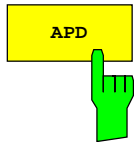
The *APD ON/OFF* softkey switches on the amplitude probability distribution function.
When the APD function is switched on, the CCDF function is switched off automatically.

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

The *CCDF ON/OFF* softkey switches on the complementary cumulative distribution function.
When the CCDF function is switched on, the APD function is switched off automatically.

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

If the CCDF function is active, the *PERCENT MARKER* softkey allows to position marker 1 by entering a probability value. Thus, the power that is exceeded with a given probability can be determined very easily.
If marker 1 is in the switched-off state, it will be switched on automatically.

IEC/IEEE-bus command: CALC:MARK:Y:PERC 0...100%
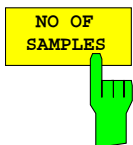
NO OF SAMPLES softkey sets the number of power measurements taken into account for the statistics.
Please note that the overall measurement time is influenced by the number of samples selected as well as by the resolution bandwidth set up for the measurement as the resolution bandwidth directly influences the sampling rate.

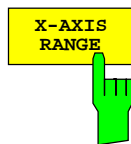IEC/IEEE-bus command: CALC:STAT:NSAM <value>
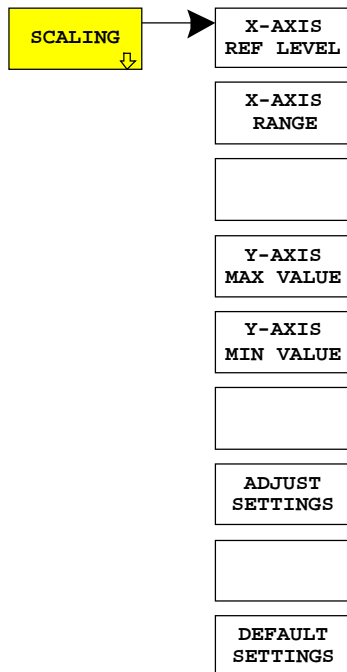
The *SCALING* softkey opens a sub menu that allows changing the scaling parameters for both the x- and the y-axis.
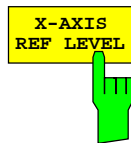
The *X-AXIS REF LEVEL* softkey changes the level settings of the instrument and sets the maximum power to be measured.
The function is identical to softkey *REF LEVEL* in menu *AMPT*.
For the *APD* function this value is mapped to the right diagram border.
For the *CCDF* function there is no direct representation of this value on the diagram as the x-axis is scaled relatively to the *MEAN POWER* measured.

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

The *X-AXIS RANGE* softkey changes the level range to be covered by the statistics measurement selected.
The function is identical to softkey *RANGE LOG MANUAL* in menu *AMPT*.

IEC/IEEE command: CALC:STAT:SCAL:X:RANG <value>
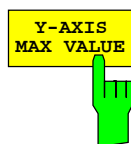
The *Y-AXIS MAX VALUE* softkey defines the upper limit of the displayed probability range.
Values on the y-axis are normalized which means that the maximum value is 1.0. As the y-axis scaling has a logarithmic axis the distance between max and min value must be at least one decade.

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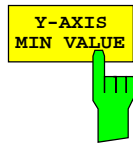
Y-AXIS MIN VALUE

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

As the y-axis scaling has a logarithmic axis the distance between max and min value must be at least one decade. Valid values are in the range 0 < value < 1.

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

ADJUST SETTINGS

See below

DEFAULT SETTINGS

The *DEFAULT SETTINGS* softkey resets the x- and y-axis scalings to their PRESET values.

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

y-axis upper limit: 1.0
y-axis lower limit: 1E-6

IEC/IEEE-bus command: `CALC:STAT:PRES`
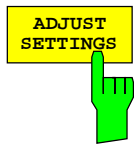
ADJUST SETTINGS

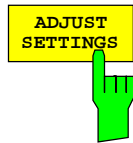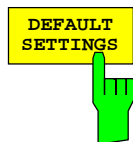The *ADJUST SETTINGS* softkey optimizes the level settings of the analyzer according to the measured peak power in order to gain maximum sensitivity of the instrument.

The level range is adjusted according to the measured difference between peak and minimum power for APD measurement and peak and mean power for CCDF measurement in order to obtain maximum power resolution.

Additionally the probability scale is adapted to the selected number of samples.

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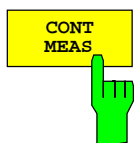
CONT MEAS

The *CONT MEAS* softkey starts collecting a new sequence of sample data and calculating the APD or CCDF curve 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`
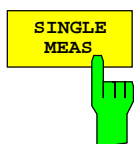
SINGLE MEAS

The *SINGLE MEAS* softkey starts collecting a new sequence of sample data and calculating the APD or CCDF curve depending on the selected measurement. At the beginning of the measurement previously obtained measurement results are discarded.

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

Code Domain Measurements on 3GPP FDD Signals

Application Firmware FS-K73 provides the peak code domain error measurement, an EVM measurement of the total signal (composite EVM), prescribed by the 3GPP standard, as well as the code domain power measurement of assigned and unassigned codes. In addition, the symbols demodulated in a slot, the decided bits or the EVM symbol can be displayed for an active channel.

Two signal recording modes are available with Application Firmware FS-K73, depending on the spectrum analyzer on which the firmware is run:

- With Spectrum Analyzer FSP, a section of approx. 2 ms is recorded. This section is searched for the beginning of an arbitrarily selected slot of the 3GPP FDD signal. All analyses are carried out for this slot only. This cuts processing time by a factor of ten compared with the analysis of a complete frame, i.e. it saves approx. 90% processing time.

- With Spectrum Analyzer FSU, the user can choose between slot analysis (recording length approx. 2 ms) and frame analysis (recording length approx. 20 ms), see *MEASURE SLOT/FRAME* softkey. In the latter case, the recorded signal section is searched for the beginning of a 3GPP FDD frame. Starting at the beginning of such a frame, 15 consecutive slots are analyzed. Frame analysis offers additional display modes compared with slot analysis:

    POWER VERSUS SLOT: display of channel power over complete frame

    COMPOSITE EVM: display of composite EVM over all slots of a frame

    PEAK CODE DOMAIN ERR: display of peak code domain error over all slots of a frame

The two signal recording modes are described jointly in the following. For each softkey/each display mode it is stated to what recording mode it applies (slot or frame analysis). In figures, frame analysis is shown always. The two recording modes can be selected on the spectrum analyzers as follows:

Slot analysis (result length one slot):   Spectrum Analyzer FSP   or
                                             Spectrum Analyzer FSU with *MEASURE SLOT*
Frame analysis (result length one frame):   Spectrum Analyzer FSU with *MEASURE FRAME*

Application firmware FS-K73 offers two different ways of representing the code domain power measurement:

- Representation of all code channels

    Option FS-K73 displays the power of all occupied code channels in a bargraph. The X-axis is scaled for the highest code class or the highest spreading factor (256). Code channels with a lower spreading factor occupy correspondingly more channels of the highest code class. The power of the code channel is always correctly measured in accordance with the actual power of the code channel. Unused code channels are assumed to belong to the highest code class and displayed accordingly. The displayed power of an unused code channel therefore corresponds to the power of a channel with the spreading factor 256 at the respective code position.
    To simplify identification, used and unused channels are displayed in different colours. Used channels are yellow, unused channels are blue.
    The measured power always refers to one slot. The time reference for the start of slot 0 is the start of the 3GPP FDD frame.

- Representation of channel power versus slots of a 3GPP FDD signal frame (result length one frame only)
  In this case the power of a selectable code channel is indicated versus a frame. The power is always measured within one slot of the selected channel. The time reference for the start of slot 0 is the start of the 3GPP FDD frame.

The measurements symbol EVM, symbol constellation diagram and bitstream are always referred to one slot of the selected channel.

The composite EVM and peak code domain error measurements are always referred to the total signal.

For code domain power (CDP) measurements, the display is operated in the SPLIT SCREEN mode. Only those display modes having the codes of the class with the highest spreading factor as basis for the x-axis are permitted in the upper part of the screen, all other display modes are assigned to the lower part of the screen.

For code domain power measurement, FS-K73 expects the Dedicated Physical Control Channel (DPCCH) to be part of the signal.

There are two modes for the CDP analysis. In the *CODE CHAN AUTOSEARCH* mode, FS-K73 performs an automatic search for active channels in the whole code domain. The channel search is based on the power of the channels and on a signal/noise ratio that should not be exceeded within the channel. In the *CODE CHAN PREDEFINED* mode, the user can define the active channels contained in the signal via tables that can be selected and edited.

Display modes – *RESULTS* hotkey

Hotkey *RESULTS*

RESULTS	→	CODE PWR RELATIVE	CODE PWR ABSOLUTE	SYMBOL CONST
		COMPOSITE EVM	CODE PWR OVERVIEW	SYMBOL EVM
		PEAK CODE DOMAIN ERR	CHANNEL TABLE	BITSTREAM
		POWER VS SLOT		
		RESULT SUMMARY		
		SELECT I Q	SELECT I Q	SELECT I Q
		SELECT CHANNEL	SELECT CHANNEL	SELECT CHANNEL
		SELECT CPICH SLOT	SELECT CPICH SLOT	SELECT CPICH SLOT
		ADJUST REF LVL	ADJUST REF LVL	ADJUST REF LVL
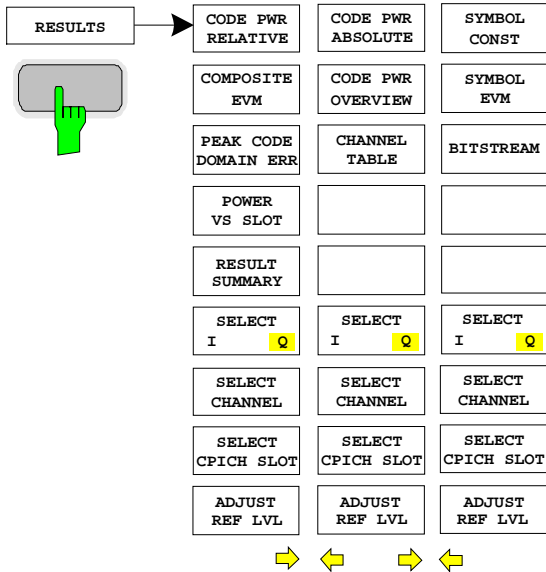
The *RESULTS* hotkey opens a submenu for setting the display mode. The main menu contains the most important display modes as well as the measurements specified by the 3GPP standard for a fast access, whereas the side menus contain more detailed display modes.

The following display modes are available:

CODE PWR RELATIVE

Code domain power with relative scaling

COMPOSITE EVM (result length one frame only) Square difference between test signal and ideal reference signal

PEAK CODE DOMAIN ERR

(result length one frame only) Projection of the error between the test signal and the ideal reference signal onto the various spreading factors and subsequent summation using the symbols of each slot of the difference signal

POWER VS SLOT (result length one frame only) Power of the selected channel versus all slots of a 3GPP FDD signal frame

RESULT SUMMARY Tabular result display

CODE PWR ABSOLUTE

Code domain power with absolute scaling

CODE PWR OVERVIEW

Code domain power with relative scaling (I and Q component simultaneously)

CHANNEL TABLE Display of channel occupation table

SYMBOL CONST Display of constellation diagram

SYMBOL EVM Display of error vector magnitude diagram

BITSTREAM Display of decided bits

By entering a channel number (*SELCT CHANNEL* softkey) in the modes *CODE PWR RELATIVE / ABSOLUTE* it is possible to mark a channel for more detailed display modes (*SYMBOL CONST*, *SYMBOL EVM* and *BITSTREAM*).

Result length one frame only: In the *POWER VS SLOT*, *COMPOSITE EVM* and *PEAK CODE DOMAIN ERR* display modes a slot can be marked by entering a slot number using the *SELECT SLOT* softkey.

The displayed component of the signal can be selected via the *SELECT I/Q* softkey.

By *ADJUST REF LVL* an optimal fitting of the reference level to the signal level can be achieved.

Above the diagram, the most important measurement settings, which form the basis of the display modes, are summarized:

```
Code Power Relative              SR 960 ksps
                                 Chan Code  2
CF 1.935 GHz        Slot # 0     Mapping    Q
```

Fig. 6-6   Indication of measurement parameters

The different elements are:
1st column:
        Code Power Relative: Name of selected display mode
        {empty}
        CF 1.935 GHz: Center frequency of signal

2nd column:
        {empty}
        {empty}
        Slot # 0:   Slot number (value of *SELECT SLOT* softkey)
        This value is only displayed at a result length of one frame.

3rd column:
        SR 30 ksps: Symbol rate of selected channel
        Chan Code 69:   Spreading code of selected channel
        Mapping Q: Selected component of the channel

Note: *For the peak code domain error display mode, the indication of the symbol rate is replaced by the indication of the spreading factor onto which the error is projected (see PEAK CODE DOMAIN ERR softkey)*
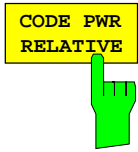
CODE PWR
RELATIVE

The *CODE PWR RELATIVE* softkey selects the code domain power display mode with relative scaling.

The power of the channels is referred to the total power auf the signal.

The measurement interval for determining the power of the channels is one slot. The time reference for the start of slot 0 is the start of the 3GPP FDD frame.

The powers of the active channels and of the unassigned codes are shown in different colours:
- yellow: active channels
- blue: unassigned codes

In the *CODE CHAN AUTOSEARCH* mode, a data channel is designated as active if its power has a minimum value (see softkey *INACT CHAN THRESH*) compared to the total power of the signal and if the a minimum signal/noise ratio is maintained within the channel.
In *CODE CHAN PREDEFINED* mode, each data channel that is included in the user defined channel table is considered to be active.

By entering a channel number (see *SELECT CHANNEL* softkey) it is possible to mark a channel for more detailed display modes. The marked channel is shown in red. The whole channel is marked if it is an assigned channel, and only the entered code is marked in the case of an unassigned code.
The display mode for the path of representation and the slot can be varied using the *SELECT I/Q* and *SELECT SLOT* (frame analysis only) softkeys.
Selecting other display modes (e.g. SYMBOL CONSTELLATION) for unassigned codes is possible but not useful since the results are not valid.

The figure shows the relative CDP representation of the Q path for 3 data channels that are active in this path.
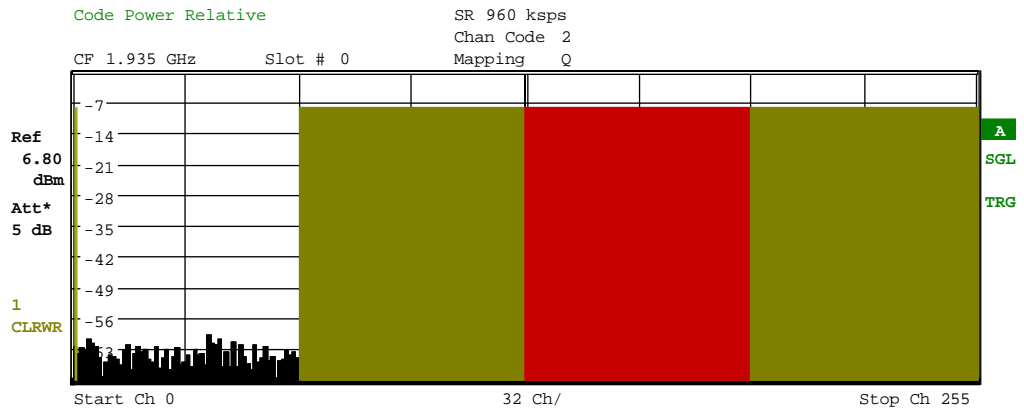
Fig. 6-7   Code domain power (relative scaling), branch Q

IEC/IEEE-bus command: :CALCulate<1>:FEED "XPOW:CDP:RAT"
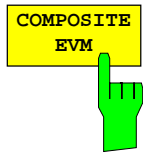
COMPOSITE
EVM

The *COMPOSITE EVM* softkey selects the composite EVM display mode according to 3GPP specification. The softkey is only valid if one frame of the 3GPP signal is analyzed.

During the composite EVM measurement, the square root of the squared errors between the real and imaginary parts of the test signal and an ideal reference signal (EVM referred to the total signal) is determined. Composite EVM thus is a measurement of the composite signal.

The measurement result consists of one composite EVM measurement value per slot. The time reference for the start of slot 0 ist the start of the 3GPP FDD frame.

Only the channels recognized as active are used to generate the ideal reference signal. If an assigned channel is not recognized, the difference between the measurement and reference signal and the composite EVM is very high.

Fig. 6-8   Display of composite EVM

IEC/IEEE-bus command: `:CALCulate2:FEED "XTIM:CDP:MACCuracy"`

PEAK CODE
DOMAIN ERR

The *PEAK CODE DOMAIN ERR* softkey selects the peak code domain error display mode. The softkey is only valid if one frame of the 3GPP signal is analyzed.

In line with the 3GPP specifications, the error between the measurement signal and the ideal reference signal is projected onto the various spreading factors. The desired spreading factor is selected via a table that is shown after the softkey has been pressed.

The result consists of a numerical value per slot for the peak code domain error value. The time reference for the start of slot 0 ist the start of the 3GPP FDD frame.

Only the channels recognized as active are used to generate the ideal reference signal for the peak code domain error. If an assigned channel is not recognized, the difference between the measurement and reference signal is very high. FS-K73 consequently indicates a peak code domain error that is too high.
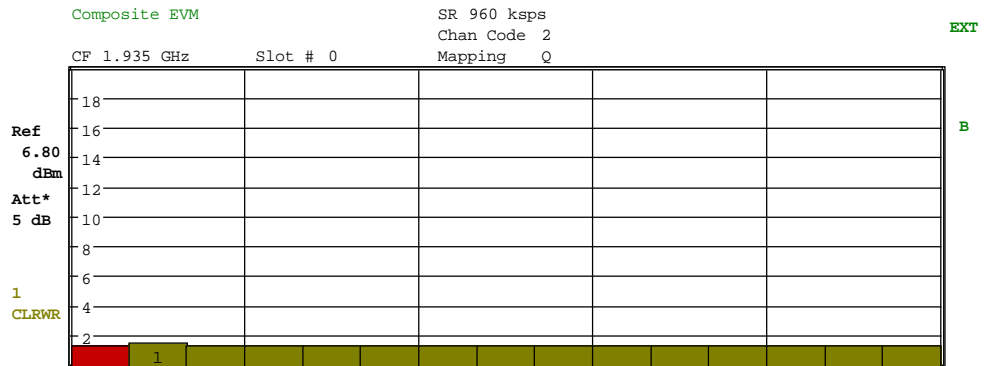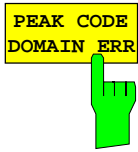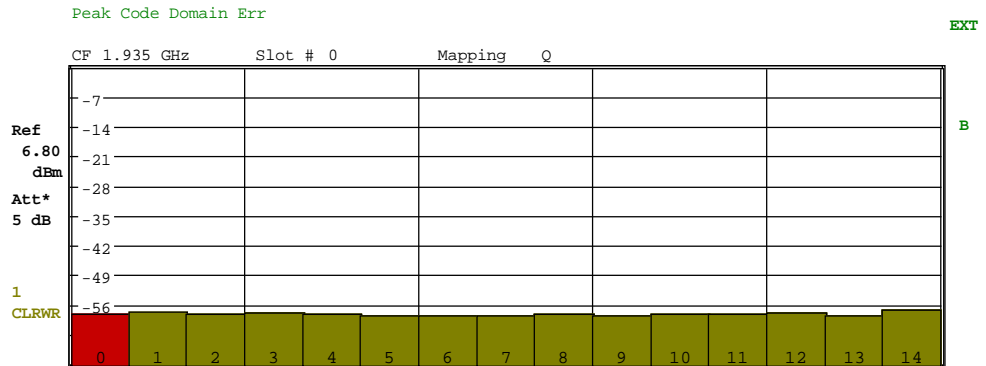
Fig. 6-9   Display of Peak code domain error

IEC/IEEE-bus command: `:CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"`
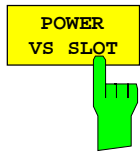
POWER VS SLOT

The *POWER VS SLOT* softkey selects the indication of the power of the selected code channel depending on the slot number. The power of the selected channel (marked red in the CDP diagram) is displayed versus all slots of a frame of the 3GPP FDD signal. The softkey is only valid if one frame of the 3GPP signal is analyzed.

Beginning at the start of the 3GPP FDD frame, 15 successive slots are displayed. The power is shown in absolute scaling.
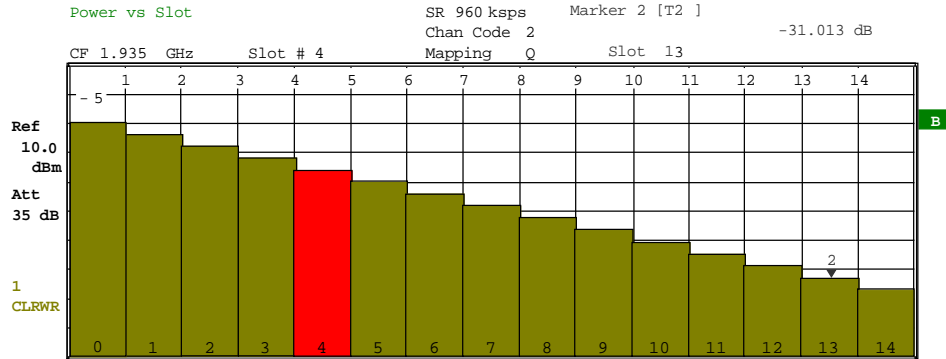
Fig. 6-10   Power versus Slot measurement for an active channel

It is not only possible to select a code channel in the CDP diagram, but also to mark a slot in the power-versus-slot diagram. Marking is done by entering the slot number (see *SELECT SLOT* softkey) and the selected slot is marked in red. For more detailed displays, the marked slot of the channel is selected (see SLOT # entry in the function panels above the diagrams in the Figures).

Modifying a slot number has the following effects:
-   The CDP diagram in the upper half of the display is updated referred to the entered slot number.
-   All results that depend on the selected slot are recalculated for selected channel. The relevant graphics are updated.

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

RESULT
SUMMARY

The *RESULT SUMMARY* softkey selects the numerical display of all results. The display is subdivided as follows:

```
Result Summary                          SR 960 ksps
                                        Chan Code  2                     EXT
         CF 1.935 GHz        Slot # 0   Mapping    Q
                                  Result Summary
        ┌─────────────────────────────────────────────────────────────────┐
        │ GLOBAL RESULTS                                                    │
Ref     │  Total Power            -1.75 dBm   Carrier Freq Error  -67.68 mHz│  B
6.80    │  Chip Rate Error        -0.05 ppm   Trigger to Frame    -32.17 ns │
 dBm    │  IQ Offset               0.02 %     IQ Imbalance          0.06 %  │
Att*    │  Composite EVM           1.39 %     Pk CDE (15.0 ksps)  -59.06 dB │
5 dB    │  Slot No                    0       No of Active Chan        7    │
        ├─────────────────────────────────────────────────────────────────┤
        │ CHANNEL RESULTS                                                   │
        │  Symbol Rate          960.00 ksps                                 │
1       │  Channel Code               2       Mapping                 Q     │
CLRWR   │  No of Pilot Bits           0                                     │
        │  Channel Power Rel      -8.45 dB    Channel Power Abs  -10.21 dBm │
        │  Symbol EVM             1.23 % rms   Symbol EVM           4.86 % Pk│
        └─────────────────────────────────────────────────────────────────┘
```

Fig. 6-11 Display of Result Summary

The upper part contains the results relating to the total signal:

Total Power: Outputs the total signal power (average power of total evaluated 3GPP FDD frame).

Carrier Freq Error:
                   Outputs the frequency error referred to the center frequency of the analyzer. The absolute frequency error is the sum of the analyzer and DUT frequency error.
                   Differences of more than 1 kHz between transmitter and receiver frequency impair the synchronization of the CDP measurement. For this reason, the transmitter and receiver should be synchronized (see chapter Getting Started).

Chip Rate Error:
                   Outputs the chip rate error in ppm
                   As a result of a high chip rate error symbol errors arise and the CDP measurement is possibly not synchronized to the 3GPP FDD signal. The result is valid even if the synchronization of analyzer and signal failed.

Trigger to Frame:
                   This result outputs the timing offset from the beginning of the recorded signal section to the start of the analyzed 3GPP FDD frame. In the case of triggered data collection, this timing offset is identical with the timing offset of frame trigger (+ trigger offset) – frame start. In the case of failure of the synchronization of analyzer and 3GPP FDD signal, the value of Trigger to Frame is not significant.

IQ Offset: DC offset of the signal in %

IQ Imbalance: IQ imbalance of the signal in %

Composite EVM: The composite EVM is the difference between the test signal and the ideal reference signal (see *COMPOSITE EVM* softkey). The composite EVM value for the selected slot is given in the *RESULT SUMMARY*.

Pk CDE: The *Pk CDE* measurement specifies a projection of the difference between the test signal and the ideal reference signal onto the selected spreading factor (see *PEAK CODE DOMAIN ERR* softkey). The Pk CDE value for the selected slot is indicated in the *RESULT SUMMARY*. The spreading factor onto which projection is made is shown beneath the measurement result.

No of Pilot Bits: Indicates the number of pilot bits detected in the control channel.

No of Active Chan:
                    Indicates the number of active channels detected in the signal. Both the detected data channels and the control channels are considered active channels.

The results of measurements on the selected channel (red in the CDP diagram) are displayed in the lower part of the *RESULT SUMMARY*.

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

Slot Number: Number of slot for which the measurement is done (see *SELECT SLOT* softkey). The entry is only valid if one frame of the 3GPP signal is analyzed.

Channel Code: Number of the spreading code of the selected channel.

Chan Mapping: Component onto which the channel is mapped (I or Q)

Chan Pow rel. / abs.:
                    Channel relative (referred to the total power of the signal) and absolute.

Symbol EVM Pk / rms:
                    Peak or average of the results of the error vector magnitude measurement (see SYMBOL EVM softkey). The measurement provides information on the EVM of the channel (marked red) in the CDP diagram in the slot (marked red) of the power-versus-slot diagram at symbol level.

IEC/IEEE-bus command:
```
:CALCulate2:FEED "XTIM:CDP:ERR:SUMM"
:CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:RESult?
        PTOTal | FERRor | TFRame | TOFFset | MACCuracy |
        PCDerror | EVMRms | EVMPeak | CERRor | CSLot |
        SRATe | CHANnel | CDPabsolute | CDPRelative |
        IQOFfset | IQIMbalance
```
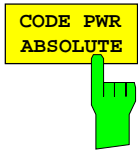
CODE PWR ABSOLUTE

The *CODE PWR ABSOLUTE* softkey selects the code domain power display mode with absolute scaling.

The powers of the active channels and of the unassigned codes are shown in different colours:

- yellow: active channels
- blue: unassigned codes

After entering a code number (*SELECT CHANNEL* softkey) it is possible to mark a channel for other display modes. The marked channel is shown in red.

The measurement interval for determining the power of the channels is a slot of the 3GPP FDD signal, starting with the frame start.

For the recognition of the active code channels, the conditions are the same as those described for *CODE PWR RELATIVE*.
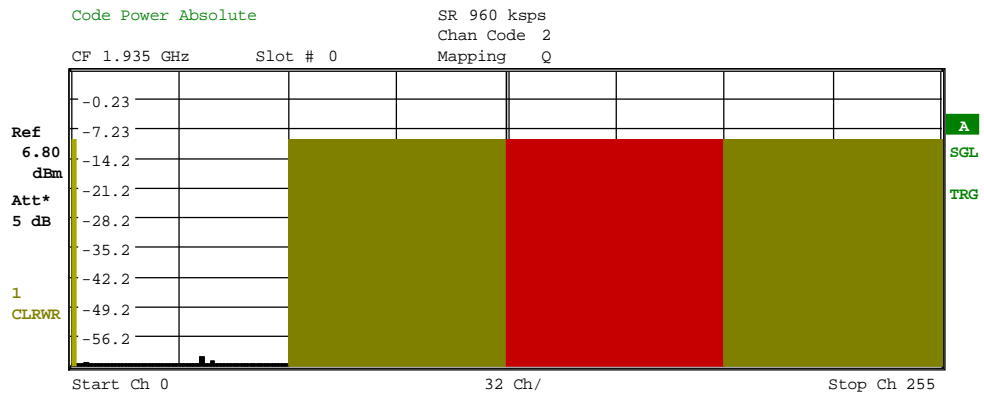
Fig. 6-12 Code domain power display mode with absolute scaling

IEC/IEEE-bus command: `:CALCulate<1>:FEED "XPOW:CDP"`
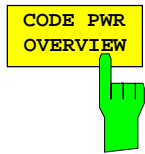
<table>
<tr><td>

CODE PWR
OVERVIEW

</td><td>

The *CODE PWR OVERVIEW* softkey displays the code domain power of the two components of the I/Q plane simultaneously. This display provides an overview of the channels contained in the signal. The display mode can be varied for different slots of the signal using the *SELECT SLOT* softkey (frame analysis only).

The conditions described at *CODE PWR RELATIVE* apply to the identification of active code channels.

</td></tr>
</table>
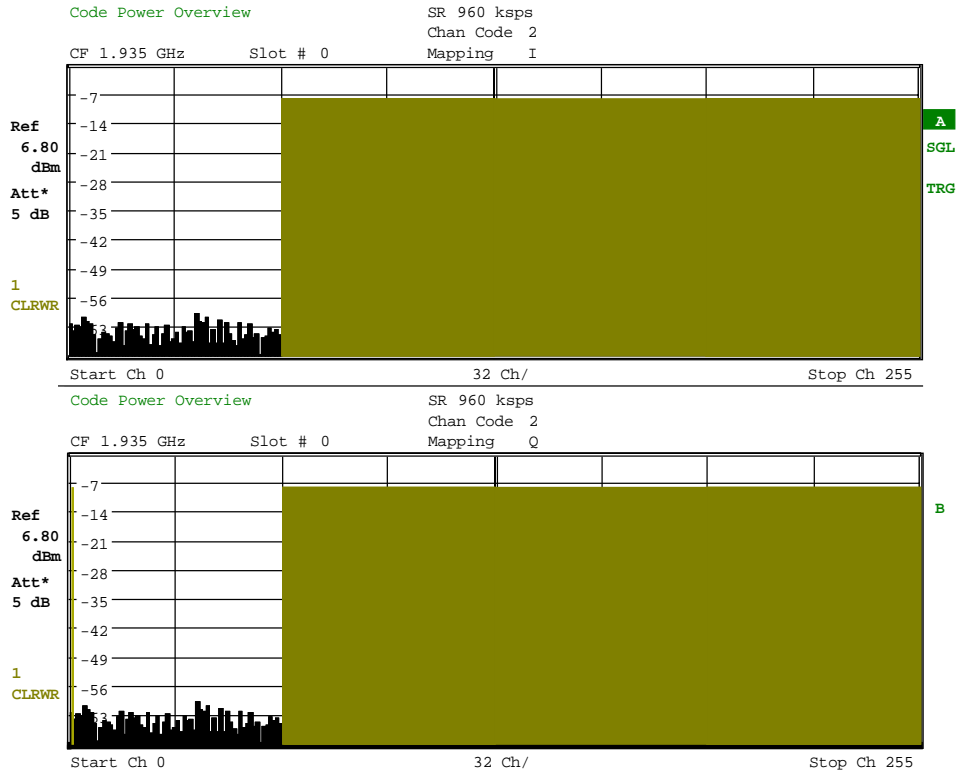
Fig. 6-13   Overview display of code domain power

IEC/IEEE-bus command: :CALCulate<1>:FEED "XPOW:CDP:OVERview"
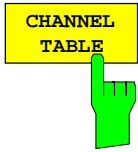
CHANNEL
TABLE

The *CHANNEL TABLE* softkey selects the display of the channel assignment table. The channel assignment table can contain a maximum of 512 entries, corresponding to the 256 codes that can be assigned within the class of spreading factor 256, both I and Q components.

The upper part of the table indicates the DPCCH channel that has to be present in every signal to be analyzed.

The lower part of the table indicates the data channels (DPDCH) contained in the signal. The channels are in descending order according to symbol rates and within a symbol rate in ascending order according to the channel numbers. Therefore, the unassigned codes are always to be found at the end of the table.

```
                                        SR 960 ksps
                                        Chan Code 2
               CF 1.935 GHz      Slot # 0     Mapping    Q
```

	Type	Symb Rate	Chan#	Status	Mapping	PilotL	Pwr Abs	Pwr Rel	
Ref	DPCCH	15.0 ksps	0	active	Q	8	-10.20	-8.45	A
6.80	DPDCH	960.0 ksps	1	active	I	---	-10.21	-8.45	SGL
dBm	DPDCH	960.0 ksps	1	active	Q	---	-10.21	-8.46	
Att*	DPDCH	960.0 ksps	2	active	I	---	-10.21	-8.45	TRG
5 dB	DPDCH	960.0 ksps	2	active	Q	---	-10.21	-8.45	
	DPDCH	960.0 ksps	3	active	I	---	-10.20	-8.45	
	DPDCH	960.0 ksps	3	active	Q	---	-10.20	-8.45	
1	------	15.0 ksps	0	inactv	I	---	-64.34	-62.59	
CLRWR	------	15.0 ksps	1	inactv	I	---	-65.94	-64.18	
	------	15.0 ksps	1	inactv	Q	---	-65.36	-63.60	

Fig. 6-14 Channel Table

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

Type: Type of channel (active channels only)

Symbol Rate: Symbol rate at which the channel is transmitted (15 ksps to 960 ksps).

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

Status: Status display. Codes that are not assigned are marked as inactive chanells.

Mapping: Component onto which the channel is mapped (I or Q). The entry is not editable, since the standard specifies the channel assignment for each channel.

PilotL: Number of pilot bits of the channel (only valid for the control channel DPCCH).

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

In *CODE CHAN AUTOSEARCH* mode, a data channel is designated as active if its power has a minimum value (see softkey *INACT CHAN THRESH*) compared to the total power of the signal and if a minimum signal/noise ratio is maintained within the channel.
In *CODE CHAN PREDEFINED* mode, each data channel that is included in the user defined channel table is considered to be active.

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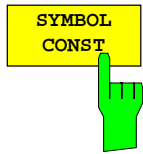
SYMBOL
CONST

The *SYMBOL CONST* softkey selects the display of symbol constellation diagram. The symbols are displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).

In order to provide a better illustration of the constellation, the channel is entered in the diagram as if its constellation points would lie in the I/Q plane, i.e. channels that are mapped onto the I comonent have points on the real axis and channels mapped onto the Q component have points on the imaginary axis.

It is possible to display the symbol constellation for unassigned codes (red marking in the CDP diagram on a code represented in blue), but the results are not meaningful, as the unassigned code channel does not contain data.
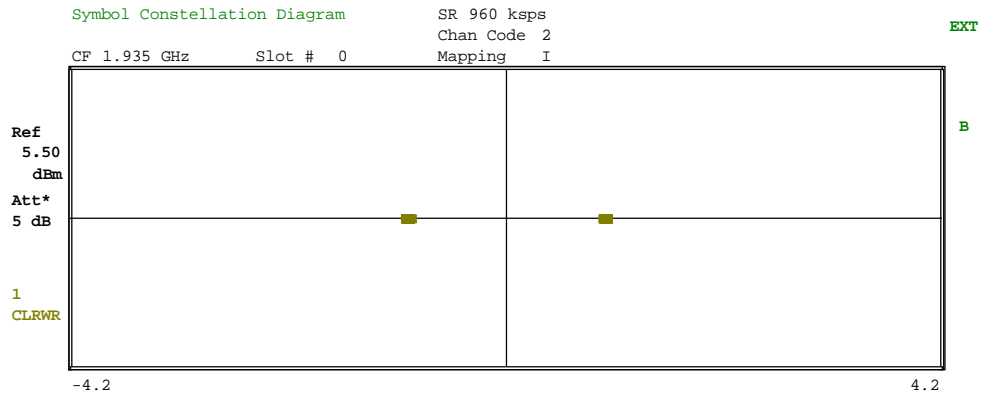
Fig. 6-15 Symbol Constellation Diagram of a channel mapped onto I component
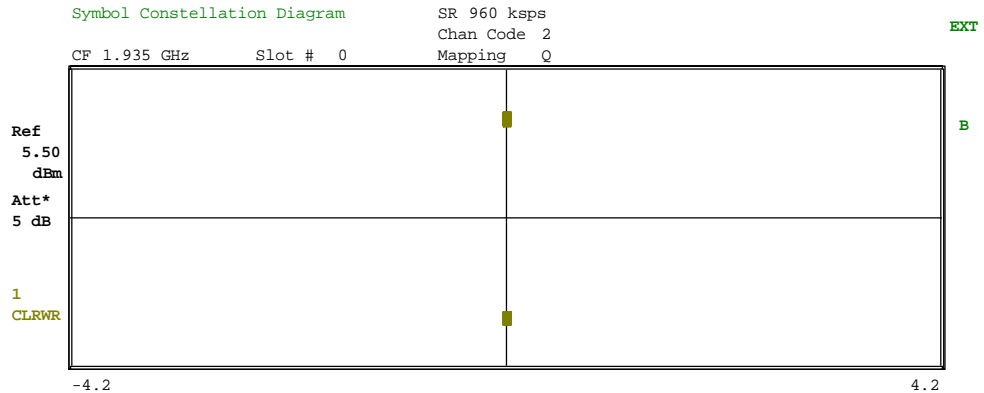
Fig. 6-16 Symbol Constellation Diagram of a channel mapped onto Q component

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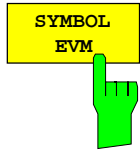
SYMBOL EVM

The *SYMBOL EVM* softkey activates the symbol error vector magnitude display. The EVM is displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).

It is possible to display the symbol error vector magnitude for unassigned codes (red marking in the CDP diagram on a code represented in blue), but the results are not valid.
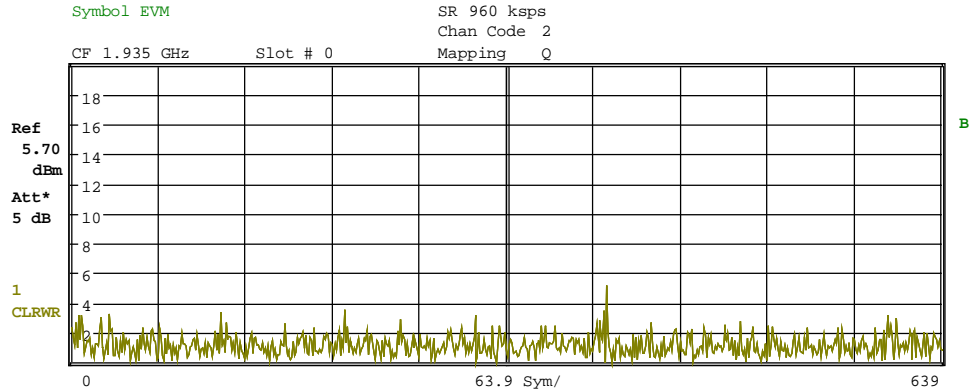
Fig. 6-17 Error Vector Magnitude for the selected slot of the selected channel

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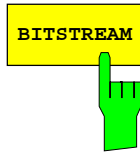
BITSTREAM

The *BITSTREAM* softkey activates the bitstream display.
The decided bits are displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).

While it is possible to display the bitstream for unused codes (red marking in the CDP diagramm at a code displayed in blue), the missing data means that the results are not very informative. In this case, "-" is used to indicate that all the bits are invalid.
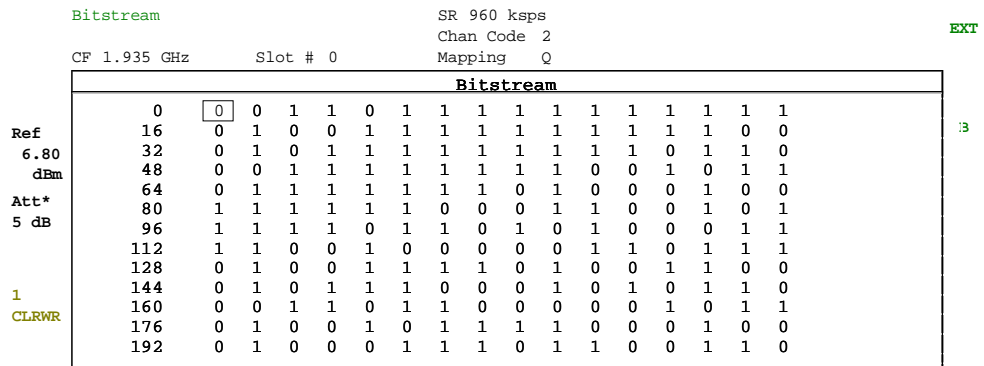
Fig. 6-18 Demodulated bits for the selected slot of the selected channel

IEC/IEEE-bus command: :CALCulate2:FEED "XTIM:CDP:BSTReam"

SELECT I Q

The *SELECT I/Q* softkey switches the display modes *CDP PWR RELATIVE /ABSOLUTE*, *CODE PWR ZOOM*, *POWER VS SLOT*, *SYMBOL CONST*, *SYMBOL EVM* between indication of I and Q component. Only channels that are mapped onto the corresponding component are taken into account by the respective display modes.

IEC/IEEE-bus command: `:[SENSe:]CDPower:MAPPing Q`

SELECT CHANNEL

The *SELECT CHANNEL* softkey activates the selection of a channel for the display modes *CDP PWR RELATIVE/ABSOLUTE*, *POWER VS SLOT*, *SYMBOL CONST*, *SYMBOL EVM*.
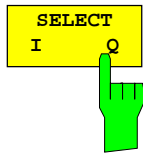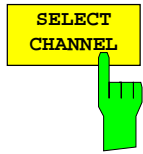
There are two ways of entering the channel numbers:

- Entry of channel number and spreading factor, separated by a decimal point
  If the channel number and the spreading factor are entered simultaneously, the entered channel is selected and marked in red if an active channel is concerned. For the display, the channel number entered is converted on the basis of spreading factor 256. For unused channels, the code resulting from the conversion is marked.
  Example: Entry 2.4
          Channel 2 is marked at spreading factor 4 (960 ksps) if the channel is active, otherwise code 128 at spreading factor 256.

- Entry of a channel number without a decimal point
  In this case, FS-K73 interprets the entered code as based on spreading factor 256. If the code entered corresponds to a used channel, the whole associated channel is marked. If the code corresponds to an unused channel, only the code entered is marked.
  Example: Entry 128
          Code 128 is marked at spreading factor 256 if there is no active channel on this code. If for instance channel 2 is active at spreading factor 4, the entire channel 2 is marked.

If the entered code corresponds to an active channel, the whole associated channel is marked. If it corresponds to a gap between the channels, only the entered code is marked.
If the code number is modified using the rollkey, the red marking changes its position in the diagram only if the code number no longer belongs to the marked channel. The step width of the changed rollkey position refers to spreading factor 256.

IEC/IEEE-bus command: `:[SENSe:]CDPower:CODE 0 to 255`
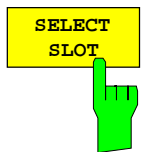
SELECT SLOT

The *SELECT SLOT* softkey activates the selection of the slot number for the display modes *POWER VS SLOT*, *SYMBOL CONST*, *SYMBOL EVM*. The softkey is only valid if one frame of the 3GPP signal is analyzed.

When the slot number is entered, the red marking in the power-versus-slot diagram changes its position in steps of a slot.

IEC/IEEE-bus command: `:[SENSe:]CDPower:SLOT 0 to 14`
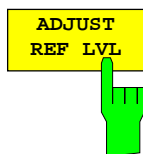
ADJUST REF LVL

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the instrument or limiting the dynamic range by a too small S/N ratio.

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

Measurement Configuration –*CHAN CONF* hotkey

Hotkey *CHAN CONF*
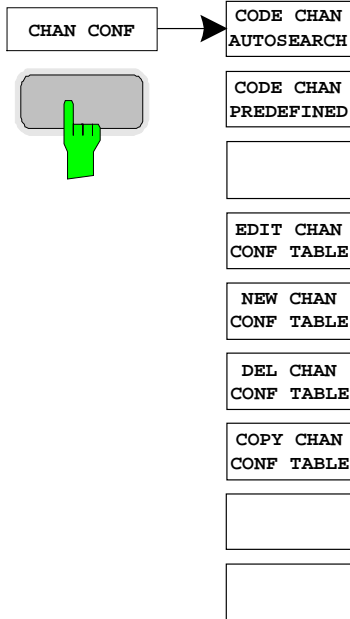
The *CHAN CONF* hotkey opens a submenu with different configurations for measurements. In this submenu, predefined channel tables can be selected as a basis for code domain measurements.

When the hotkey is selected, a table including the channel tables stored on the measuring instrument's hard disk is opened. The table provides just an overview and a table for the measurement can only be selected after actuating the *CODE CHAN PREDEFINED* softkey.

IEC/IEEE-bus command:
    :CONFigure:WCDPower[:BTS]:CTABle:CATalog?

The *CODE CHAN AUTOSEARCH* softkey allows code domain power measurements in the automatic search mode. In this mode, the whole code domain (all permissible symbol rates and channel numbers) is searched for active channels. The channel search is based on a comparison of the powers of active channels and unused codes. Furthermore, the restrictions in channel configuration given by the 3GPP specifications are taken into account.

The synchronization channel DPCCH is assumed to be present in the signal by the CDP analysis and added to the channel table for each measurement.

The *CODE CHAN AUTOSEARCH* mode is the preset search mode when starting the CDP analysis. It is mainly intended for giving the user an overview of the channels contained in the signal. If the signal contains channels that are not detected as being active in the automatic search mode, the CDP analysis can be performed with the channel configurations predefined by the user by switching to the *CODE CHAN PREDEFINED* mode.

IEC/IEEE-bus command:
    CONFigure:WCDPower[:BTS]:CTABle[:STATe] OFF
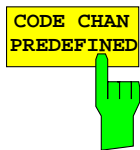
The *CODE CHAN PREDEFINED* softkey activates the predefined channel table mode. No search for active channels in the code domain is performed in this mode, but the channels contained in a channel table defined prior to the measurement are assumed to be active. The code domain power measurement and all further evaluations are carried out for these channels.

On selecting the softkey, a table containing all channel tables stored in the measuring instrument is opened. The CDP analysis is switched to the mode "predefined channel table". When the next measurement is

started, the power is measured according to this mode. The last table of the automatic search mode is first taken as a basis for the measurement. This table is available under the *RECENT* entry.

Switching to one of the predefined channel tables is done by selecting the corresponding table entry and pressing one of the unit keys. From the next measurement onwards, the selected channel table is taken as a basis for the sweep. A tick marks the selected channel table.

IEC/IEEE-bus command:
```
CONFigure:WCDPower[:BTS]:CTABle[:STATe] ON
CONFigure:WCDPower[:BTS]:CTABle:SELect
"3GB_1_32"
```
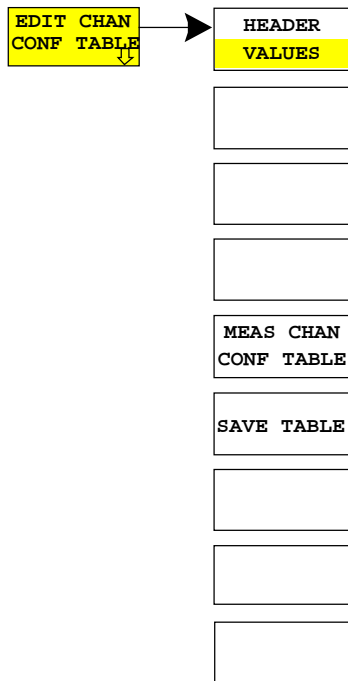
The *EDIT CHAN CONF TABLE* softkey opens a channel table in which the user can edit the channel configuration. In addition, a submenu is opened giving access to the softkeys required for editing the table.

EDIT CHANNEL TABLE						
NAME:	UP6DPDCH					
COMMENT:	Channel configuration with 6 data channels					
SYMBOL RATE [ksps]	CHAN #			PILOT BITS	CDP REL. [dB]	STATUS
DPCCH	0	Q		8	0.0000	ACTIVE
960	1	I		---	0.0000	ACTIVE
960	1	Q		---	0.0000	ACTIVE
960	3	I		---	0.0000	INACTIVE
960	3	Q		---	0.0000	INACTIVE
960	2	I		---	0.0000	INACTIVE
960	2	Q		---	0.0000	INACTIVE

Date: 27.MAR.2002 13:52:42

Fig. 6-19 Table for editing a channel configuration

Basically, any channel table stored on the instrument's hard disk can be edited as required. An edited table is not stored automatically but only after pressing the *SAVE TABLE* softkey. This prevents inadvertent overwriting of a table.

If the user edits the table currently used in CDP analysis, the edited table is taken as a basis for the next measurement immediately after it is stored. The effects of modifications made to the table show, therefore, at once. Here, too, the *SAVE TABLE* softkey must be pressed to store the edited table on the instrument's hard disk.

If the user edits a table stored on the hard disk but currently not active, the modifications become visible only after storage (*SAVE TABLE* softkey) and subsequent activation.
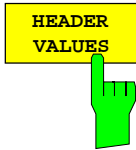
The *HEADER/VALUES* softkey switches between editing the channel table haeder or ist values.

HEADER allows editing the table header, i.e. the name and the comment. By changing the table name, overwriting of a table already stored is prevented. The table name may contain max. 8 characters.

IEC/IEEE-bus command:

```
:CONFigure:WCDPower[:BTS]:CTABle:NAME "NEW_TAB"
```

VALUES allows editing the entries in a channel table. The following parameters are available for each channel of a table (confirm each entry with one of the unit keys):

SYMBOL RATE: Symbol rate at which a channel is transmitted. This entry can only be edited if one data channel is used within the channel configuration.

CHAN #: Number of channel in the associated transmission class. For the channel numbers are fixed for all channel configurations of 3GPP uplink, the entry is not editable. The channel numbers will be set automatically according to the specifications.

MAPPING: I or Q component the channel is projected onto. The entry is not editable since the component the channel should be projected onto is fixed in 3GPP specifications for each channel.

PILOT BITS: Number of pilot bits of a channel. The entry is editable for the DPCCH only.

CDP REL.: Information about relative channel power. This entry cannot be edited and exists only for the *RECENT* table; it is used for indicating low-power channels.

STATUS: Channel status (active/inactive). Setting the channel status to inactive excludes a channel entered in the table from CDP analysis without the complete channel line having to be cleared from the table. Only channels with an active status are taken into account in CDP analysis. By activating/deactivating a channel the analysis is switched between the one-data-channel-model and the multiple-data-channel-model. At the model with more than one data channel, the channel configurations will be set according to the 3GPP specifications.

IEC/IEEE-bus commands:

```
:CONFigure:WCDPower[:BTS]:CTABle:DATA
8,0,0,0,0,0,1,0.00,8,1,0,0,0,0,1,0.00,7,1,0,256,
8
,0,1,0.00

:CONFigure:WCDPower[:BTS]:CTABle:COMMent
"Comment for new table"
```

MEAS CHAN CONF TABLE
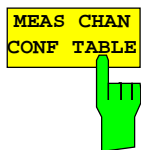
The *MEAS CHAN CONF TABLE* softkey starts a measurement in the *CODE CHAN AUTOSEARCH* mode. The measurement results are entered in the channel table currently open. This softkey is available only in the *CODE CHAN AUTOSEARCH* mode.

IEC/IEEE-bus command: `--`

SAVE TABLE

The *SAVE TABLE* softkey saves the table under the specified name.
Caution: Editing a channel model and storing it under its original name will overwrite the model.

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

NEW CHAN CONF TABLE → **HEADER VALUES**

MEAS CHAN CONF TABLE

SAVE TABLE
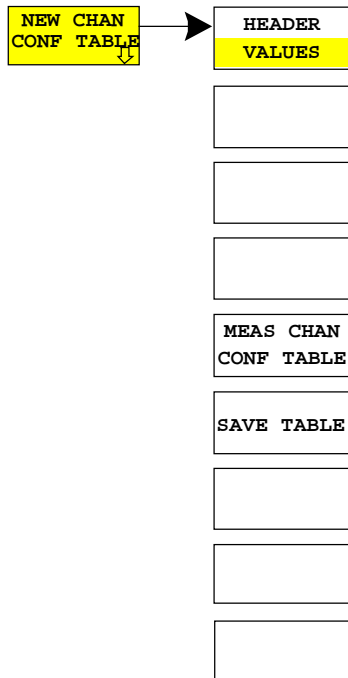
The *NEW CHAN CONF TABLE* softkey opens a submenu identical to that opened by the *EDIT CHAN CONF TABLE* softkey. In contrast to *EDIT CHAN CONF TABLE, NEW CHAN CONF TABLE* opens a table in which only the control channel is entered; the table name is not yet defined.

EDIT CHANNEL TABLE						
NAME:	default					
COMMENT:	default					
SYMBOL RATE [ksps]	CHAN #			PILOT BITS	CDP REL. [dB]	STATUS
DPCCH	0	Q		8	0.0000	ACTIVE
15	64	I		---	0.0000	ACTIVE
960	1	Q		---	0.0000	INACTIVE
960	3	I		---	0.0000	INACTIVE
960	3	Q		---	0.0000	INACTIVE
960	2	I		---	0.0000	INACTIVE
960	2	Q		---	0.0000	INACTIVE

Date: 27.MAR.2002 13:53:19

Fig. 6-20   Creating a new channel configuration

DEL CHAN CONF TABLE

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

IEC/IEEE-bus command:
     `:CONFigure:WCDPower[:BTS]:CTABle:DELete`

COPY CHAN CONF TABLE
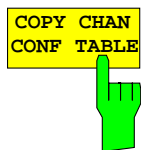
The *COPY CHAN CONF TABLE* softkey copies a selected table. The user is queried to enter the name under which the copy is to be saved.

IEC/IEEE-bus command:
     `:CONFigure:WCDPower[:BTS]:CTABle:COPY "CTAB2"`

Configuration of CDP Measurement – *SETTINGS* hotkey

Hotkey *SETTINGS*

```
SETTINGS  ──▶  SCRAMBLING
               CODE

               SCR TYPE
               LONG SHRT

               INACT CHAN
               THRESHOLD

               MEASURE
               SLOT FRAME




               INVERT Q
               ON  OFF

               SIDE BAND
               NORM  INV

               NORMALIZE
               ON  OFF
```
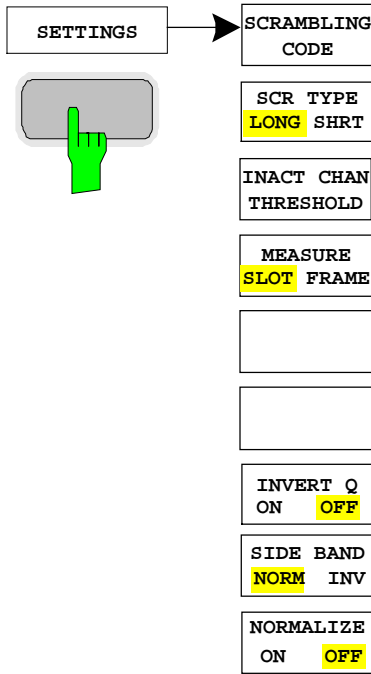
The *SETTINGS* hotkey opens a submenu with softkeys for setting parameters for the CDP measurement.
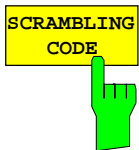
SCRAMBLING CODE

The *SCRAMBLING CODE* softkey opens a window for entering the scrambling code. The scrambling code is input in hex format.

The entered scrambling code has to coincide with that of the signal. Otherwise a CDP measurement of the signal is not possible.

IEC/IEEE-bus command: :[SENSe:]CDPower:LCODe[:VALue] #H2
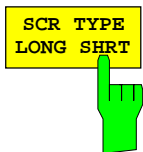
SCR TYPE LONG SHRT

The *SCR TYPE LONG/SHRT* softkey determines whether the scrambling code entered (see softkey SCRAMBLING CODE) is to be handled as long or short scrambling code.

IEC/IEEE-bus command: :[SENSe:]CDPower:LCODe:TYPE SHORt
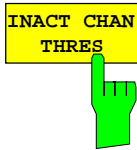
INACT CHAN THRES

The *INACT CHAN THRESH* softkey activates the entry of the minimum power which a single channel should have as compared to the total signal in order to be considered an active channel.

Channels that are below the specified threshold are considered to be not active. Channels that are not active appear in blue colour in the CDP diagram.

The two measurements *COMPOSITE EVM* and *PEAK CODE DOMAIN ERR,* specified as measurements on the total signal, are performed with the aid of the list of active channels. These two measurements are falsified whenever active channels are recognized as not active (see above example) or if unassigned codes get the status "assigned channel". *INACT CHAN THRESHOLD* is therefore used to influence the results of the two measurements.

The default value is -60 dB. If not all channels in the signal are automatically detected with that, *INACT CHAN THRES* has to be decremented.

IEC/IEEE-bus command:
```
:[SENSe:]CDPower:ICTReshold -100dB to +10dB
```
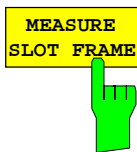
MEASURE SLOT FRAME

The *MEASURE SLOT / FRAME* softkey switches between a result length of one slot and one complete frame. The softkey is only valid, if the spectrum analyzer FSU is used. For spectrum analyzer FSP, a fixed result length of one slot is used.

IEC/IEEE-bus command:
```
:[SENSe:]CDPower:BASE   SLOT | FRAME
```

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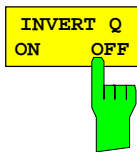
The *INVERT Q* softkey inverts the sign of the Q component of the signal.
Default setting is *OFF*.

IEC/IEEE-bus command: `[SENSe:]CDPower:QINVert OFF`
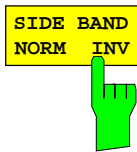
SIDE BAND NORM INV

The *SIDE BAND NORM / INV* softkey is used to perform the measurement both in the normal (NORM) and inverted position (INV).

NORM   The normal position allows the measurement of RF signals from the user equipment.

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

The default setting is *NORM*.

IEC/IEEE-bus command: `:[SENSe:]CDPower:SBANd NORMal|INVers`

NORMALIZE ON OFF

The *NORMALIZE ON / OFF* softkey eliminates the DC offset of the signal.
Default setting is OFF.

IEC/IEEE-bus command : `[SENSe:]CDPower:NORMalize OFF`

Frequency Settings – Key *FREQ*

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

The *CENTER* softkey opens the window for manually entering the center frequency.
The allowed range of values for the center frequency is:

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

f_{center}	center frequency
minspan	smallest selectable span > 0 Hz (10 Hz)
f_{max}	max. frequency

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

The CF *STEPSIZE* softkey opens a submenu for setting the step size of the center frequency. The step size can be coupled to the span (frequency domain) or the resolution bandwidth (time domain) or it can be manually set to a fixed value. The softkeys are mutually exclusive selection keys.

The *FREQUENCY OFFSET* softkey activates the window for entering an arithmetical frequency offset which is added to the frequency axis labelling. The allowed range of values 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 – Key *SPAN*

The *SPAN* key is disabled for measurements in the CDP mode. For all other measurements (see *MEAS* key), the permissible span settings are described with the relevant measurement. The associated menu corresponds to that of the measurement in the basic unit and is described in the manual of the basic unit.

Level Settings – Key *AMPT*

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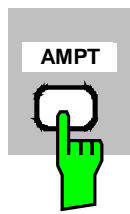
The *AMPT* key opens a submenu for level setting.

The *REF LEVEL* softkey allows the reference level to be input in the currently active unit (dBm, dBμV, etc).

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

ADJUST REF LVL executes a routine for optimum adjustment of the reference level to the signal.

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

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

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

Y PER DIV determines the grid spacing on the Y axis for all diagrams, where possible.

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

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

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

The *RF ATTEN MANUAL* softkey allows the attenuation to be entered irrespective of the reference level.
If the defined reference level cannot be set for the given RF attenuation, the reference level will be adjusted accordingly and the warning "Limit reached" will be output.

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

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

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

Marker Settings – Key *MKR*

MKR

MARKER 1

MARKER 2

MARKER 3

MARKER 4

MARKER NORM DELTA

MARKER ZOOM

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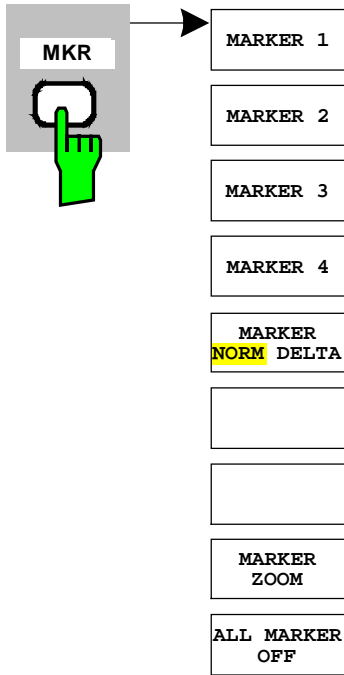
The *MARKER* key opens a submenu for the marker settings.

Markers are not available for the *RESULT SUMMARY* and *CHANNEL TABLE* displays. In all other displays, up to four markers can be activated, which can be defined as marker or delta marker by means of the *MARKER NORM/DELTA* softkey.

The *MARKER 1/2/3/4* .softkey selects the corresponding marker and activates it.
MARKER 1 is always the normal marker. After they have been switched on, *MARKERS 2 to 4* are delta markers that refer to *MARKER 1*. These markers can be converted into markers with absolute value display by means of the *MARKER NORM DELTA* softkey. When *MARKER 1* is the active marker, pressing the M*ARKER NORM DELTA* softkey switches on an additional delta marker.
Pressing the *MARKER 1 to 4* softkey again switches off 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 *MARKER ZOOM* softkey expands the area around MARKER 1. With the zoom function, more details of the display can be seen.
If *MARKER 1* is not active when the softkey is pressed, it is automatically activated and set to the highest peak in the window.
If an instrument setting is changed after selection of *MARKER ZOOM*, the function is aborted.

IEC/IEEE-bus command: CALC:MARK1:FUNC:ZOOM

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

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

The parameters concerning an activated marker are output at the top of the diagram:

```
Marker 1 [T1 ]
                          -6.02 dBm
     Slot  4 SR 960.0 ksps Ch 2
```
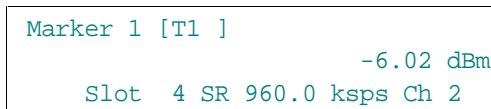
Fig. 6-21 Parameters of the marker info field

Besides the channel power, the parameters are:
Slot 4:   Slot number of the channel
SR 960 ksps: Symbol rate of the channel unassigned codes 15 ksps)

Ch 2:   Number of the spreading code of the channel

For all other measurements, the marker functions of the basic unit apply.

Changing Instrument Settings – Key *MKR→*

MKR->

| SELECT MARKER |
| PEAK |
| NEXT PEAK |
| NEXT MODE **LEFT** RIGTH |
| PEAK MODE MIN **MAX** |
| CPICH |
| PCCPCH |
| |
| |
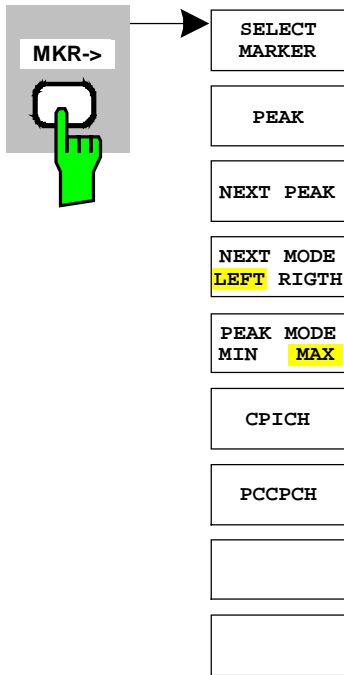
The *MKR→* key opens a submenu for marker functions:

The *SELECT MARKER* softkey activates the numerical selection of the marker in the data entry field. Delta marker 1 is selected by input of ' 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 peak of the trace.
If no marker is active when *MKR->* menu is called, *MARKER 1* is automatically switched on and the peak search is performed.

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

The *NEXT PEAK* softkey sets the active marker/delta marker to the next lower peak value on the trace. The search direction is defined in the *NEXT MODE* submenu (see below).

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 defines the searching direction for the search of the next maximum/minimum. For *NEXT MODE LEFT/RIGHT* the next extremum is searched to the left/right of the active marker.

IEC/IEEE-bus command: 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 defines wheather the peak should be searched in minima or maxima. This parameter influences the behaviour of the softkeys *PEAK* and *NEXT PEAK*.

IEC/IEEE-bus command: --

Marker Functions – Key MKR *FCTN*

The *MKR FCTN* key is disabled for all measurements in the code domain power. For all other FS-K73 measurements, the menu softkeys are described in the manual of the basic unit.

Bandwidth Setting – Key *BW*

The *BW* key is disabled for all measurements in the code domain power. For all other FS-K73 measurements, the menu-specific softkeys are described in the manual of the basic unit.

Measurement Control – Key *SWEEP*

The menu of the *SWEEP* key contains options for switchover between single measurement and continuous measurement and for the control of individual measurements. For measurements within the spectrum, the measurement time for a sweep can also be set. All menu-specific softkeys are described in the manual of the basic unit.

Measurement Selection – Key *MEAS*

The menu of the *MEAS* key contains all the FS-K73 measurements, which can be selected at a keystroke. The menu and its submenus are described in chapter 6.

Trigger Settings – Key *TRIG*

The selectable trigger functions depend on the measurement selected. Code domain power measurements allow the free run mode as well as the frame trigger mode specified by the 3GPP standard. For all other measurements, the trigger modes are identical to those of the corresponding measurement in the basic unit. The associated softkeys are described in the manual of the basic unit.

Trace Settings – Key *TRACE*

TRACE

| CLEAR/ WRITE |
| MAX HOLD |
| MIN HOLD |
| AVERAGE |
| VIEW |
| SWEEP COUNT |
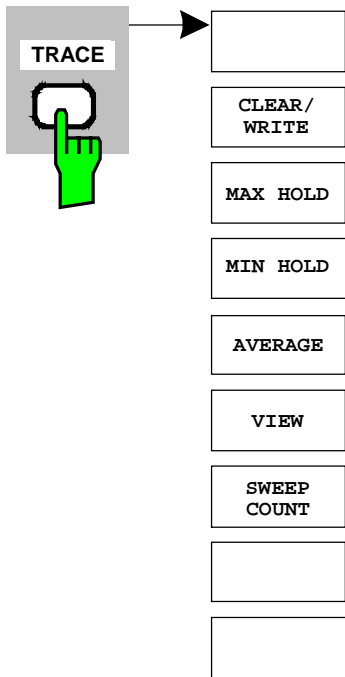
The Key *TRACE* opens the following submenu:

The *CLEAR/WRITE* softkey activates the overwrite mode for the collected measured values, i.e. the trace is overwritten by each sweep.
In the *CLEAR/WRITE* display mode all the available detectors can be selected. In the default mode the autopeak detector (setting *AUTO*) is selected.
Each time the *CLEAR/WRITE* softkey is actuated, the analyzer clears the selected trace memory and starts the measurement anew.

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

The *MAX HOLD* softkey activates the max peak detector.
The analyzer saves the sweep result in the trace memory only if the new value is greater than the previous one.
The signal spectrum is filled up upon each sweep until all signal components are detected in a kind of envelope.
Pressing the *MAX HOLD* softkey again clears the trace memory and restarts the max hold mode.

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

The *MIN HOLD* softkey activates the min peak detector.
The analyzer saves the sweep result in the trace memory only if the new value is greater than the previous one.
The signal spectrum is filled up upon each sweep until all signal components are detected in a kind of envelope.
Pressing the *MIN HOLD* softkey again clears the trace memory and restarts the max hold mode.

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

The *AVERAGE* softkey activates the trace averaging function. The average is formed over several sweeps. Averaging can be performed with any of the detectors available. If the detector is automatically selected by the analyzer, the sample detector is used.
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

The *VIEW* softkey freezes the current contents of the trace memory and displays it.
If a trace is frozen by *VIEW*, the instrument settings can be changed without the displayed trace being modified (exception: level display range and reference level, see below). The fact that the trace and the current instrument setting do not agree any more is indicated by an enhancement label "*" at the right edge of the grid.
If in the *VIEW* display mode the level display range (*RANGE*) or the reference level (*REF LEVEL*) are changed, the instrument automatically adapts the measured data to the changed display range. This allows an amplitude zoom to be made after the measurement in order to show details of the trace.

IEC/IEEE-bus command   DISP:WIND:TRAC:MODE VIEW

The *SWEEP COUNT* softkey activates the entry of the number of sweeps

used for averaging. The allowed range of values is 0 to 30000 and the following should be observed:

- Sweep Count = 0 means running averaging

- Sweep Count = 1 means no averaging being carried out

- Sweep Count > 1 means averaging over the selected number of sweeps; in the continuous sweep mode averaging is performed until the set number of sweeps is attained and is then continued as running averaging.

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

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

Display Lines – Key *LINES*

The *LINES* key is disabled for all measurements in the code domain power. For all other measurements, the menu settings are equivalent to those of the corresponding measurement in the basic unit; the associated softkeys are described in the manual of the basic unit.

Settings of Measurement Screen – Key *DISP*

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

Storing and Loading of Unit Data – Key *FILE*

The *FILE* menu is identical to that of the basic unit. All softkeys are described in the manual of the basic unit.

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

7 Remote-Control Commands for 3GPP FDD Code Domain Power Measurements

The following chapter describes the remote-control commands for the application firmware. An alphabetical list at the end of this chapter provides an overview of the commands.

The commands, which are also valid for the basic unit in the signal analyzer mode as well as the system settings, are described in the operating manual of the analyzer.

CALCulate:FEED - Subsystem

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

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2>			
:FEED	<string>		
:XPOWer			
:CDP			
[:ABSolute]			
:RATio			
:OVERview			
:XTIMe			
:CDPower			
:ERRor			
:SUMMary			
:CTABle			
:PCDomain			
:MACCuracy			
:PVSLot			
:BSTReam			
:SYMBol			
:CONStellation			
:EVM			

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

This command selects the measured data that are to be displayed. .

Parameter:	<string>::=	'XPOW:CDP' |
		'XPOW:CDP:RAT' |
		'XPOW:CDP:OVERview' |
		'XTIM:CDP:MACCuracy' |
		'XTIM:CDP:PVSLot' |
		'XTIM:CDP:BSTReam' |
		'XTIM:CDP:ERR:SUMM' |
		'XTIM:CDP:ERR:CTABle' |
		'XTIM:CDP:ERR:PCDomain' |
		'XTIM:CDP:SYMB:CONStellation' |
		'XTIM:CDP:SYMB:EVM'

'

Example: `:CALC2:FEED 'XTIM:CDP:MACCuracy'`

Features: *RST value: 'XTIM:OFF'

SCPI: conforming

Note: *For code domain power (CDP) measurements, the display is always operated in the SPLIT SCREEN mode and the assignment of display mode to measurement window is fixed. Therefore, the numeric suffix that is required or permitted is given in brackets for each display mode.*

The string parameters have the following meaning:

'XPOW:CDP'	Result display of code domain power as bargraph (`CALCulate<1>`)
'XPOW:CDP:RAT'	Result display of code domain power ratio as bargraph (`CALCulate<1>`)
'XPOW:CDP:OVERview'	Result display of code domain power (both I and Q component) as bargraph (`CALCulate<1>`)
'XTIM:CDP:ERR:SUMM'	Result display in tabular form (`CALCulate2`)
'XTIM:CDP:ERR:CTABle'	Result display of channel assignment table (`CALCulate<1>`)
'XTIM:CDP:ERR:PCDomain'	Result display of peak code domain error (`CALCulate2`)
'XTIM:CDP:MACCuracy'	Result display of composite EVM (error vector magnitude referred to the overall signal) (`CALCulate2`)
'XTIM:CDP:PVSLot'	Result display of power versus slot (`CALCulate2`)
'XTIM:CDP:BSTReam'	Result display of bit stream (`CALCulate2`)
'XTIM:CDP:SYMB:CONStellation'	Result display of symbol constellation (`CALCulate2`)
'XTIM:CDP:SYMB:EVM'	Result display of symbol error vector magnitude (`CALCulate2`)

CALCulate:LIMit – Subsystem

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate:LIMit:ESPectrum :MODE	AUTO | USER		

:CALCulate:LIMit:ESPectrum:MODE AUTO | USER

This command activates or deactivates automatic selection of the limit line in the spectrum emission mask measurement.

Parameters: AUTO The limit line is set as a function of the measured channel power.

USER Query only; user-defined limit lines are active (refer to description of limit lines in manual for basic unit).

Example: `":CALC:LIM:ESP:MODE AUTO"`

Features: *RST value: AUTO

SCPI: device-specific

CALCulate:MARKer – Subsystem

COMMAND	PARAMETER	UNIT	COMMENT

CALCulate<1|2>
  :MARKer<1...4>
    :FUNCtion
      :WCDPower
        :MS
          :RESult?
	PTOTal | FERRor | TFRame |
	MACCuracy | PCDerror |
	EVMRms | EVMPeak | CERRor |
	CSLot | SRATe | CHANnel |
	CDPabsolute | CDPRelative |
	IQOFfset | IQIMbalance |
	CMAPping | PSYMbol		

:CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:MS:RESult?
      PTOTal | FERRor | TFRame | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor |
      CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance |
      CMAPping | PSYMbol

This command queries the measured and calculated results of the 3GPP FDD code domain power measurement.

Example: `":CALC:MARK:FUNC:WCDP:RES? PTOT"`

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

PTOTal	total power
FERRor	frequency error in Hz
TFRame	trigger to frame
MACCuracy	composite EVM
PCDerror	peak code domain error
EVMRms	error vector magnitude RMS
EVMPeak	error vector magnitude peak
CERRor	chip rate error
CSLot	channel slot number
SRATe	symbol rate
CHANnel	channel number
CDPabsolute	channel power absolute
CDPRelative	channel power relative
IQOFfset	IQ offset
IQIMbalance	IQ imbalance
CMAPping	Channel component
PSYMbol	Number of pilot bits

CALCulate:STATistics - Subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functions in the instrument. The measurement window cannot be selected with these functions. The numeric suffix in CALCulate is therefore ignored.

COMMAND	PARAMETER	UNIT	COMMENT
:CALCulate			
:STATistics			
:MS			
:CCDF			
[:STATe]	<Boolean>		
:NSAMples	<numeric_value>	--	
:SCALe			
:Y			
:UPPer	<numeric_value>	--	
:LOWe	<numeric_value>	--	

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

This command switches on or off the measurement of the complementary cumulative distribution function (CCDF).

Example: "CALC:STAT:MS:CCDF ON"

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

:CALCulate:STATistics:NSAMples 100 to 32768

This command sets the number of measurement points to be acquired for the statistical measurement functions

Example: "CALC:STAT:NSAM 5000"

Features: *RST value: 10000
                   SCPI: device-specific

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

This command defines the upper limit for the Y-axis of the diagram in statitistical measurements. Since probabilities are specified on the Y-axis, the entered numerical values are dimensionless.

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

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

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

This command defines the lower limit for th Y-axis of the diagram in statistical measurements. Since probabilities are specified on the Y-axis, the entered numerical values are dimensionless.

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

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

CONFigure:WCDPower Subsystem

This subsystem comprises the commands for configuring the code domain power measurements. Only the numeric suffix 1 is permissible in `CONFigure`.

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			
: :WCDPower			
:MS			Option FS-K73
:MEASurement	POWer | ACLR | ESPectrum | OBANdwidth | OBWidth | WCDPower | CCDF		
:CTABle			
[:STATe]	<Boolean>		
:SELect	<file_name>		
:NAME	<file_name>		
:DATA	AUTO | <numeric_value>, AUTO | <numeric_value>..		
:COMMent	<string>		
:COPY	<file_name>		
:DELete			
:CATalog?			

CONFigure<1>:WCDPower:MS:MEASurement   POWer | ACLR | ESPectrum | OBANdwith | OBWidth | WCDPower | CCDF

This command selects the 3GPP FDD user equipment tests. The settings of the predefined measurements are described for the associated softkey in chapter 6.

Parameter:	POWer FDD	Channel power measurement (standard 3GPP 3GPP Forward) with predefined settings
	ACLR	Adjacent channel power measurement (standard 3GPP 3GPP FDD Forward) with predefined settings
	ESPectrum	Measurement of spectrum emission mask
	OBANdwith | OBWidth	Measurement of occupied power bandwidth
	WCDPower	Code domain power measurement. This selection has the same effect as command `INSTrument:SELect WCDPower`.
	CCDF	Measurement of Complementary Cumulative Distribution Function

Example: `"CONF:WCDP:MS:MEAS POW"`

Features: *RST value: POWer
                      SCPI: device-specific

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

This command switches the channel table on or off. On switching on, the measured channel table is stored under the name RECENT and switched on. After the RECENT channel table is switched on, another channel table can be selected with the command `CONF:WCDP:MS:CTABle:SELect`.

Note: *The RECENT channel table must always be switched on first with the command* `CONF:WCDP:MS:CTAB:STAT` *and then the required channel table can be selected with the command* `CONF:WCDP:CTAB:SEL`

Example: `":CONF:WCDP:MS:CTAB ON"`

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

CONFigure<1>:WCDPower:MS:CTABle:SELect <string>

This command selects a predefined channel table file. Before using this command, the RECENT channel table must be switched on first with the command `CONF:WCDP:CTAB:STATe ON`.

Example: `":CONF:WCDP:MS:CTABle ON"`
                 `":CONF:WCDP:MS:CTAB:SEL 'CTAB_1'"`

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

:CONFigure:WCDPower:MS:CTABle:NAME <file_name>

This command selects an existing channel table or creates the name of a new channel table.

Example: `":CONF:WCDP:CTAB:NAME 'NEW_TAB'"`

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

:CONFigure:WCDPower:MS:CTABle:DATA   2..8,0..255,0|1,-1|3|4|5|6|7|8 ,0|1,<numeric_value>...

This command defines the values of the selected channel table. Each line of the table consists of 6 values:

<code class>,<code number>,<chan mapping>,<pilot length>,<status>,<CDP relative [dB]>....

code class: 2 to 8
code number: 0 to 255
chan mapping: 1: I, 0: Q
pilot length: entry valid for DPCCH only
status: 0: not active, 1:active
CDP relative: for setting commands any value, for query CDP relative value

The Channel DPCCH may only be defined once. If channel DPCCH is missing in the command, it is automatically added at the end of the table.

Prior to this command, the name of the channel table has to be defined with command `CONF:WCDP:MS:CTAB:NAME`.

Example: `":CONF:WCDP:MS:CTAB:DATA 8,0,0,5,1,0.00,`
                 `4,1,1,0,1,0.00,4,1,0,0,1,0.00"`
                 The following channels are defined: DPCCH and two data channels with 960 ksps.

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

:CONFigure:WCDPower:MS:CTABle:COMMent <string>

This command defines a comment for the selected channel table

Prior to this command, the name of the channel table has to be defined with command `CONF:WCDP:MS:CTAB:NAME` and the values of the table have to be defined with command `CONF:WCDP:MS:CTAB:DATA`.

Example: `":CONF:WCDP:MS:CTAB:COMM 'Comment for table 1'"`

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

:CONFigure:WCDPower:MS:CTABle:COPY   <file_name>

This command copies one channel table onto another one. The channel table to be copied is selected with command `CONF:WCDP:MS:CTAB:NAME`.

Parameter: <file_name> ::= name of the new channel table

Example: `":CONF:WCDP:MS:CTAB:COPY 'CTAB_2'"`

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

The name of the channel table may contain a maximum of 8 characters. This command is an "event" which is why it is not assigned an *RST value and has no query.

:CONFigure:WCDPower:MS:CTABle:DELete

This command deletes the selected channel table. The channel table to be deleted is selected with command `CONF:WCDP:MS:CTAB:NAME`.

Example: `":CONF:WCDP:MS:CTAB:DEL"`

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

This command is an "event" which is why it is not assigned an *RST value and has no query.

:CONFigure:WCDPower:MS:CTABle:CATalog?

This command reads out the names of all channel tables stored on the harddisk.

Syntax of output format:

<Sum of file lengths of all subsequent files>,<free memory on hard disk>,
<1st file name>,,<1st file length>,<2nd file name>,,<2nd file length>,....,<nth file name>,
<nth file length>

Example: `":CONF:WCDP:MS:CTAB:CAT?"`

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

INSTrument Subsystem

:INSTrument[:SELect]   SANalyzer | RECeiver | MSGM
                                 | **MWCDpower**

This command switches between the operating modes by means of text parameters.

Selection MWCDpower presets the instrument as described in Chapter 2, Section "Basic Settings in Code Domain Measurement Mode".

Example: `":INST MWCD"`

Features: *RST value: SANalyzer
               SCPI: conforming

SENSe:CDPower Subsystem

This subsystem controls the parameters for the code domain mode. The numeric suffix in `SENSe<1|2>` is not significant in this subsystem.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe<1|2>]			
:CDPower			Option FS-K73
:ICTReshold	<numeric_value>	dB	
:SBANd	NORMal	INVerse		
:LCODe			
[:VALue]	<hex>		
:TYPE	LONG	SHORT		
:CODE	<numeric_value>	--	
:SLOT	<numeric_value>		
:SFACtor	4	8	16	32	64	128	256		
:MAPing	I	Q		
:NORMalize	<Boolean>		
:QINVert	<Boolean>		
:BASE	SLOT	FRAME		

:[SENSe:]CDPower:ICTReshold -100 dB to + 10 dB

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

Example: `":CDP:ICTR –10DB"`

Features: *RST value: -60 dB
SCPI: device-specific

:[SENSe:]CDPower:SBANd NORMal | INVers

This command is for interchanging the left and the right sideband.

Example: `":CDP:CDP:SBAN INV"`

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

:[SENSe:]CDPower:LCODe[:VALue] #H0 to #H1fff

This command defines the scrambling code in hexadecimal format.

Example: `":CDP:LCOD #H2"`

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

:[SENSe:]CDPower:LCODe:TYPE LONG | SHORt

This command switches between long and short scrambling code.

Example: `":CDP:LCOD:TYPE SHOR"`

Features: *RST value: LONG
SCPI: device-specific

:[SENSe:]CDPower:CODE   0 to 255

This command sets the code number. The code number refers to code class 8 (spreading factor 256).

Example:	":SENS:CDP:CODE 128"
Features:	*RST value: 0
	SCPI: device-specific

:[SENSe:]CDPower:SLOT   0 to 14

This command sets the slot number.

Example:	":SENS:CDP:SLOT 3"
Features:	*RST value: 0
	SCPI: device-specific

:[SENSe:]CDPower:SFACtor 4 | 8 | 16 | 32 | 64 | 128 | 256

This command defines the spreading factor. The spreading factor is only significant for display mode PEAK CODE DOMAIN ERROR.

Example:	":SENS:CDP:SFACtor 256"
Features:	*RST value: 256
	SCPI: device-specific

:[SENSe:]CDPower:MAPPing   I | Q

This command switches between I and Q component of the signal.

Example:	"CDP:MAPP I"
Features:	*RST value: Q
	SCPI: device-specific

:[SENSe:]CDPower:NORMalize ON | OFF

This command switches elimination of IQ offset on or off.

Example:	":SENS:CDP:NORM OFF"
Features:	*RST value: OFF
	SCPI: device-specific

:[SENSe:]CDPower:QINVert ON | OFF

This command inverts the Q component of the signal.

Example:	":SENS:CDP:QINV ON"
Features:	*RST value: OFF
	SCPI: device-specific

:[SENSe<1|2>:]CDPower:BASE SLOT | FRAMe

This command chooses the base of the CDP analysis: At SLOT one slot of the signal is analyzed only; at FRAME the complete 3GPP frame will be analyzes.

| **Example:** | ```:CDP:BASE SLOT``` |

| **Features:** | *RST-Wert: | SLOT |
| | SCPI: | device-specific |

TRACe Subsystem

:TRACe[:DATA] TRACE1 | TRACE2 | ABITstream | CTABle

This command transfers trace data from the controller to the instrument, the query reads trace data out of the instrument.

| **Example:** | ```:TRAC TRACE1,"+A$``` | (A$: data list in current format) |
| | ```:TRAC? TRACE1``` | |

| **Features:** | *RST value: | - |
| | SCPI: | conforming |

ABITstream can be set only if `CALC2:FEED "XTIM:CDP:BSTReam"` is selected (in the lower bitstream window). This command returns the bitstreams of all 15 slots one after the other, the output format may be REAL, UINT or ASCII.

CTABle reads out the channel table: Seven values are transmitted for each channel, the sixth value (reserved for pilot length) being constantly 0:
< class>,<cannel number>,<absolute level>,<relative level>, <I/Q component>,0,<state>...

For TRACE1 or TRACE2 the following measured values are transferred depending on the display mode:

CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE (TRACE1)

Each channel is defined by the class, the channel number, the absolute level, the relative level and the timing offset. The class denotes the spreading factor of the channel.

Class 8 corresponds to the highest spreading factor (256, symbol rate 15 ksps), class 2 to the lowest admissible spreading factor (4, symbol rate 960 ksps).

Five values are transmitted for each channel.
    <class>,<cannel number>,<absolute level>,<relative level>,<I/Q component>, ...

For CODE PWR ABSOLUTE / RELATIVE, the channels are output in ascending order sorted according to the code numbers, i.e in the same sequence as they are displayed on the screen. For CHANNEL TABLE, the channels are sorted according to the code classes, i.e. the unassigned channels are transmitted last.

The units are:

| Absolute level | dBm, |
| Relative level | dB referred to the total power of the signal. |

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

1st channel: spreading factor 256, channel number 0, component Q
2nd channel: spreading factor 4, channel number 1, component I
3rd channel: spreading factor 4, channel number 1, component Q

This yields the following result: 8,0,-20.0,0.0,0,2,-20.0,0.0,1,2,1,-20.0,0.0,0

The channels come in the same order as in the CDP diagram, i.e. depending on their position in the code domain of spreading factor 256.

RESULT SUMMARY (TRACE2)

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

        <composite EVM>,<peak CDE>,<carr freq Error>,<chip rate error>,
        <total power>,<trg to frame>,<EVM peak channel>,<EVM mean channel>, <class>,
        <channel number>,<power abs. channel>,<power rel. channel>,<I/Q component>,
        <pilotm length>,<IQ offset>,<IQ imbalance>

The units are:

EVM peak channel/mean channel, composite EVM, IQ offset/imbalance :	%,
Peak CDE, total power and power abs. channel	dB.
Power rel. Channel	dB referred to the total power of the signal.
Carr freq error :	Hz
Chip Rate Error	ppm.
Trg to Frame	µs.
Pilot length	bits
I/Q component	absolute

POWER VS SLOT (TRACE2)

15 pairs of slot (slotnumber of CPICH) and level values (for 15 slots) are always transferred.
<slot number>, <level value in dB>,<slot number>,<level value in dB>,.....

SYMBOL EVM (TRACE2)

The number of level values depends on the spreading factor:

Spreading factor 256	10 values
Spreading factor 128	20 values
Spreading factor 64	40 values
Spreading factor 32	80 values
Spreading factor 16	160 values
Spreading factor 8	320 values
Spreading factor 4	640 values

PEAK CODE DOMAIN ERR and COMPOSITE EVM (TRACE2)

15 pairs of slot (slotnumber of CPICH) and values are always transferred.
PEAK CODE DOMAIN ERR: <slot number>, <level value in dB>,.....
COMPOSITE EVM: <slot number>, <lvalue in %>, ...

SYMBOL CONST(TRACE2)

The real and the imaginary part are transferred as a pair:
<re 0>,<im 0>,<re 1>,<im 1>,.....<re n>, <im n>

For the channels have exclusively I or Q components in FS-K73, the <re> or <im> values are 0, depending on the selected component.

The number of level values depends on the spreading factor:

Spreading factor 256	10 values
Spreading factor 128	20 values
Spreading factor 64	40 values
Spreading factor 32	80 values
Spreading factor 16	160 values
Spreading factor 8	320 values
Spreading factor 4	640 values

BITSTREAM (TRACE2)

The bitstream of one slot is transferred. One value is transferred per bit (range 0,1,). The number of symbols is not constant and may vary for each sweep. Specific symbols in the bitstream may be invalid depending on the channel type and the bit rate (symbols without power). The assigned invalid bits are marked by "9".

Alphabetical List of Commands

Command	Parameter
:CALCulate<1|2>:FEED	'XPOW:CDP' 'XPOW:CDP:RAT' 'XTIM:CDP:MACCuracy' 'XTIM:CDP:PVSLot' 'XTIM:CDP:BSTReam' 'XTIM:CDP:ERR:CTABle' 'XTIM:CDP:ERR:SUMM' 'XTIM:CDP:ERR:PCDomain' 'XTIM:CDP:SYMB:CONStellation' 'XTIM:CDP:SYMB:EVM'
:CALCulate:LIMit:ESPectrum:MODE	AUTO | MANual | USER
:CALCulate:LIMit:ESPectrum:VALue	<numeric_value>
:CALCulate<1>:MARKer<1>:FUNCtion:WCDPower:MS:RESult?	PTOTal | FERRor | TFRame | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance | CMAPping | PSYMbol
:CALCulate:MARKer<1>:Y:PERCent	0 ... 100%
:CALCulate:STATistics: SCALe:Y:LOWer	-1E-6 .... 0.1
:CALCulate:STATistics:NSAMples	100 ... 32768
:CALCulate:STATistics:SCALe:Y:UPPer	-1E-5 ... 1.0
:CALCulate:STATistics:MS:CCDF[:STATe]	ON | OFF
:CONFigure<1>:WCDPower:MS:MEASurement	POWer | ACLR | ESPectrum | OBANdwidth|OBWidth | WCDPower | CCDF
:CONFigure<1>:WCDPower:MS:CTABle:CATAlog?	
:CONFigure<1>:WCDPower:MS:CTABle:COMMent	<string>
:CONFigure<1>:WCDPower:MS:CTABle:COPY	<file_name>
:CONFigure<1>:WCDPower:MS:CTABle:DATA	2..9, 0..255, 0|1, -1|3|4|5|6|7|8, 0|1, <numeric_value>....
:CONFigure<1>:WCDPower:MS:CTABle:DELete	
:CONFigure<1>:WCDPower:MS:CTABle:NAME	<file_name>
:CONFigure<1>:WCDPower:MS:CTABle:SELect	<string>
:CONFigure<1>:WCDPower:MS:CTABle[:STATe]	ON | OFF
:INSTrument[:SELect]	MWCDpower
:[SENSe:]CDPower:BASE	SLOT | FRAME
:[SENSe:]CDPower:CMAPping	I | Q
:[SENSe:]CDPower:CODE	0 to 255
:[SENSe:]CDPower:ICTReshold	−100 to 10 dB
:[SENSe:]CDPower:LCODe[:VALue]	#H0 to #H1fff
:[SENSe:]CDPower:LCODe:TYPE	LONG | SHORT
:[SENSe:]CDPower:NORMalize	ON | OFF
:[SENSe:]CDPower:QINVert	ON | OFF
:[SENSe:]CDPower:SBANd	NORMal | INVers
:[SENSe:]CDPower:SFACtor	4 | 8 | 16 | 32 | 64 | 128 | 256
:[SENSe:]CDPower:SLOT	0 ... 14
:TRACe[:DATA]	TRACE1|TRACE2 | ABITstream | CTABle

Table of Softkeys with Assignment of IEC/IEEE Commands

`3G FDD BS`	`INSTrument:SELect BWCDpower│WCDPower`

`POWER`	`:CONFigure<1>:WCDPower:MEASurement POWer` Query of results: `:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? CPOWer`

`ACLR`	`:CONFigure<1>:WCDPower:MEASurement ACLR` Query of results: `:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? ACPower`

`SPECTRUM EM MASK`	`:CONFigure:WCDPower:MEASurement ESPectrum` Query of results: `:CALCulate<1>:LIMit<1>:FAIL?`

`LIMIT LINE AUTO`	`:CALCulate<1>:LIMit<1>:ESPectrum:MODE AUTO`

`LIMIT LINE MANUAL`	`:CALCulate<1>:LIMit<1>:ESPectrum:MODE MANual` `:CALCulate<1>:LIMit<1>:ESPectrum:VALue <numeric_value>`

`LIMIT LINE USER`	`:CALCulate:LIMit<1>:NAME <string>`
	`:CALCulate:LIMit<1>:UNIT DBM`
	`:CALCulate:LIMit<1>:CONTrol[:DATA] <num_value>, <num_value>, ...`
	`:CALCulate:LIMit<1>:CONTrol:DOMain FREQuency`
	`:CALCulate:LIMit<1>:CONTrol:TRACe 1`
	`:CALCulate:LIMit<1>:CONTrol:OFFset <num_value>`
	`:CALCulate:LIMit<1>:CONTrol:MODE   RELative`
	
	`:CALCulate:LIMit<1>:UPPer[:DATA] <num_value>, <num_value>..`
	`:CALCulate:LIMit<1>:UPPer:STATe   ON │ OFF`
	`:CALCulate:LIMit<1>:UPPer:OFFset <num_value>`
	`:CALCulate:LIMit<1>:UPPer:MARGin <num_value>`
	`:CALCulate:LIMit<1>:UPPer:MODE   ABSolute`
	`:CALCulate:LIMit<1>:UPPer:SPACing LINear`

Notes:
- If the y values are entered using the command:`CALCulate:LIMit<1>:LOWer[:DATA]`   the limit check yields "failed" if the values are below the limit line.
- If a user-defined limit line is activated, it has priority over limit lines selected via AUTO.

`OCCUPIED BANDWIDTH`	`:CONFigure<1>:WCDPower:MEASurement OBANdwidth` Query of results: `:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? OBANdwidth`

`STATISTICS`	`:CONFigure:WCDPower:MEASurement CCDF` **or** `:CALCulate:STATistics[:BTS]:CCDF[:STATe] ON` Query of results: `CALCulate:MARKer:X?`

`PERCENT MARKER`	`:CALCulate:MARKer:Y:PERCent 0...100%`

`NO OF SAMPLES`	`CALCulate:STATistics:NSAMamples 1...32768`

`AVERAGE ON  OFF`	`:DISPlay[:WINDow]:TRACe<1>:MODE  AVERage │ VIEW`

`SWEEP COUNT`	`:[SENSe<1│2>:]:SWEep:COUNt 6`

`Y MAX`	`:CALCulate:STATistics:SCALe:Y:UPPer 1E-5..1`

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

CODE DOM POWER	`:INSTrument<1>[:SELect] WCDPower` oder `:CONFigure:WCDPower:MEASurement WCDPower` Query of results: `:TRACe:DATA? TRACE1	TRACE2	ABITstream	CTABle`  or        `:CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:RESult?`                 `PTOTal	FERROr |TFRame	TOFFset	MACCuracy |`                 `PCDerror	EVMRms	EVMPeak	CERRor	CSLot	SRATe |`                 `CHANnel	CDPabsolute	CDPRelative	IQOFfset |`                 `IQIMbalance` or marker functions (see submenu MARKER)
CHAN CONF	--
CODE CHAN AUTOSEARCH	`:CONFigure:WCDPower[:BTS]:CTABle[:STATe] OFF`
CODE CHAN PREDEFINED	`:CONFigure:WCDPower[:BTS]:CTABle[:STATe] ON` `:CONFigure:WCDPower[:BTS]:CTABle:SELect  <channel table name>`
EDIT CHAN CONF TABLE	
CHAN TABLE HEADER	`:CONFigure:WCDPower[:BTS]:CTABle:NAME "channel table name"` `:CONFigure:WCDPower[:BTS]:CTABle:COMMent "Comment for new table"`
CHAN TABLE VALUES	`:CONFigure:WCDPower[:BTS]:CTABle:NAME "channel table name"` `:CONFigure:WCDPower[:BTS]:CTABle:DATA <numeric_value>`
ADD PICH	--
INSERT LINE	--
DELETE LINE	
MEAS CHAN CONF TABLE	--
SAVE TABLE	-- (erfolgt bei Fernbedienung automatisch)
SORT TABLE	--
NEW CHAN CONF TABLE	Siehe EDIT CHAN CONF TABLE
DEL CHAN CONF TABLE	`:CONFigure:WCDPower[:BTS]:CTABle:NAME "channel table name"` `:CONFigure:WCDPower[:BTS]:CTABle:DELete`
COPY CHAN CONF TABLE	`:CONFigure:WCDPower[:BTS]:CTABle:NAME "channel table name"` `:CONFigure:WCDPower[:BTS]:CTABle:COPY "new channel table name"`
SETTINGS	--
SCRAMBLING CODE	`:[SENSe:]CDPower:LCODe[:VALue] #H0 ... #H1fff<hex>`
SCR TYPE LONG SHRT	`:[SENSe:]CDPower:LCODe:TYPE LONG	SHORT`

INACT CHAN THRESH	`:[SENSe:]CDPower:ICTReshold –100 dB ... +10 dB`
MEASURE SLOT FRAME	`:[SENSe:]CDPower:BASE SLOT	FRAME`
INVERT Q	`:[SENSe:]CDPower:QINVert ON	OFF`
SIDE BAND NORM INV	`:[SENSe:]CDPower:SBANd NORMal	INVerse`
NORMALIZE ON OFF	`:[SENSe:]CDPower:NORMalize ON	OFF`
RESULTS	`--`
CODE PWR RELATIVE	`:CALCulate<1>:FEED  'XPOW:CDP:RAT'`
COMPOSITE EVM	`:CALCulate2:FEED "XTIM:CDP:MACCuracy"`
PEAK CODE DOMAIN ERR	`:CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"`
POWER VS SLOT	`:CALCulate2:FEED "XTIM:CDP:PVSLot"`
RESULT SUMMARY	`:CALCulate2:FEED "XTIM:CDP:ERR:SUMMary"`

```
Query of results:
   :CALCulate:MARKer:FUNCtion:WCDPower:MS:RESult?
    PTOTal | FERRor | TFRame | MACCuracy | PCDerror | EVMRms | EVMPeak |
   CERRor | CSLOt | SRATe | CHANnel | CDPabsolute | CDPRelative |
   IQOFfset | IQIMbalance
```

CODE PWR ABSOLUTE	`:CALCulate<1>:FEED  'XPOW:CDP'`
CODE PWR OVERVIEW	`:CALCulate<1>:FEED  'XPOW:CDP:OVERview'`
CHANNEL TABLE	`:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"`
SYMBOL CONST DIAG	`:CALCulate2:FEED "XTIM:CDP:SYMB:CONStellation"`
SYMBOL EVM	`:CALCulate2:FEED "XTIM:CDP:SYMB:EVM"`
BITSTREAM	`:CALCulate2:FEED "XTIM:CDP:SYMB:BITStream"`
SELECT I Q	`:[SENSe:]CDPower:CMAPping I	Q`
SELECT CHANNEL	`:[SENSe:]CDPower:CODE 0...511`
SELECT SLOT	`:[SENSe:]CDPower:SLOT 0 ... 14`

8   Performance Test

- Switch off the instrument (spectrum analyzers FSP or FSU) before removing or inserting modules.
- Check the setting of the AC supply voltage selector (230 V) prior to switching on the unit.
- Measure the parameters after a warm-up time of at least 30 min. and the completion of system error correction of the analyzer and SMIQ. Only then is it ensured that the specifications are complied with.
- Unless specified otherwise all settings are made after a PRESET.
- Conventions for settings on the analyzer during the measurement:

[***<Key>***]	Press a key on the front panel, eg [SPAN]
[<SOFTKEY>]	Press a softkey, eg [MARKER -> PEAK]
[<nn unit>]	Enter a value and terminate by entering the unit, eg [12 kHz]
{<nn>}	Enter values indicated in one of the following tables.

Successive entries are separated by [:], eg [***SPAN***: 15 kHz].

- The values stated hereinafter are not guaranteed values. Only the data sheet specifications are binding.

Required Measuring Equipment and Accessories

Table 8-1   Required Measuring Equipment and Accessories

Item	Instrument type	Recommended characteristics	Recommended equipment	R&S Order No.	Use
1	Signal generator	Vector signal generator for generating cdmaOne signals	SMIQ with options: SMIQB42 SMIQB20 SMIQB11	1125.5555.xx 1104.7936.02 1125.5190.02 1085.4502.04	

Test Procedure

The performance test refers exclusively to results of the code-domain power.
It is not required to check the POWER-, ACLR- and SPECTRUM results since they are covered by the performance test of the basic unit.

Default settings on   ***[PRESET]***
SMIQ: ***[LEVEL :   0 dBm]***
                                       [FREQ: 2.1175 GHz]
                                  DIGITAL STD
                                      WCDMA 3GPP
                                          LINK DIRECTION   UP/REVERSE
                                          TEST MODELS (NOT STANDARDIZED)...
                                              C+D960K
                                          SELECT BS/MS
                                              MS 1 ON
                                                  OVERALL SYMBOL RATE... 6*960
                                          STATE: ON

Trigger output: *RADIO FRAME*

The channel list should show the following:

CHANNEL NUMBER	1	2	3	4	5	6
TYPE	DPDCH	DPDCH	DPDCH	DPDCH	DPDCH	DPDCH
SYMBOL RATE	960	960	960	960	960	960
CHAN CODE	1	1	3	3	2	2
DATA	PN15	PN15	PN15	PN15	PN15	PN15

Default settings on
the analyzer:
[PRESET]
[CENTER: *2.1175 GHz]*
[REF: *10 dBm]*
[3G FDD BS]
[TRIG   *EXTERN]*
[SETTINGS   *SCRAMBLING CODE 0]*
[RESULTS   *CHANNEL TABLE]*

Test setup and other
settings

> Connect external trigger input of the analyzer to SMIQ

> Connect external reference output of FSU to SMIQ

UTILITIES
            REF OSC
SMIQ   *SOURCE: EXT*

[SETUP: *REFERENCE INT]*

analyzer

The display of the the analyzer should show the following:

```
                                        SR 960 ksps
                                        Chan Code  2
       CF 1.935 GHz        Slot #  0    Mapping     Q
       ┌──────────────────────────────────────────────────────────────────────┐
       │                          Channel Table                                │
       ├───────┬───────────┬───────┬────────┬─────────┬────────┬────────┬──────┤
       │ Type  │ Symb Rate │ Chan# │ Status │ Mapping │ PilotL │ Pwr Abs│Pwr Rel│
Ref    │ DPCCH │  15.0 ksps│     0 │ active │    Q    │      8 │  -10.20│ -8.45 │  A
6.80   │ DPDCH │ 960.0 ksps│     1 │ active │    I    │    --- │  -10.21│ -8.45 │  SGL
 dBm   │ DPDCH │ 960.0 ksps│     1 │ active │    Q    │    --- │  -10.21│ -8.46 │
Att*   │ DPDCH │ 960.0 ksps│     2 │ active │    I    │    --- │  -10.21│ -8.45 │  TRG
5 dB   │ DPDCH │ 960.0 ksps│     2 │ active │    Q    │    --- │  -10.21│ -8.45 │
       │ DPDCH │ 960.0 ksps│     3 │ active │    I    │    --- │  -10.20│ -8.45 │
       │ DPDCH │ 960.0 ksps│     3 │ active │    Q    │    --- │  -10.20│ -8.45 │
 1     │ ------│  15.0 ksps│     0 │ inactv │    I    │    --- │  -64.34│-62.59 │
CLRWR  │ ------│  15.0 ksps│     1 │ inactv │    I    │    --- │  -65.94│-64.18 │
       │ ------│  15.0 ksps│     1 │ inactv │    Q    │    --- │  -65.36│-63.60 │
       │                                                                        │
       └──────────────────────────────────────────────────────────────────────┘
```

```
       Result Summary                   SR 960 ksps
                                        Chan Code  2                              EXT
       CF 1.935 GHz        Slot #  0    Mapping     Q
       ┌──────────────────────────────────────────────────────────────────────┐
       │                          Result Summary                               │
       ├───────────────────────────────────┬──────────────────────────────────┤
       │ GLOBAL RESULTS                     │                                  │
Ref    │   Total Power        -1.75 dBm     │ Carrier Freq Error   -67.68 mHz  │  B
6.80   │   Chip Rate Error    -0.55 ppm     │ Trigger to Frame     -72.17 ns   │
 dBm   │   IQ Offset           0.02 %       │ IQ Imbalance          0.06 %     │
Att*   │   Composite EVM       1.39 %       │ Pk CDE (15.0 ksps)   -59.06 dB   │
5 dB   │   Slot No                 0        │ No of Active Chan          7     │
       ├───────────────────────────────────┼──────────────────────────────────┤
       │ CHANNEL RESULTS                    │                                  │
       │   Symbol Rate       960.00 ksps    │ Timing Offset          0 Chips   │
 1     │   Channel Code            2        │ Mapping                    Q     │
CLRWR  │   No of Pilot Bits        0        │                                  │
       │   Channel Power Rel  -8.45 dB      │ Channel Power Abs    -10.21 dBm  │
       │   Symbol EVM         1.23 % rms    │ Symbol EVM            4.86 % Pk   │
       └──────────────────────────────────────────────────────────────────────┘
```

       Date: 25.MAR.2002 11:22:31

9 Glossary

Composite EVM	In accordance with the 3GPP specifications, the squared error between the real and imaginary parts of the test signal and an ideal reference signal is determined (EVM referred to the total signal) in a composite EVM measurement.
DPCCH	Dedicated physical control channel, control channel. The DPCCH contains pilot, TFCI, TPC and FBI bits. The control channel is assumed to be present in every signal in FS-K73.
DPDCH	Dedicated physical data channel, data channel. The data channels only contain data bits. Data channels for user equipment signals are assigned a certain scheme defined in 3GPP specifications.
Inactive Channel Threshold	Minimum power that a single channel must have as compared to the total signal to be recognized as an active channel
Peak Code Domain Error	In accordance with the 3GPP specifications, the error between the test signal and the ideal reference signal is projected onto the classes of the different spreading factors in the case of a peak code domain measurement.

10 Index