



ROHDE & SCHWARZ

Test and Measurement
Division

Operating Manual

3GPP WCDMA Base Station Test

Application Firmware Module R&S[®] FSIQK72

1126.4746.02

3GPP HSDPA Base Station Test

Application Firmware Module R&S[®] FSIQK74

1153.1109.02

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Contents of Manual for Application Firmware R&S® FSIQK72/K74

This manual contains all information on the operation of R&S® FSIQ equipped with Application Firmware R&S® FSIQK72/K74. It includes operation via menus and the remote-control commands for the 3GPP WCDMA base station 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 base station tests.
- Chapter 4** describes the 3GPP WCDMA test models as stipulated in standard FDD (3G TS 25.141 V3.7.0).
- Chapter 5** gives a schematic overview of the WCDMA control menus.
- Chapter 6** contains a detailed description of the possible base station 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 R&S® FSIQ operating manual. It includes exclusively functions of Application Firmware R&S® FSIQK72/K74. For all other descriptions, please refer to the R&S® FSIQ operating manual.

3GPP WCDMA/HSDPA Base Station Test - Application Firmware R&S® FSIQK72/K74

Signal Analyzer R&S® FSIQ equipped with Application Firmware R&S® FSIQK72/K74 performs code domain power measurements on downlink signals according to standard 3GPP (FDD mode). The application firmware is in line with standard 3GPP (Third Generation Partnership Project) with version release 5. Signals that meet the conditions for channel configuration of test models 1 to 4 according to 3GPP can be measured with FSIQK72. 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. The spectrum analyzer R&S® FSIQ equipped with Application Firmware FSIQK74 additionally allows to perform measurements on test model 5 (HSDPA). Installation of FSIQK72 is a precondition for equipping the FSU with FSIQK74.

The following hardware is required for using R&S® FSIQ in combination with option R&S® FSIQK72/K74:

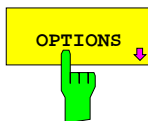
- Option R&S® FSIQ B70 – Extended I/Q memory and DSP module
- Module I/Q Demodulator: model index 05 (Order No.: 1066.2520.05)

- Notes:**
- *The code domain power measurements can be performed for units fitted with IQ demodulators other than model 05. However, the linearity of the R&S® FSIQK72/K74 level values can only be guaranteed with an IQ demodulator of model 05 or higher.*
 - *The model index of the I/Q Demodulator is indicated in table “Installed Components” (SYSTEM-INFO HARDWARE+OPTIONS menu)*

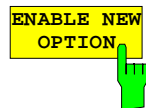
1 Enabling the Firmware Option

Firmware Option R&S® FSIQK72/K74 is enabled in the *CONFIGURATION SETUP* menu by entering a keyword. The keyword is delivered with the option (see Key Code Document, 1153.1121). R&S® FSIQK72 and R&S® FSIQK74 have different keywords. An installation of R&S® FSIQK72 is a precondition for installing R&S® FSIQK74. If the options are factory-installed, they are already enabled.

CONFIGURATION 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 *ENABLE NEW OPTION* softkey activates the entry of the keyword for a firmware option.

One or 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.

The *FIRMWARE OPTIONS* table can be displayed in the *FIRMWARE OPTIONS* softkey in the *INFO* menu.

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

2 Getting Started

The following chapter explains basic WCDMA base station tests by means of a setup with Signal Generator R&S SMIQ. It describes how operating and measurement errors can be avoided using correct presetting. The measurements are performed with an analyzer equipped with R&S® FSIQK72. An additional installation of R&S® FSIQK74 is not necessary.

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 CPICH (Common Pilot Channel) in vector signal analyzer mode
 - Setting: Synchronization of reference frequencies
- 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:

- Signal Analyzer R&S® FSIQ with Application Firmware R&S® FSIQK72/K74: WCDMA base station test (option R&S® FSIQ B70 required)
- Vector Signal Generator SMIQ with option SMIQB43: digital standard WCDMA (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 R&S® FSIQ:

- | | |
|-------------|--|
| [<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, R&S® FSIQ 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 FWD
Sweep	CONTINUOUS
CDP mode	CODE CHAN AUTOSEARCH
Trigger settings	FREE RUN
Trigger offset	-266.67µs
Scrambling code	0
Threshold value	-20 dB
Symbol rate	15 ksps
Code number	0
Slot number	0
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 WCDMA signal and the spurious emissions close to the carrier.

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

Settings on SMIQ:

```

[PRESET]
[LEVEL: 0 dBm]
[FREQ: 2.1175 GHz]
DIGITAL STD
  WCDMA/3GPP
    SET DEFAULT
    SELECT BS/MS
      BS 1 ON
        P-CPICH STATE ON
          STATE: ON
  
```

Settings on R&S® FSIQ:

```

[PRESET]
[CENTER: 2.1175 GHz]
[REF: 0 dBm]
[MODE: 3GPP BTS ANALYZER: POWER]
  
```

Measurement on R&S® FSIQ: The following is displayed:

- The spectrum of the WCDMA signal (CPICH only) on the trace
- The signal channel power within the 3.84 MHz channel bandwidth (in the marker info field)

Measurement 2: Measurement of CPICH in Vector Signal Analyzer Mode

When the WCDMA signal only contains one channel, the signal can be measured in the vector analyzer mode of the analyzer. Since each channel is QPSK-modulated, the total signal is QPSK-modulated also if only one channel is transmitted.

The measurement of the QPSK signal allows, for instance, to determine the frequency offset between DUT and analyzer.

This may be useful for troubleshooting, e.g. if synchronization is not possible during the code domain power measurement.

Test setup *As for measurement 1*

Settings on SMIQ: *As for measurement 1*

Settings on R&S® FSIQ: **[PRESET]**
[CENTER: *2.1175 GHz]*
[REF: *0 dBm]*
[MODE: *VECTOR ANALYZER*
DIGITAL STANDARDS W-CDMA 3GPP FWD]

Measurement on R&S® FSIQ: The following is displayed:

- Screen A: Constellation diagram of signal (QPSK)
- Screen B: Numeric results of demodulation

Frequency error The frequency error display denotes the frequency offset between the DUT and the analyzer. For a high frequency offset (>1 kHz), the CDP measurements are inaccurate and a synchronization of the analyzer and the measurement signal is no longer possible. The frequency offset can be corrected by tuning the transmitter or center frequency of the analyzer. It is recommended to synchronize the analyzer and the DUT via the reference input of the analyzer.

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 R&S® FSIQ: *As for measurement 2, plus*
[SETUP: *REFERENCE EXT]*

Measurement on R&S® FSIQ: Frequency error The displayed frequency error should be < 10 Hz.

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

Measurement 3: Measurement of Relative Code Domain Power

A code domain power measurement on one of the test models (model 1 with 32 channels) is shown in the following. To demonstrate the effects the basic parameters of CDP measurements which allow an analysis of the signal are changed one after the other from values adapted to the measurement signal to non-adapted values.

Test setup

- Connect the RF output of SMIQ to the input of FSIQ
- 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
    TEST MODELS ...
      TEST1_32
    SELECT BS/MS
      BS 1 ON
        PICH STATE: OFF
          STATE: ON
  
```

Settings on R&S® FSIQ:

```

[PRESET]
[CENTER:              2.1175 GHz]
[REF:                 10 dBm]
[MODE:                3GPP BTS ANALYZER: CODE DOM POWER
MEAS SETTINGS          SCRAMBLING CODE 0]
  
```

Measurement on R&S® FSIQ: The following is displayed:

Screen A: Code domain power of signal
(test model 1 with 32 channels)

Screen B: Numeric results of CDP measurement

Setting: Behaviour with Deviating Center Frequency Setting

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

Settings on SMIQ: ➤ Tune the center frequency of the signal generator in 1 kHz steps and watch the analyzer screen:

Measurement on R&S® FSIQ:

- 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. 3 kHz, a CDP measurement cannot be performed. R&S® FSIQ 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 1 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 R&S® FSIQ: Set scrambling code to new value:
[MODE: 3GPP BTS ANALYZER: CODE DOM POWER
MEAS SETTINGS SCRAMBLING CODE 1]

Measurement on R&S® FSIQ: The CDP display again shows the test model.

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 WCDMA frame in this section. Depending on the position of the frame start, the required computing time can be quite long (up to approx. 3 seconds). The computing time can be reduced by applying an external (frame) trigger.

- Test setup
- Connect the RF output of SMIQ to the input of FSIQ
 - Connect the reference input (EXT REF IN/OUT) on the rear panel of R&S® FSIQ 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 R&S® FSIQ (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 R&S® FSIQ: *As for measurement 3, plus
[MEAS SETTINGS TRIGGER EXT]*

Measurement on R&S® FSIQ: The following is displayed:
Screen A: Code domain power of signal
(test model 1 with 32 channels)
Screen B: Numeric results of CDP measurement

Trg to Frame: Offset between trigger event and start of WCDMA 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 WCDMA frame can be compensated by modifying the trigger offset.

Settings on R&S® FSIQ: **[MODE:** 3GPP BTS ANALYZER: CODE DOM POWER
MEAS SETTINGS EXT TRIG OFFSET 100 μ s]

Measurement on R&S® FSIQ: The parameter Trg to Frame in the numeric results table (screen B) changes:
Trg to Frame -100 μ s

Note: *To enable the start of a CDP measurement at slot 0 of a WCDMA frame, the trigger offset has to be set to -266,67 μ s. For a detailed description of the relation between trigger offset and CDP analysis see the following chapters*

A trigger offset compensates analog delays of the trigger event.

Measurement 5: Measurement of Composite EVM

The composite EVM measurement represents a measurement of the RMS-averaged deviation of the test signal from the ideal 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 FSIQ
 - Connect the reference input (EXT REF IN/OUT) on the rear panel of R&S® FSIQ 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 R&S® FSIQ (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
    TEST MODELS ...
      TEST1_32
    SELECT BS/MS
      BS 1 ON
        PICH STATE OFF
      STATE: ON
```

Settings on R&S® FSIQ:

```
[PRESET]
[CENTER:              2.1175 GHz]
[REF:                 10 dBm]
[MODE:                3GPP BTS ANALYZER: CODE DOM POWER
MEAS SETTINGS          SCRAMBLING CODE 0
                       INACT CHAN THRESHOLD -20
                       TRIGGER EXT

[menu change key UP]
RESULT DISPLAY          COMPOSITE EVM]
```

Measurement on R&S® FSIQ: The following is displayed:

- Screen A: Code domain power of signal
(Test model 1 with 32 channels)
- 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 WCDMA 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.

- Test setup
- Connect the RF output of SMIQ to the input of FSIQ
 - Connect the reference input (EXT REF IN/OUT) on the rear panel of R&S® FSIQ 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 R&S® FSIQ (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
    TEST MODELS ...
      TEST1_32
    SELECT BS/MS
      BS 1 ON
    PICH STATE OFF
  STATE: ON
```

Settings on R&S® FSIQ:

```
[PRESET]
[CENTER:            2.1175 GHz]
[REF:              0 dBm]
[MODE:            3GPP BTS ANALYZER: CODE DOM POWER
MEAS SETTINGS      SCRAMBLING CODE 0
                   INACT CHAN THRESHOLD -20
                   TRIGGER EXT

[menu change key UP]
RESULT DISPLAY    PEAK CODE DOMAIN ERR
                  SELECT PCDE SF 512]
```

Measurement on R&S® FSIQ:

The following is displayed:

Screen A: Code domain power of signal
(test model 1 with 32 channels)

Screen B: Peak code domain error (projection of the error onto the class
with spreading factor 512)

3 Setup for Base Station 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. The level at the R&S® FSIQ RF input of +20 dBm with a 0 dB input attenuator must under no circumstances be exceeded.
- 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 WCDMA base station 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 R&S® FSIQK72 and for measurements on test model 5 additionally R&S® FSIQK74 must be properly installed following the instructions given in chapter 1 of the present manual.

Standard Test Setup

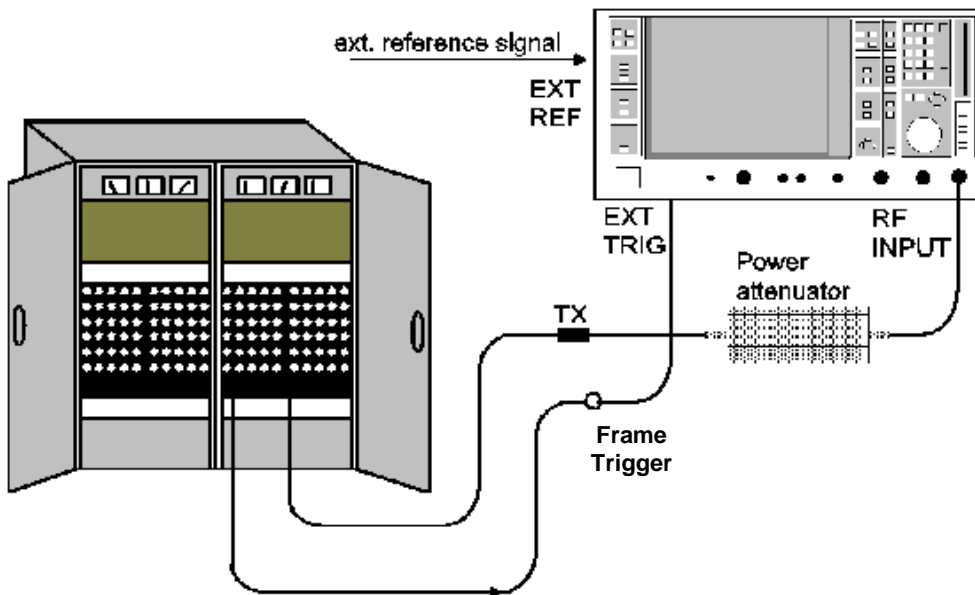


Fig. 3-1 BTS test setup

- Connect antenna output (or TX output) of BTS 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 base stations. A rubidium frequency standard may be used for instance as a reference source.

- If the base station is provided with a trigger output, connect this output to the rear trigger input of the analyzer (*EXT TRIG GATE*).

Presetting

- Enter external attenuation (reference level offset)
- Enter reference level
- Enter center frequency
- Set the trigger
- Select standard and measurement

4 WCDMA Test Models

For measurements on base-station signals in line with 3GPP, test models with different channel configuration are specified in the document "Base station conformance testing (FDD)" (3GPP TS 25.141 V5.7.0). An overview of the test models is given in this chapter.

The channel configurations of test models 1 to 4 can be measured properly if at least R&S® FSIQK72 is installed on the analyzer. In addition to the data channels containing pilot symbols, the special channels SCCPCH and PICH will be detected both in *CODE CHAN AUTOSEARCH* and *CODE CHAN PREDEFINED* mode. In mode *CODE CHAN PREDEFINED* the 3GPP test models 1 to 4 can be used for the measurement at a keystroke (see softkey *CODE CHAN PREDEFINED* for a detailed description).

The channel configuration for test model 5 according to 3GPP contains channels in which the modulation type can vary. Those channels can be measured both in *CODE CHAN AUTOSEARCH* and *CODE CHAN PREDEFINED* mode if the analyzer is equipped with R&S® FSIQK74. In this case test model 5 can be used as well at a keystroke in mode *CODE CHAN PREDEFINED*.

Table 4-1 Test model 1

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (x256T _{chip})
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
SCCPCH (SF=256)	1	1.6	-18	3	150
DPCH (SF=128)	16/32/64	76.8 total	see TS 25.141	see TS 25.141	see TS 25.141

Table 4-2 Test model 2

Channel type	Number of channels	Power(%)	Level (dB)	Spreading code	Timing offset (x256T _{chip})
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
SCCPCH (SF=256)	1	5	-13	3	150
DPCH (SF=128)	3	2 x 10, 1 x 50	2 x -10, 1 x -3	24, 72, 120	1, 7, 2

Table 4-3 Test model 3

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (x256T _{chip})
PCCPCH+SCH	1	12,6/7,9	-9 / -11	1	0
Primary CPICH	1	12,6/7,9	-9 / -11	0	0
PICH	1	5/1.6	-13 / -18	16	120
SCCPCH (SF=256)	1	5/1.6	-13 / -18	3	150
DPCH (SF=256)	16/32	63,7/80,4 total	see TS 25.141	see TS 25.141	see TS 25.141

Table 4-4 Test model 4

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (x256T _{chip})
PCCPCH+SCH	1	50 to 1.6	-3 to -18	1	0
Primary CPICH	1	10	-10	0	0

* The CPICH is optional.

Table 4-5 Test model 5

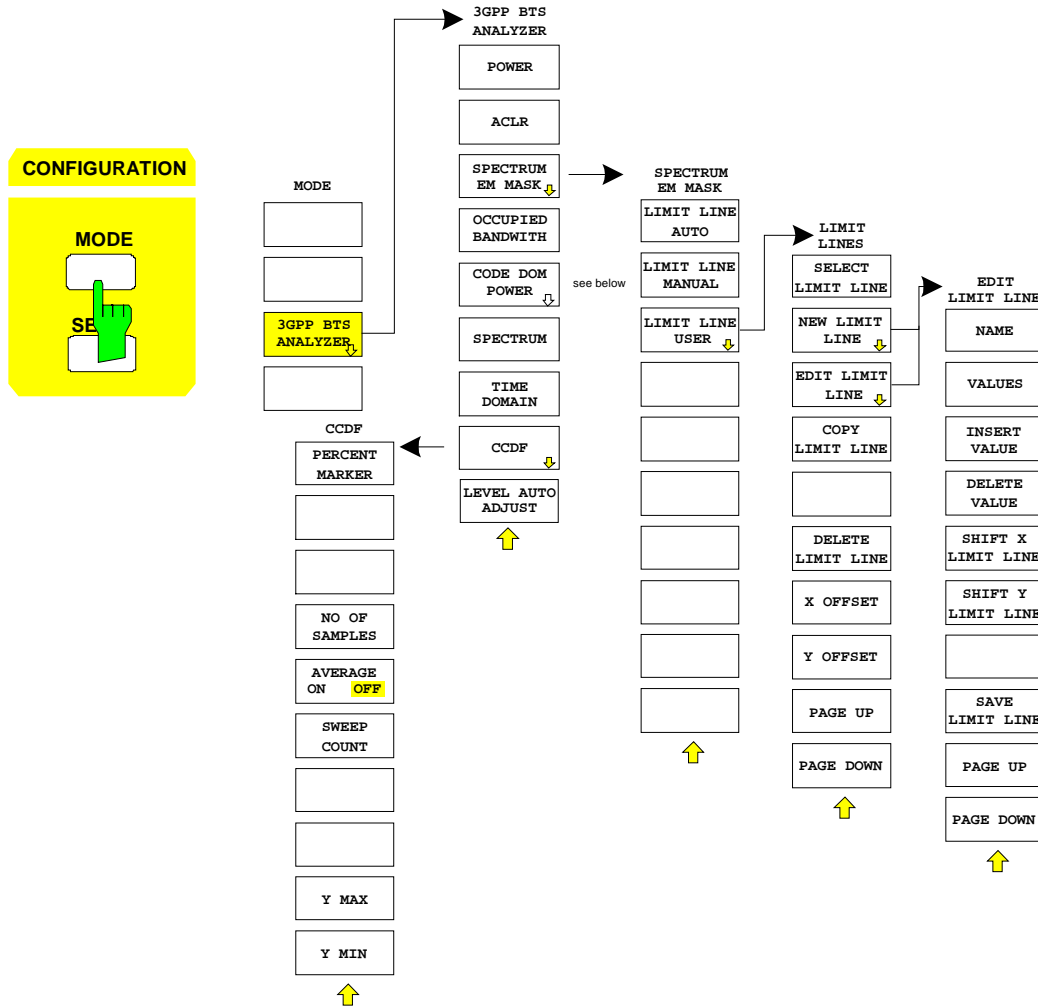
Kanaltyp	Anzahl der Kanäle	Leistung (%)	Level (dB)	Spreading Code	Timing offset (x256T _{chip})
PCCPCH+SCH	1	7,9	-11	1	0
Primary CPICH	1	7,9	-11	0	0
PICH	1	1.3	-19	16	120
SCCPCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=256)	30/14/6(*)	14/14.2/14.4 gesamt	Siehe TS 25.141	Siehe TS 25.141	Siehe TS 25.141
HS_SCCH	2	4 gesamt	Siehe TS 25.141	Siehe TS 25.141	Siehe TS 25.141
HS_PDSCH (16QAM)	8/4/2(*)	63.6/63.4/63.2 gesamt	Siehe TS 25.141	Siehe TS 25.141	Siehe TS 25.141

* 2 HS_PDSCH correspond to 6 DPCH, 4 HS_PDSCH to 14 DPCH und 8 HS_PDSCH to 30 DPCH

This test model can be measured with an analyzer equipped with R&S® FSIQK74.

5 Menu Overview

Application Firmware Module R&S® FSIQK72/K74 (WCDMA base station test) extends the analyzer by the code domain measurement mode for 3GPP WCDMA standard. Additional softkeys are available which allow overview measurements in the analyzer and vector analyzer modes.



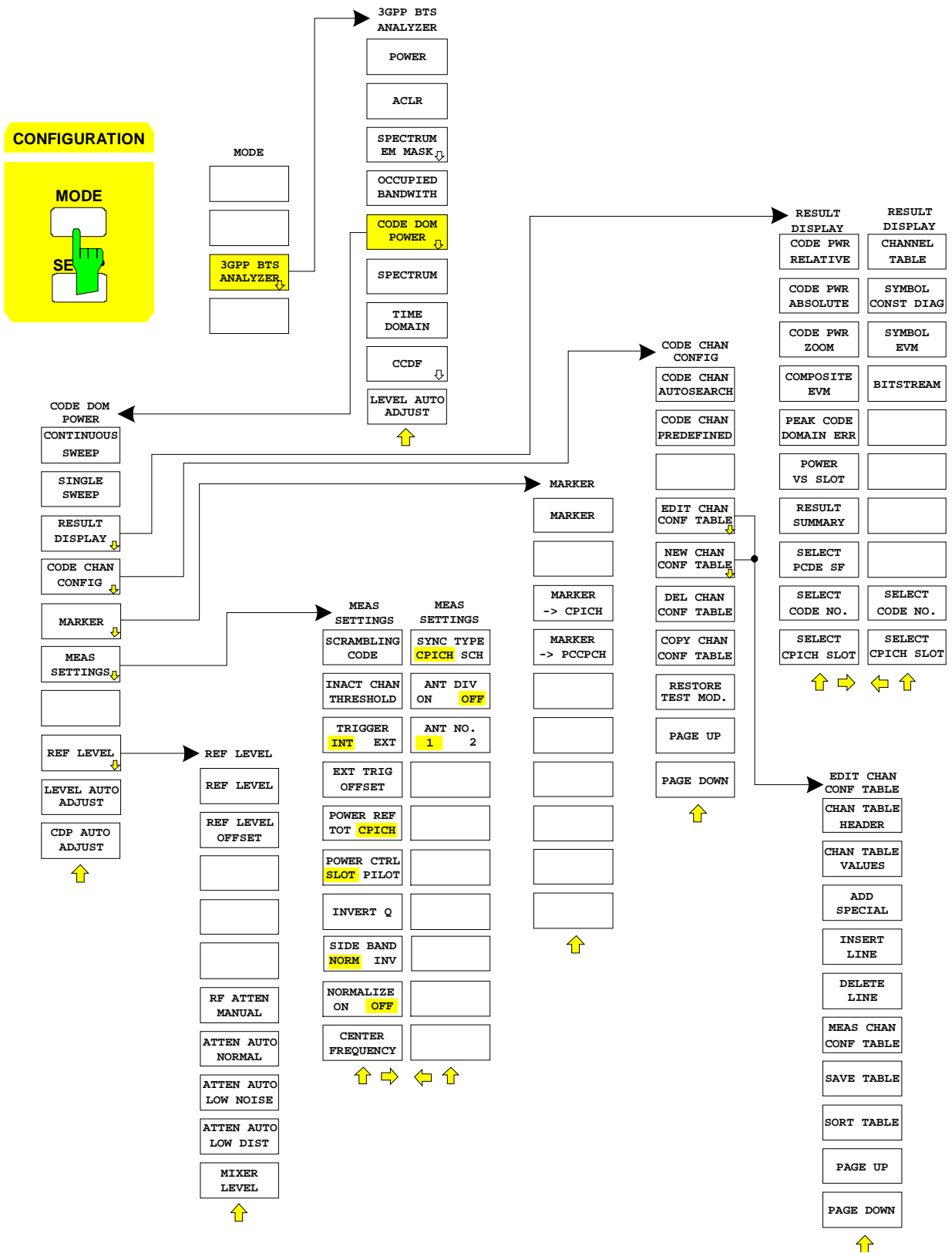


Fig. 5-1 Overview of menus

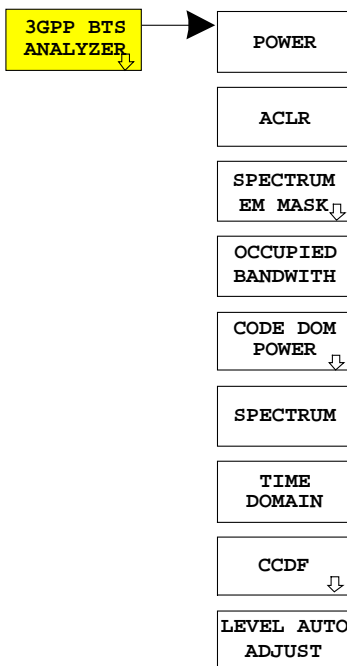
6 Configuration of WCDMA Measurements

The most important parameters for the 3GPP WCDMA base station tests are summarized in the menu *cdmaOne BTS* (*CONFIGURATION* key group, *Mode* key) and are explained below using the softkey functions. The measurements described at the softkeys can be performed both with an analyzer equipped with R&S® FSIQK72 only and with an analyzer with additional R&S® FSIQK74. The description of measurement functions and the graphics it contains refer to R&S® FSIQK72. If a different behaviour of measurement functions or additional information can be reached by equipping the analyzer with R&S® FSIQK72, this will be stated within the text.

The *CDP MEAS* softkey activates the code domain measurement mode and opens the submenus for setting the measurement.

The softkeys *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH*, *SPECTRUM*, *TIME DOMAIN* and *CCDF* activate base station tests in the analyzer or vector analyzer mode. The settings required by 3GPP specifications are performed by pressing the associated softkey, a subsequent modification of settings is possible. The other menus of R&S® FSIQ correspond to the menus of these modes and are described in the operating manual of FSIQ.

CONFIGURATION MODE menu

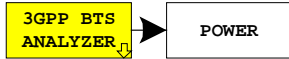


The *3GPP BTS ANALYZER* softkey opens a submenu for setting the various measurement modes of option R&S® FSIQK72/K74:

- *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 R&S® FSIQ are adapted to the functions of the code domain measurement mode.
- *SPECTRUM* activates an overview measurement with defined settings in the analyzer mode.
- *TIME DOMAIN* activates the measurement of the WCDMA signal CREST factor in the time domain display mode (analyzer mode).
- *CCDF* evaluates the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).

Measurement of Channel Power

Submenu: CONFIGURATION- MODE – 3GPP BTS ANALYZER – POWER



The *POWER* softkey activates the measurement of the WCDMA signal channel power.

FSIQ 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 is displayed numerically in the marker info field at the top right edge of the screen.

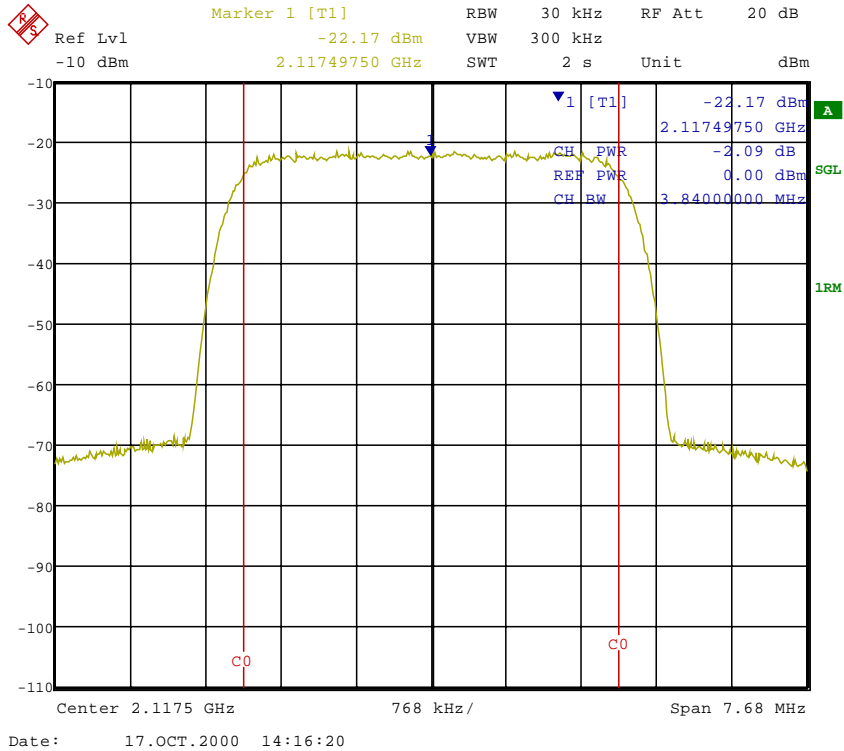


Fig. 6-1 Power measurement in the 3.84 MHz transmission channel

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	
MARKER NORMAL	CHANNEL POWER	
MARKER NORMAL	POWER MEAS SETTINGS - ACP STANDARD	W-CDMA 3GPP FWD

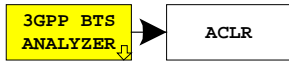
Starting from these settings, R&S® FSIQ can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

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

Query of results: :CALCulate:MARKer:FUNCTion:POWer:RESult? CPOWER

Measurement of Adjacent-Channel Power - ACLR

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER



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

FSIQ measures the channel power and the relative power of adjacent channels and of the next channels. The results are displayed in the marker info field at the top right edge of the screen.

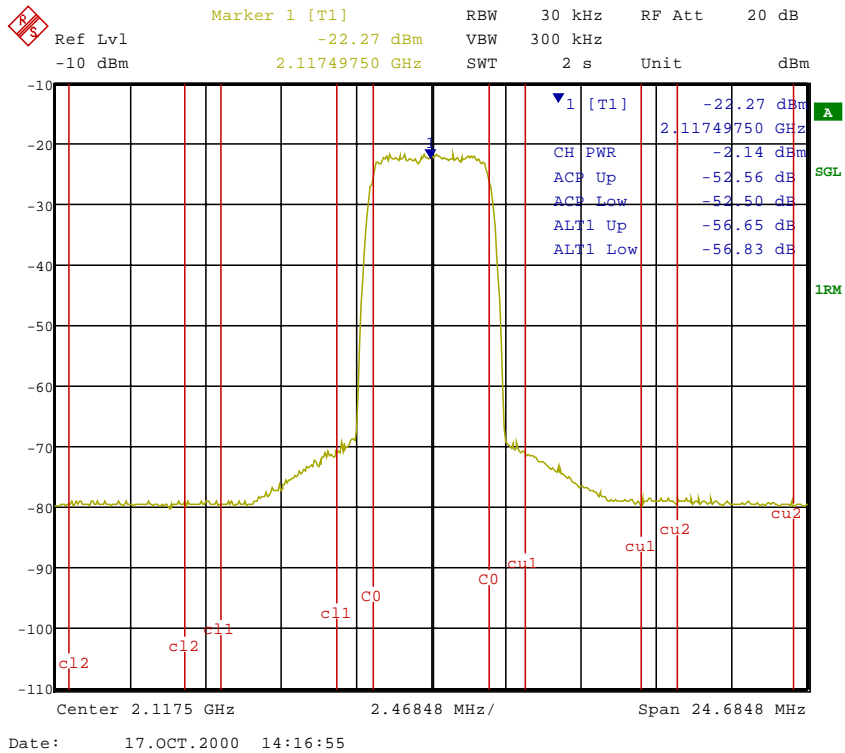


Fig. 6-2 Adjacent-channel power measurement of a WCDMA base station.

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	
MARKER NORMAL	ADJACENT CHAN POWER	
MARKER NORMAL	POWER MEAS SETTINGS - ACP STANDARD	W-CDMA 3GPP FWD
	SET NO OF ADJ CHAN'S	2

Starting from these settings, R&S® FSIQ 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 ACLR

Query of results: :CALCulate:MARKer:FUNCTion:POWER:RESult? ACPower

Signal Power Check – SPECTRUM EM MASK

CONFIGURATION - MODE - 3GPP BTS ANALYZER submenu

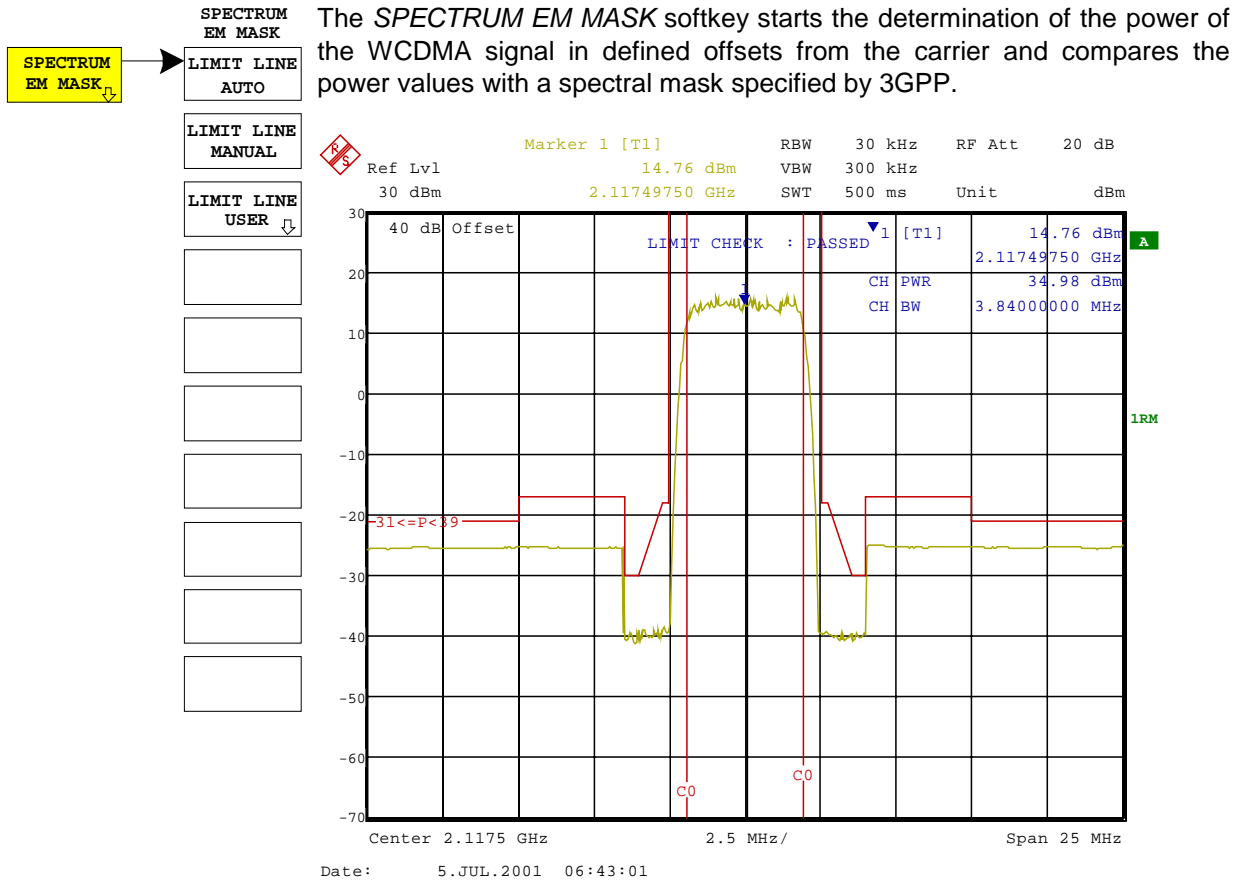


Fig. 6-3 Measurement of Spectrum Emission Mask.

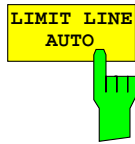
Pressing the softkey activates the analyzer mode with defined settings:

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	
MARKER NORMAL	CHANNEL POWER	
MARKER NORMAL	POWER MEAS SETTINGS - ACP STANDARD	W-CDMA 3GPP FWD
	SET NO OF ADJ CHAN'S	0
MARKER NORMAL	CP / ACP ABS / REL	ABS
FREQUENCY SPAN		25 MHz
	CENTER FIXED	
SWEEP SWEEP	SWEEP TIME MANUAL	0.5 sec
TRACE 2/3/4	DETECTOR	RMS

Starting from these settings, R&S® FSIQ 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 ESpectrum

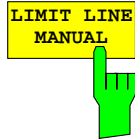
Query of results: :CALCulate:LIMit:FAIL? and visual evaluation



The *LIMIT LINE AUTO* softkey automatically selects the limit line to be checked 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



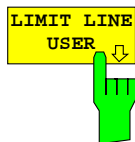
The *LIMIT LINE MANUAL* softkey activates the manual selection of a predefined limit line. If this softkey is selected, the channel power measurement is not used to select the limit line, but only to determine its relative components. The power at the different frequency offsets is compared with the user-defined limit line.

The softkey opens a table with all the limit lines predefined in the device:

P >= 43 dBm
 39 dBm <= P < 43 dBm
 31 dBm <= P < 39 dBm
 P < 31 dBm

The name of the limit line indicates the expected power range, for which the limit line has been defined.

IEC/IEEE-bus command: :CALC:LIM:ESP:MODE MANuAl
 :CALC:LIM:ESP:VALue 39



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 limit lines created by the user are included in the table for *LIMIT LINE MANUAL*.

The following limit line settings are useful for base station tests:

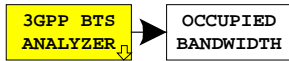
Trace 1, Domain Frequency, X-Scaling relative, Y-Scaling absolute, Spacing linear, Unit dBm

In contrast to the predefined limit lines supplied with the R&S® FSIQ 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

Measurement of Occupied Bandwidth - OCCUPIED BANDWIDTH

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER



The *OCCUPIED BANDWIDTH* activates the measurement of the bandwidth which the signal occupies.

The occupied bandwidth is defined as the bandwidth in which 99% of the total transmitter power is contained.

The occupied bandwidth and the frequency markers are output in the marker info field at the top right edge of the screen.

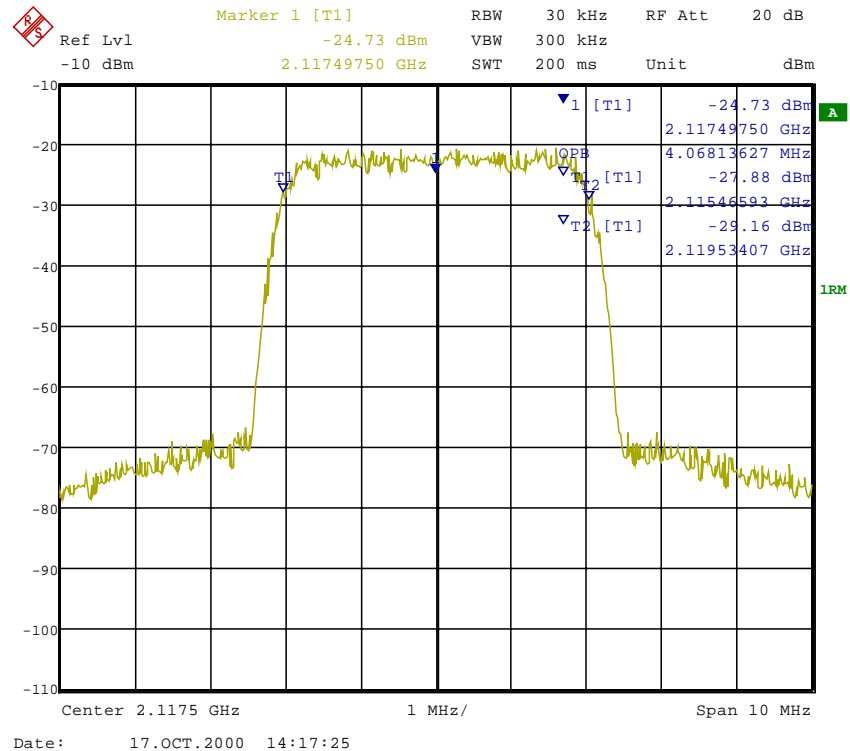


Fig. 6-4 Measurement of occupied bandwidth.

Pressing the softkey activates the analyzer mode with defined settings:

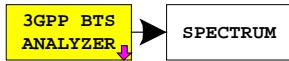
SYSTEM PRESET		
After Preset the following user-specific settings are restored and so the adaptation to the DUT is maintained:		
		Reference Level , Reference Level Offset
		Center Frequency, Frequency Offset
		Input Attenuation, Mixer Level
		All trigger settings
MARKER NORMAL	OCCUPIED PWR BANDW	
FREQUENCY SPAN		10 MHz
SWEEP SWEEP	SWEEP TIME MANUAL	0.2 sec
SWEEP COUPLING	RBW MANUAL	30 kHz
TRACE 1	DETECTOR	RMS

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

Query of results: :CALCulate:MARKer:FUNction:POWer:RESult? OBANdwidth

Spectrum Measurement - SPECTRUM

Submenu: CONFIGURATION- MODE - 3GPP BTS ANALYZER



The *SPECTRUM* softkey displays the spectrum of the WCDMA BTS signal with a span of 25 MHz in the analyzer mode.

This measurement gives an overview of the W-CDMA signal spectrum so that interfering signals in the immediate vicinity can be identified. Measurement settings, e.g. the span, can be modified as required for further signal measurements.

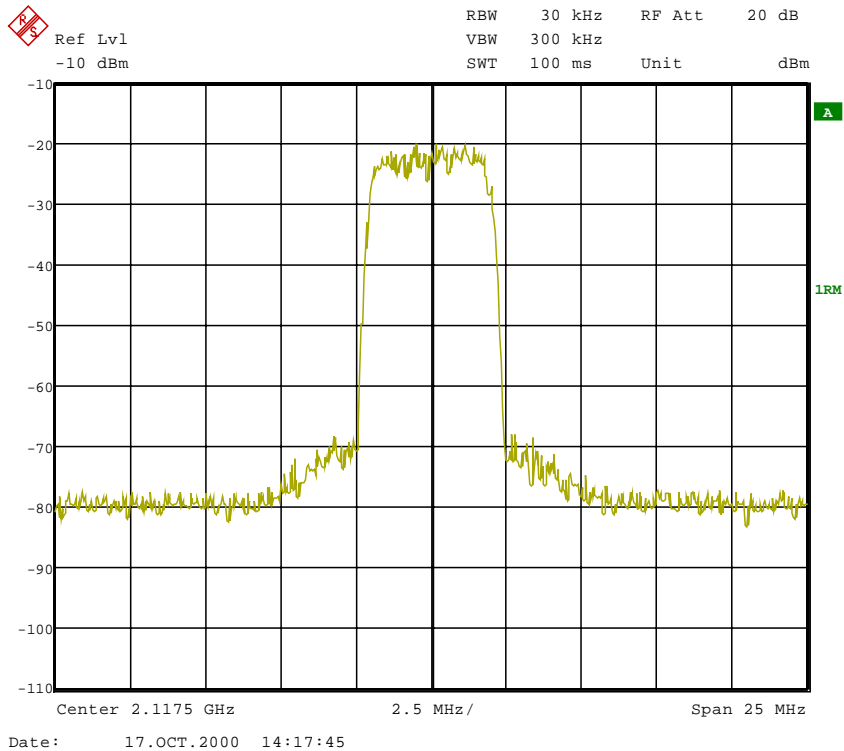


Fig. 6-5 Spectrum display of WCDMA signal at a 25 MHz span.

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		
FREQUENCY SPAN		25 MHz
SWEEP SWEEP	SWEEP TIME MANUAL	0.1 sec
SWEEP COUPLING	RES BW MANUAL	30 kHz
TRACE 1	DETECTOR	RMS

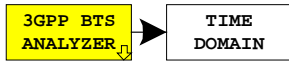
Starting from these settings, R&S® FSIQ can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE-bus command: :CONFIGure:WCDPower:MEASurement FDOMain

Query of results: -- (visual evaluation)

Measurement of Crest Factor - TIME DOMAIN

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER



The *TIME DOMAIN* softkey displays the CREST factor of the WCDMA BTS signal in the analyzer mode.

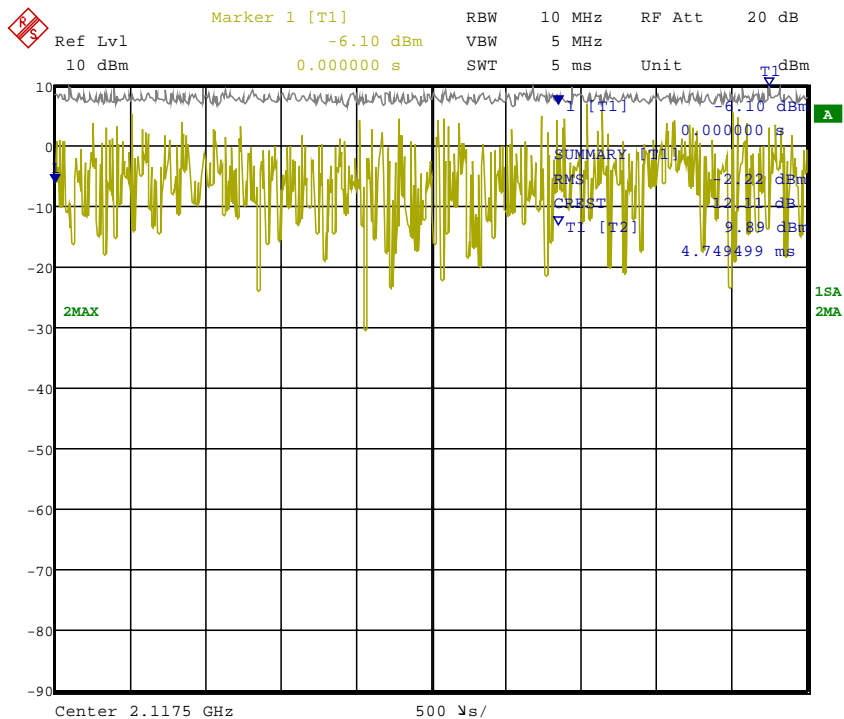
For this measurement, a signal section is continuously recorded.

The W-CDMA signal is measured in the zero span in the time domain. The result is displayed in two traces.

Trace 1 is measured with the sample detector. The analyzer calculates the average power from the displayed trace points.

Trace 2 is measured with the peak detector in the max. hold mode, i.e. the peak value of the signal is displayed.

The analyzer calculates the crest factor from the difference between the peak and the average power and displays it in the Marker Info field.



Date: 17.OCT.2000 14:18:36

Fig. 6-6 Time domain display of WCDMA 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		
FREQUENCY SPAN		ZERO SPAN
SWEEP SWEEP	SWEEP TIME MANUAL	0.1 sec
SWEEP COUPLING	RES BW MANUAL	10 MHz
	VIDEO BW MANUAL	5 MHz
TRACE 1	DETECTOR	SAMPLE
MARKER NORMAL		MARKER 1
TRACE 2		MAX HOLD
TRACE 2	DETECTOR	MAX PEAK
MARKER SEARCH	SUMMARY MARKER	ON
MARKER SEARCH	SUMMARY MARKER	RMS
MARKER NORMAL	MARKER INFO	ON

Starting from these settings, R&S® FSIQ 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 TDOMain

Query of results: :CALCulate:MARKer:FUNCTion:CRESt?
:CALCulate:MARKer:FUNCTion:SUMMary:RMS:RESult?
:CALCulate:MARKer:FUNCTion:SUMMary:STATe ON

Signal Statistics - CCDF

CONFIGURATION - MODE - 3GPP BTS ANALYZER sub menu

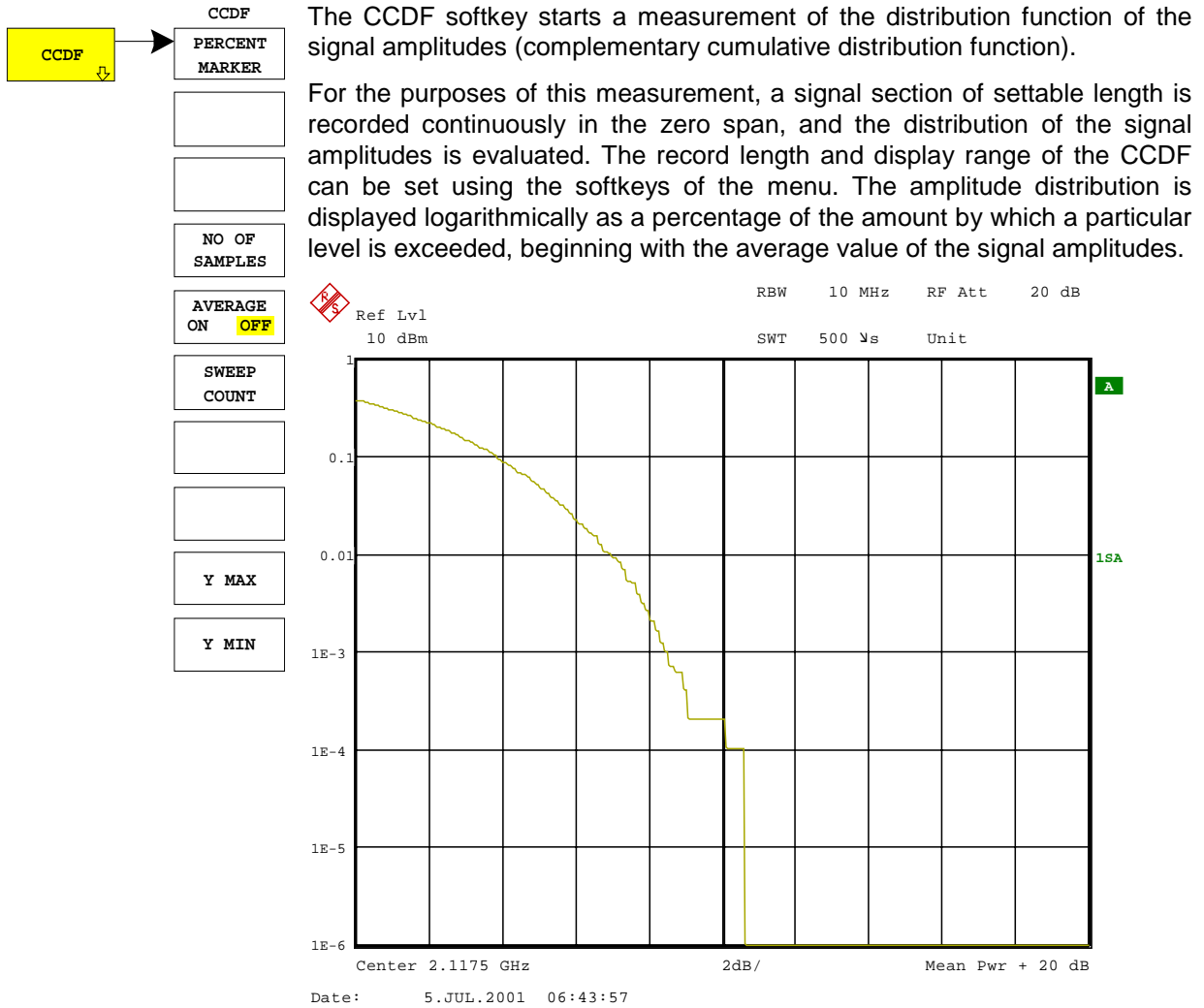


Fig. 6-7 CCDF of WCDMA signal.

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	
FREQUENCY SPAN		ZERO SPAN
TRACE1	DETECTOR	SAMPLE
SWEEP COUPLING	RES BW MANUAL	10 MHz
	VIDEO BW MANUAL	5 MHz

Starting from these settings, R&S® FSIQ 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

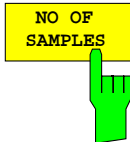
Query of results: :CALCulate:MARKer:X?



The *PERCENT MARKER* softkey sets the marker to the specified percentage of the Y axis. The step width of the marker movement depends on the current marker value.

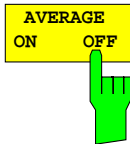
In addition to this marker, the normal markers of the analyzer can be activated for the display mode.

IEC/IEEE-bus command: :CALC:MARK:Y:PERC 5



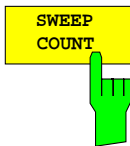
The *NO OF SAMPLES* softkey specifies the number of samples used to create the CCDF.

IEC/IEEE-bus command: CALC:STAT:NSAM 5000



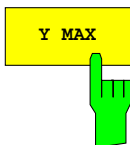
The *AVERAGE ON / OFF* softkey specifies whether or not the results of continuous measurements (in conjunction with *SWEEP COUNT*) are averaged. The default setting of the softkey is *OFF*.

IEC/IEEE-bus command: :DISP:TRAC1:MODE AVER | VIEW



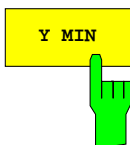
The *SWEEP COUNT* softkey determines the number of signal sections across which averaging is carried out (in the case of *AVERAGE ON*). Using *SWEEP COUNT* >1 and *AVERAGE ON*, the number of samples used to evaluate the statistical characteristics of the signal can be increased.

IEC/IEEE-bus command: :SWE:COUN 6



The *Y MAX* softkey specifies the upper limit of the display range of the CCDF. Since probabilities are specified on the Y axis, the entered numerical values are dimensionless. The maximum value of the softkey is 1.

IEC/IEEE-bus command: CALC:STAT:SCAL:Y:UPP 0.01



The *Y MIN* softkey specifies the lower limit of the display range of the CCDF. The minimum value of the softkey is 1E-6.

IEC/IEEE-bus command: CALC:STAT:SCAL:Y:LOW 0.001

Code Domain Measurements on WCDMA Signals

Application Firmware R&S® FSIQK72/K74 provides the peak code domain error measurement and composite EVM measurement, 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.

A signal section of approx. 20 ms is recorded for analysis and searched for the start of a WCDMA frame. If a frame start is found in the signal, the CDP analysis is performed for a complete frame starting from slot 0.

Because of the power control over one power group prescribed by the 3GPP specification, permitting the channel power for a specific slot to be controlled at the beginning of the pilot symbol of the preceding slot, the signal has to be shifted in the memory in such a way that the WCDMA frame start is preceded by at least 1024 chips (longest sequence of pilot symbols).

Because of this shift and without triggering it may happen, however, that the recorded signal does not allow the analysis of a complete frame to start from slot 0. In this case, R&S® FSIQK72/K74 will start the CDP analysis from the first complete slot in the memory instead from slot 0. The 15 slots following the first complete one will be analyzed.

With triggering (frame trigger) and a trigger offset of 0 the CDP analysis for a complete WCDMA frame cannot start from slot 0 because of the shifting of the signal in the memory. In this case, R&S® FSIQK72/K74 will typically start CDP analysis from slot 1. With a trigger offset of $-266,67 \mu\text{s}$ ($= 1024$ chips) the start of the analysis can be shifted to slot 0.

The start slot of the CDP analysis can be seen in all graphs where the x axis is referenced to the slot. A detailed description is given with the respective display modes.

Application firmware R&S® FSIQK72/K74 offers two different ways of representing the code domain power measurement:

- Representation of all code channels

Option R&S® FSIQK72/K74 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 (512). 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 512 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 a slot is the CPICH slot. When a timing offset is used this means that the power measurement period does not have to be identical for the various code channels as the beginning of the channel slot depends on the timing offset.

- Representation of channel power versus slots of a WCDMA signal frame

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. If code channels contain a timing offset, a specific slot of each channel is started at a different time. The offset to the beginning of the CPICH slot may be as long as one frame. The time reference for the display (x axis) is the CPICH. The power displayed for the measured code channel is however referred to the physical time at which it actually occurs. The timing offset of all power-controlled code channels can thus be directly read in the measured trace.

For all measurements performed in a slot of a selected channel (bits, symbols, EVM), the actual slot spacing of the channel is taken as a basis.

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 the display modes for the codes of the class with the highest spreading factor are permitted in the upper part of the screen, all other display modes are assigned to the lower part of the screen.

FSIQK72/K74 expects the following synchronization channels for the code domain power measurements.

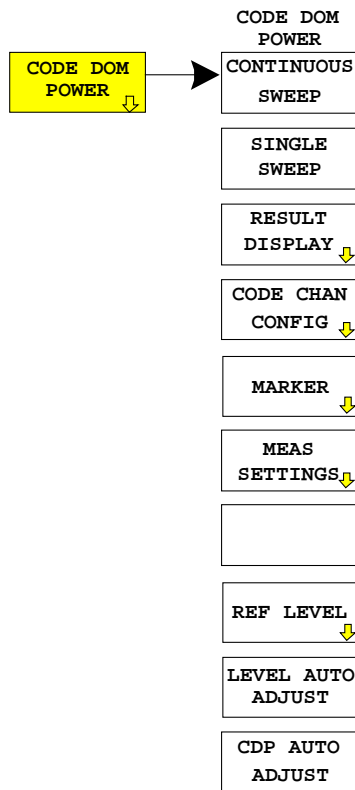
- Primary common control physical channel (PCCPCH). This channel shall be active within each channel configuration
- Primary synchronization channel (PSCH).
- Secondary synchronization channel (SSCH).
- Common pilot channel (CPICH). This channel is optional. If the signal does not contain CPICH, the firmware application shall be switched to *SYNC TYPE SCH* (see softkey *SYNC TYPE CPICH/SCH*).

There are two modes for the CDP analysis, mode *CODE CHAN AUTOSEARCH* and mode *CODE CHAN PREDEFINED*. R&S® FSIQK72 and R&S® FSIQK74 differ in both modes:

When operated in *CODE CHAN AUTOSEARCH* mode, R&S® FSIQK72 performs an automatic search for active channels (DPCH's) in the whole code domain. The search is based on the presence of known symbol sequences (pilot sequences) in the despread symbols of a channel. Channels without pilot sequences can therefore not be detected as being active in this mode. However, special channels SCCPCH and PICH will be detected even though they do not contain any pilot symbols. 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. For these channels a channel search by comparison with pilot sequences is no longer performed. In this mode, special channels without pilot sequences (which should be in the code domain however) can therefore be taken into account by R&S® FSIQK72 for the CDP analysis.

When operated in *CODE CHAN AUTOSEARCH* mode, FS-K74 performs an automatic search for channels in the whole code domain which is not based on the presence of any known symbol sequences. With FS-K74 therefore channels of High Speed Data Packet Access (HSDPA) that do not contain pilot sequences can be detected as well. Additionally the possibility of changing modulation type within the channels is taken into account. Thus, channels with a modulation type differing from the usual QPSK of DPCH are properly measured as well. In mode *CODE CHAN PREDEFINED*, the channels contained in the signal are considered as predefined analogous to FS-K72. Only the modulation type of each channel will be measured by the firmware application.

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER



The *CODE DOM POWER* softkey activates the code domain measurement mode and opens a submenu for configuring the measurements.

All settings can be performed in these submenus.

IEC/IEEE-bus command:

```
:CONFigure:WCDPower:MEASurement WCDPower
```

or:

```
:INSTrument:SElect WCDPower
```

Query of results:

```
:TRACe:DATA? TRACE1|TRACE2|ABITstream|PWCDp|CTable
```

or

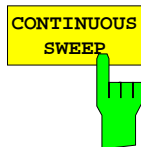
```
:CALCulate<1|2>:MARKer<1>:FUNctIon:WCDPower:RESult?
PTOTal | FERRor | TFRame | TOFFset | MACCuracy |
PCDError | EVMRms | EVMPeak | CERRor | CSLot |
SRATe | CHANnel | CDPabsolute | CDPRelative |
IQOffset | IQIMbalance
```

or

Marker functions (see MARKER submenu)

Continuous Measurement - Continuous Sweep

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER



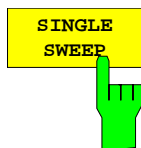
The *CONTINUOUS SWEEP* softkey sets a continuous measurement mode. The start of the actual measurement, however, may depend on an external trigger. (see section Trigger Settings - TRIGGER Menu)

IEC/IEEE-bus command: :INITiate:CONTinuous ON;

```
:INITiate:IMMediate
```

Single Measurement - Single Sweep

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER



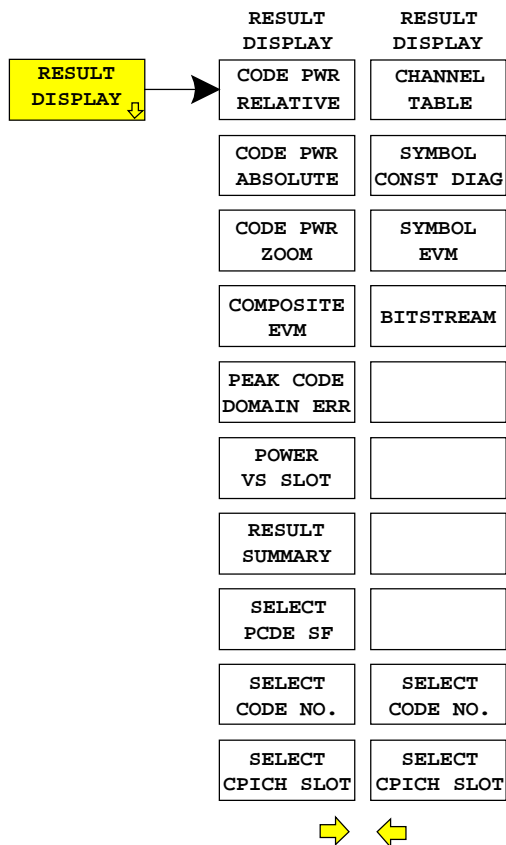
The *SINGLE SWEEP* softkey sets the single measurement mode. A single sweep is performed upon pressing the softkey. The start of the actual measurement, however, may depend on an external trigger (see section Key group SWEEP).

IEC/IEEE-bus command: :INITiate:CONTinuous OFF;

```
:INITiate:IMMediate
```

Display Mode - RESULT DISPLAY

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER



The *RESULT DISPLAY* softkey 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 menu contains more detailed display modes.

The following display modes are available:

CODE PWR RELATIVE	Code domain power with relative scaling
CODE PWR ABSOLUTE	Code domain power with absolute scaling
CODE PWR ZOOM	Selection of 64 codes out of the 512 possible codes
COMPOSITE EVM	Square difference between test signal and ideal reference signal
PEAK CODE DOMAIN ERR	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 difference signal slot
POWER VS SLOT	Power of the selected channel versus all slots of a WCDMA signal frame
RESULT SUMMARY	Tabular result display
CHANNEL TABLE	Display of channel occupation table
SYMBOL CONST DIAG	Display of constellation diagram
SYMBOL EVM	Display of error vector magnitude diagram
BITSTREAM	Display of decided bits

By entering a code number (*SELCT CODE NO:* softkey) in the modes *CODE PWR RELATIVE / ABSOLUTE / ZOOM, POWER VS SLOT, SYMBOL CONST DIAG / EVM* it is possible to mark a channel for more detailed display modes.

The desired spreading factor can be selected with the *SELECT PCDE SF* softkey in the *PEAK CODE DOMAIN* display mode.

In the *POWER VS SLOT*, *SYMBOL CONST DIAG* and *SYMBOL EVM* display modes a slot can be marked by entering a slot number using the *SELECT CPICH SLOT* softkey.

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

CF	2.1175 GHz	SR	30 ksps
Code Pwr Relative		Chan Code	27
CPICH Slot	10	Chan Slot	1

Fig. 6-8 Indication of measurement parameters

The different elements are:

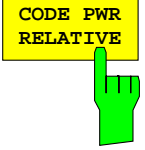
1st column:

CF 2.1175 GHz:	Center frequency of signal
Code Pwr Relative:	Name of selected display mode
CPICH Slot 10:	CPICH slot number (value of <i>SELECT CPICH SLOT</i> softkey)

2nd column:

SR 30 ksps:	Symbol rate of selected channel
Chan Code 27:	Spreading code of selected channel
Chan Slot 1:	Slot number of selected 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.

In default mode, the power of the channels is referred to the CPICH power (code No. 0). This power reference was selected since the total power may vary depending on the slot due to the possibility of controlling the power in the different code channels. In contrast to the variable total power, the power of the CPICH is the same in all slots so that it can form the constant reference for the display. The reference can be switched to total power selecting setting *TOT* for the *POWER REF* softkey.

The measurement interval for determining the power of the channels is a slot in the CPICH (corresponding to a timing offset of 0 chip referred to the beginning of the signal frame).

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

- yellow: active channels
- blue: unassigned codes

If the analyzer is equipped with R&S® FSIQK72, a data channel in *CODE CHAN AUTOSEARCH* mode is considered to be active if the pilot symbols as specified by 3GPP standard are to be found at the end of each slot. Channels without or with incorrect pilot symbols are therefore not recognized by R&S® FSIQK72 in this mode. An exception to this rule are the special channels SCCPCH and PICH which can be recognized as active in the automatic search mode although they do not contain pilot symbols. In addition, the channel must exceed a minimum power (see *INACT CHAN THRESHOLD* softkey).

In *CODE CHAN PREDEFINED* mode, each data channel that is included in the user defined channel table is considered to be active.

If the analyzer is equipped additionally with R&S® FSIQK74, all channels that meet special quality criteria are recognized as active. The detection of channels does not depend on pilot sequences or other pre-known symbol sequences in R&S® FSIQK74. An active channel has only to exceed a minimum power (see *INACT CHAN THRESHOLD* softkey).

By entering a code channel number (see *SELECT CODE NO* 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 channels, and only the entered code is marked in the case of an unassigned code.

Selecting other display modes (e.g. *SYMBOL CONSTELLATION*) for unassigned codes is possible but not useful since the results are not valid.

At an analyzer equipped with R&S® FSIQK72 only, in the CDP diagram, the effect of missing or incomplete pilot symbols in a data channel can be shown in analyzer mode *CODE CHANNEL AUTOSEARCH*. At the points of the CDP diagram where the channel should appear due to its spreading code, there is a power value higher than the noise. The associated bars, however, are displayed in blue colour (black in the figures). In such a case, the channel should be checked for its pilot symbols. In *CODE CHANNEL PREDEFINED* mode, the channel should be included in the user defined channel table.

If the analyzer is equipped additionally with R&S® FSIQK74, channels without pilot sequences are recognized as active as well if they meet special quality criteria.

The following figures show how the CDP is displayed when all active channels contained in the signal have been found and when one of the channels has been recognized as inactive, eg because of missing pilot symbols (analyzer equipped with R&S® FSIQK72).

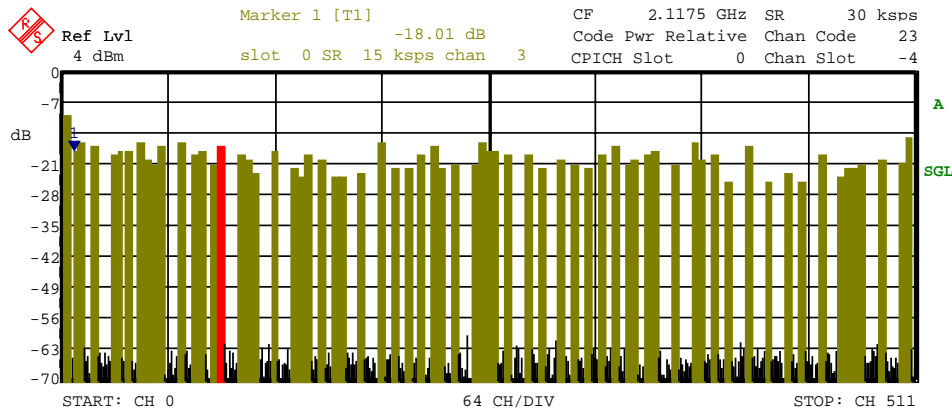


Fig. 6-9 CDP diagram with all channels recognized as active

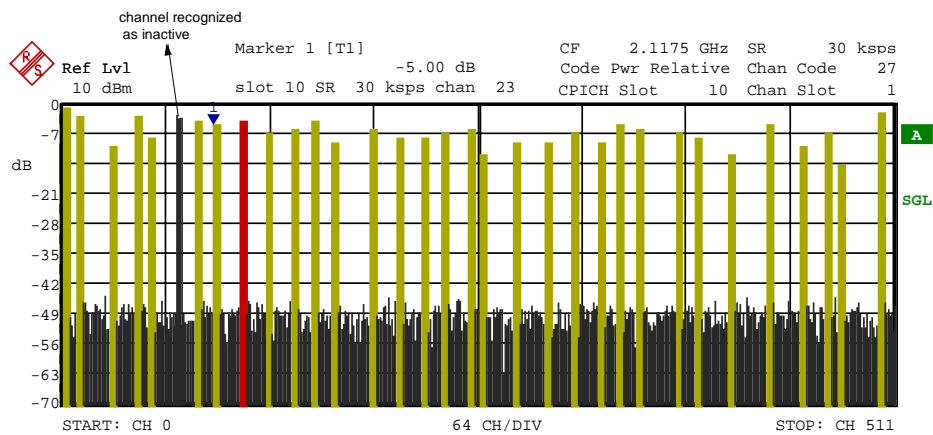


Fig. 6-10 CDP diagram with one of the channels recognized as inactive

At an analyzer equipped with additional R&S® FSIQK74, channels without pilot symbols, e.g. channels of type HS-PDSCH, are recognized as active. The following figure shows test model 5 with 8 HS-PDSCH channels and 30 DPCH channels.

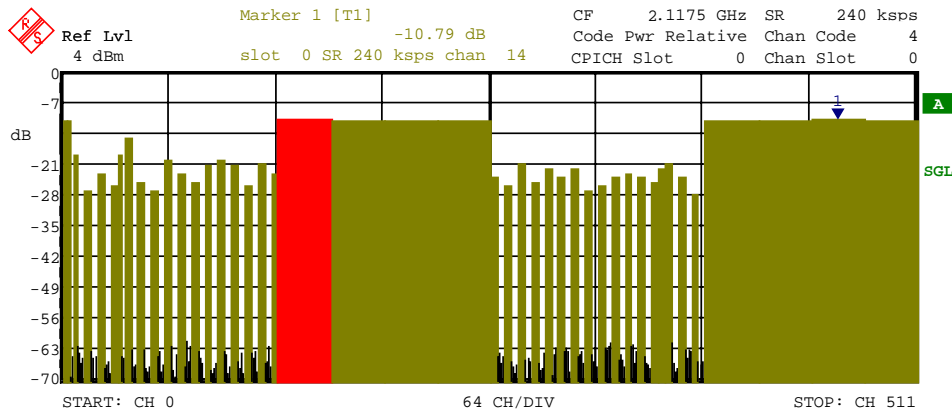
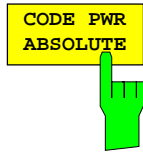


Fig. 6-11 CDP diagram (test model 5)

IEC/IEEE-bus command: :CALCulate<l>:FEED "XPOW:CDP:RAT"



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 CODE NO* 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 in the CPICH (corresponding to a timing offset of 0 chip referred to the beginning of the signal frame).

For the recognition of the active code channels, the conditions are the same as those described for *CODE PWR RELATIVE*.

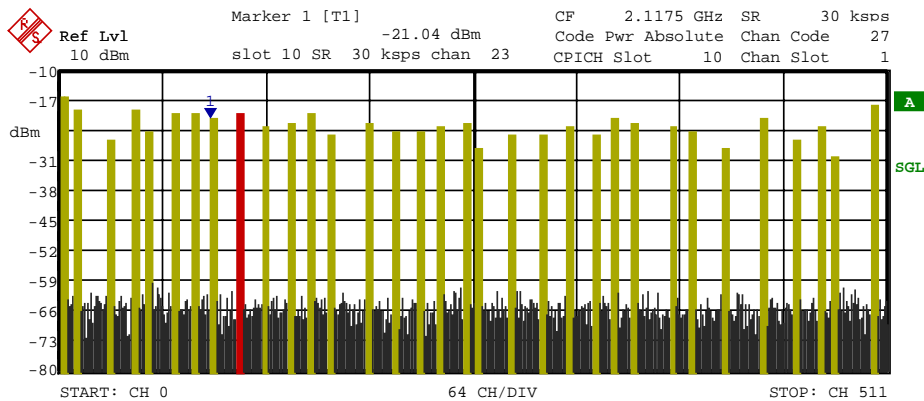
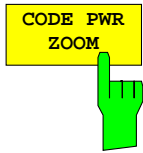


Fig. 6-12 Code domain power display mode with absolute scaling

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



The *CODE PWR ZOOM* softkey zooms the x- axis of the code domain power display. The analyzer displays a window of 64 codes out of the 512 possible codes.

The representation is referred to the position of an activated marker. If no marker is active, the zoomed representation starts from code 0.

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

- yellow: active channels
- blue: unassigned codes

By entering a code channel number (see *SELECT CODE NO* softkey) it is possible to mark a channel for more detailed display modes. The marked channel is shown in red.

In the zoomed representation, the marked channel need not be contained in the displayed picture section. The display does not scroll depending on the marked channel.

The measurement interval for determining the power of the channels is a slot in the CPICH (corresponding to a timing offset of 0 chip referred to the beginning of the signal frame).

For the recognition of the active code channels, the conditions are the same as those described for *CODE PWR RELATIVE*.

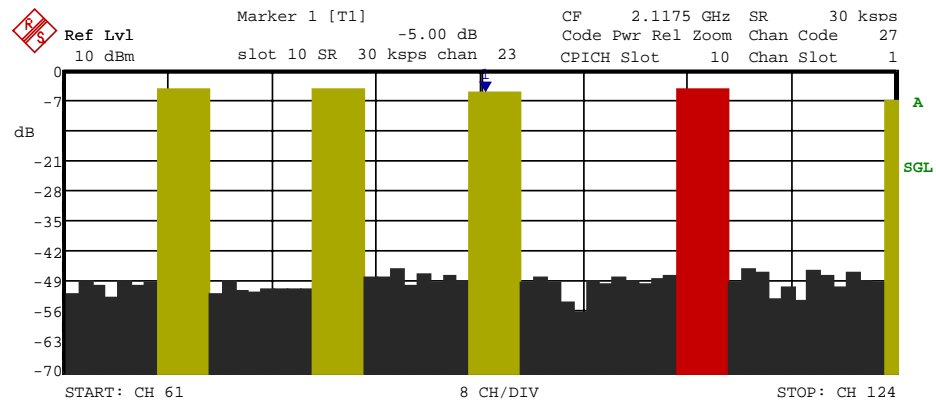


Fig. 6-13 Zoomed representation of the CDP diagram

IEC/IEEE-bus command: --



The *COMPOSITE EVM* softkey selects the composite EVM display mode.

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

The measurement result consists of one composite EVM measurement value per slot. In this case, the measurement interval is the slot spacing of the CPICH (timing offset of 0 chip referred to the beginning of the frame).

Only the channels recognized as active are used to generate the ideal reference signal. If an assigned channel is not recognized as active since pilot symbols are missing or incomplete, the difference between the measurement and reference signal, and the composite EVM is very high (see figures).

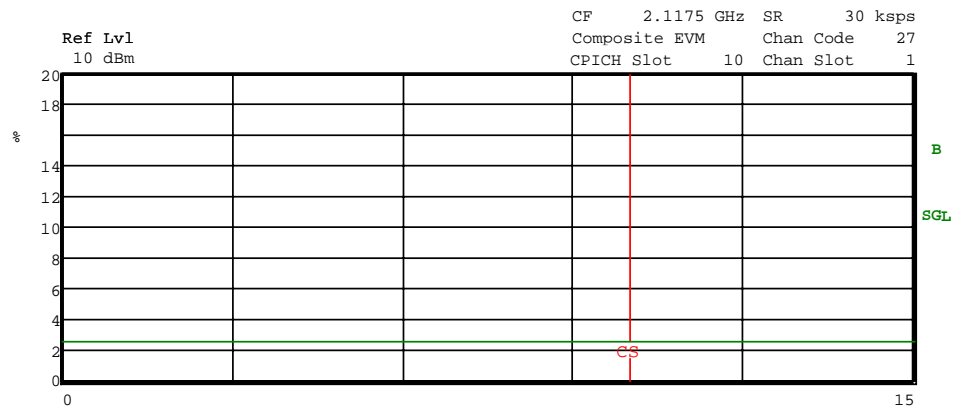


Fig. 6-14 Composite EVM - all channels are recognized as active

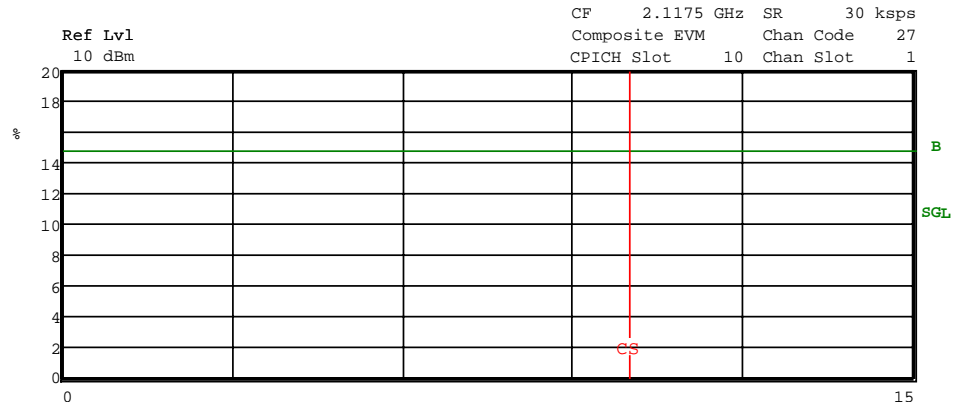
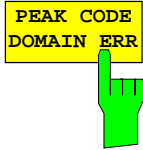


Fig. 6-15 Composite EVM - one channel is recognized as inactive

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



The *PEAK CODE DOM ERR* softkey selects the peak code domain error display mode.

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 by means of the *SELECT PCDE SF* softkey.

The result consists of a numerical value per slot for the peak code domain error value. The measurement interval is the slot spacing of the CPICH (timing offset of 0 chip referred to the beginning of the 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 as active since pilot symbols are missing or incomplete, the difference between the measurement and reference signal is very high. R&S® FSIQK72/K74 consequently indicates a peak code domain error that is too high (see figures).

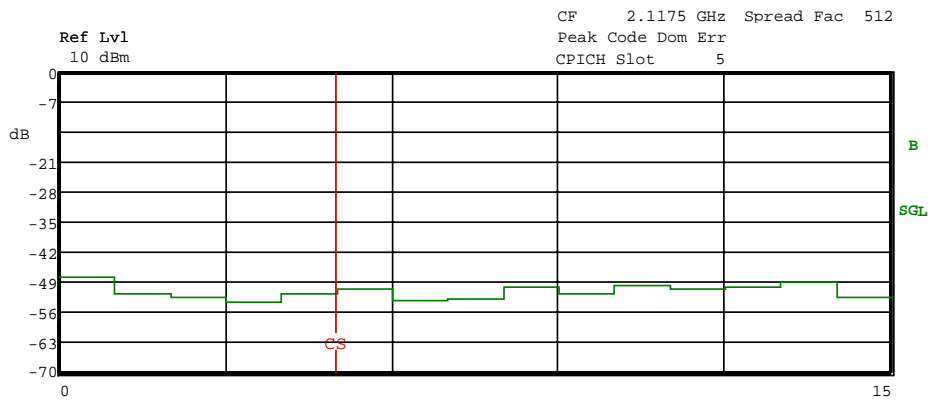


Fig. 6-16 Peak Domain Error - all channels are recognized as active

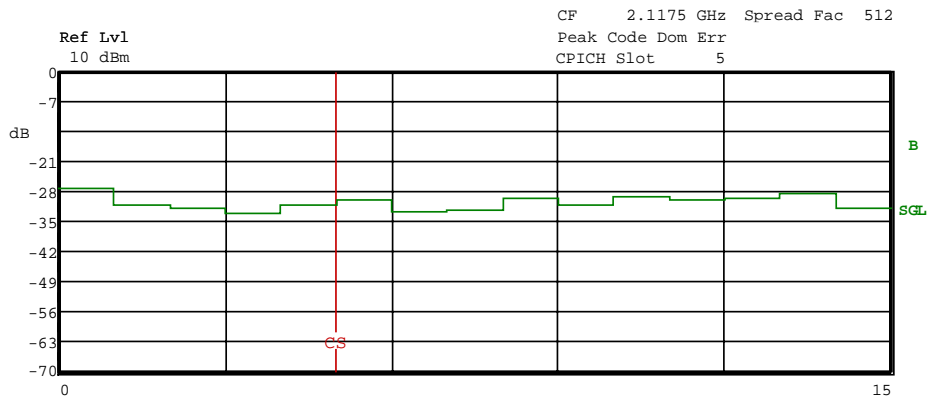


Fig. 6-17 Peak Domain Error - one channel is recognized as inactive

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

- Channel with a timing offset of 2304 chips referred to the CPICH (beginning of frame) without power control.

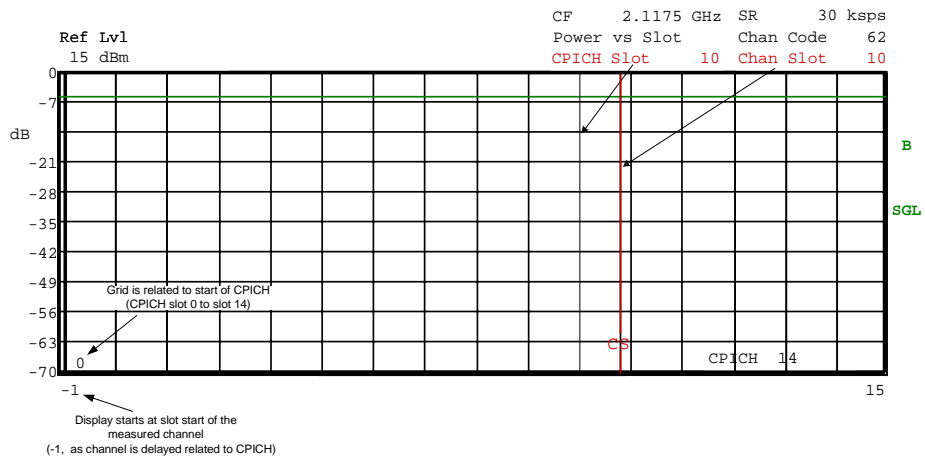


Fig. 6-19 Power versus Slot measurement for a channel without power control (timing offset 2304)

- Channel without timing offset from the CPICH (unassigned codes have a timing offset of 0 chip referred to beginning of the frame)

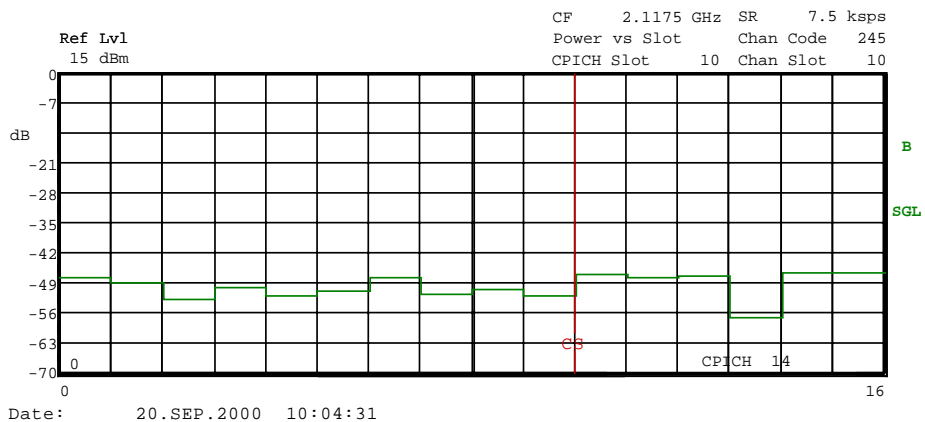


Fig. 6-20 Power versus Slot measurement for a channel without timing offset (unassigned code)

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 CPICH slot number (see *SELECT CPICH SLOT* softkey) and the selected slot is marked in red. The red marking is always on the starting point of a slot and can be varied only with the slot spacing (see vertical line CS in the figures above).

Modifying a slot number has the following effects:

- The CDP diagram in the upper half of the display is updated referred to the entered CPICH slot number.
- Starting from the CPICH slot, all dependent results are calculated for the actual slot of the selected channel. The relevant graphics are updated.

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



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

RESULT SUMMARY			
GLOBAL RESULTS			
Total PWR	-8.63 dBm	Carr Freq Err	14.81 Hz
Chip Rate Err	-0.89 ppm	Trg to Frame	4.46 ms
IQ Offset	0.06 %	IQ Imbalance	0.03 %
Composite EVM	1.20 % rms	Pk Code Dom Err	-59.16 dB rms
CPICH Slot Number	0		(15 ksps)
CHANNEL RESULTS			
Symb Rate	240 ksps	Timing Offset	0 Chips
Channel Code	4	Chan Slot Number	0
Modulation Type	16QAM	No. of Pilot Bits	0
Chan Pow rel.	-10.84 dB	Chan Pow abs.	-19.47 dBm
Symbol EVM	1.41 % rms	Symbol EVM	5.52 % Pk

Fig. 6-21 Result Summary

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

- Total PWR:** Outputs the total signal power (average power of total evaluated WCDMA frame).
- Carr Freq Err:** 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 Err:** Outputs the chip rate error (3.84 Mcps) in ppm. As a result of a high chip rate error symbol errors arise and the CDP measurement is possibly not synchronized to the WCDMA signal. The result is valid even if the synchronization of analyzer and W-CDMA signal failed.
- Trg to Frame:** This result outputs the timing offset from the beginning of the recorded signal section to the start of the analyzed WCDMA 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 W-CDMA signal, the value of Trg to Frame is not significant.
- IQ Offset:** DC offset of signals in %
- IQ Imbalance:** IQ imbalance of signal in %
- Composite EVM:** The composite EVM is the difference between the test signal and the ideal reference signal (see *COMPOSITE EVM* softkey). The rms average (of the analyzed frame) of the measurement results for each slot is given in the *RESULT SUMMARY*.

Peak Code Dom Err:

The *PEAK CODE DOMAIN ERROR* 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* and *SELECT PCODE SF* softkeys). The average (of the analyzed frame) of the measurement results for each slot is indicated in the *RESULT SUMMARY* as an overview. The spreading factor onto which projection is made is shown below the measurement result.

CPICH Slot: Outputs the number of the CPICH slot at which the measurement is performed (see *SELECT CPICH SLOT* softkey).

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

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

Timing Offset: Offset between the start of the first slot in the channel and the start of the analyzed WCDMA frame.

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

Chan Slot Number:

The *CHAN SLOT NUMBER* is obtained by combining the value of the *SELECT CPICH SLOT* softkey and the channel's timing offset.

Modulation Type : Modulation type. This parameter is only measured if the analyzer is equipped with R&S® FSIQK74. At an analyzer equipped with R&S® FSIQK74, modulation type of data channels of HSDPA (HS-PDSCH) can be QPSK or 16QAM. If the analyzer is not equipped with R&S® FSIQK74 modulation type of each channel is QPSK.

No of Pilot Bits: Number of pilot bits of the selected channel.

Chan Pow rel. / abs.:

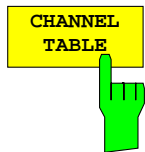
Channel relative (referred to CPICH) and absolute.

Error Vector Mag Pk / rms:

Peak or average of the results of the error vector magnitude measurement (see *SYMBOL EVM* softkey).

IEC/IEEE-bus command:

```
:CALCulate2:FEED "XTIM:CDP:ERR:SUMM"
:CALCulate<1|2>:MARKer<1>:FUNction:WCDPower:RES?
PTOTAL| FERRor| TFRame| TOFFset| MACCuracy|
PCDError| EVMRms| EVMPeak| CERRor| CSLot| SR
```



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 512 assignable codes of the class with spreading factor 512.

The upper part of the table indicates the control channels of the signal. The power of the CPICH and PCCPCH is specified. The power of the PSCH and SSCH channels is not determined and therefore the associated fields are empty. If the channel table contains SCCPCH and PICH these channels are also listed in the upper part of the table.

The lower part of the table indicates the data channels (DPCH) 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 at the end of the table.

The lower part of the table indicates the data channels contained in the signal. Data channels are all channels that do not have predefined channel numbers and symbol rates. That means that for example a channel like SCCPCH, whose channel number and symbol rate can vary, will be found among the data channels in *CODE CHAN AUTOSEARCH* mode if its symbol rate or channel number differs from that prescribed in 3GPP standard. If the analyzer is equipped with R&S® FSIQK72 only, the pilot symbols prescribed in 3GPP standard have to be found at the end of each slot of data channels. If the analyzer is equipped with R&S® FSIQK74, the channels of HSDPA will be found among the data channels. If the type of a channel can be fully recognized, as for example at a DPCH (based on pilot sequences) or at a HS-PDSCH (based on modulation type), the type will be entered into the field *TYPE*. All channels with channel type not fully recognized are of type CHAN.

The channels are to be found 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. If the modulation type for a channel can vary, the measured value of modulation type will be appended to the type of the channel (see figure).

The following figure shows *CHANNEL TABLE* for an analyzer equipped with R&S® FSIQK72 and R&S® FSIQK74 and measuring test model 5.

CHANNEL TABLE								
Type	SR(ksp/s)	Ch#	Status	TFCI	PilL	PWR ABS	PWR REL	Toffs
CPICH	15.0	0	active	---	--	-19.63	-11.00	---
PCCPCH	15.0	1	active	---	--	-19.62	-10.99	---
SCCPCH	15.0	3	active	OFF	0	-27.64	-19.01	0
PICH	15.0	16	active	---	--	-27.60	-18.97	30720
HSPDSCH_16QAM	240.0	4	active	OFF	0	-19.47	-10.84	0
HSPDSCH_16QAM	240.0	5	active	OFF	0	-19.71	-11.07	0
HSPDSCH_16QAM	240.0	6	active	OFF	0	-19.76	-11.13	0
HSPDSCH_16QAM	240.0	7	active	OFF	0	-19.69	-11.06	0
HSPDSCH_16QAM	240.0	12	active	OFF	0	-19.79	-11.16	0
HSPDSCH_16QAM	240.0	13	active	OFF	0	-19.79	-11.16	0
HSPDSCH_16QAM	240.0	14	active	OFF	0	-19.42	-10.79	0

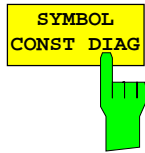
Fig. 6-22 Channel Table

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

Type:	Type of a channel (active channels only). If the modulation type of a channel can vary (HS-PDSCH, at an analyzer equipped with R&S® FSIQK74), the value of modulation type measured by the firmware application will be appended to the channel type. Data channels that do not have a type which can be fully recognized are of type CHAN (at an analyzer equipped with R&S® FSIQK74).
SR:	Symbol rate at which the channel is transmitted (7.5 ksps to 960 ksps).
Ch #:	Number of channel spreading code (0 to [spreading factor 1])
Status:	Status display. Since the active data channels are automatically searched for by the CDP measurement, each channel is in the active state.
TFCI:	Indication of whether or not the data channel uses TFCI symbols.
PiIL:	Number of pilot bits of a channel.
PWR ABS / PWR REL:	Indication of the absolute and relative channel power (referred to the CPICH or the total power of the signal).
T Offs:	Timing offset. Offset between the start of the first slot of the channel and the start of the analyzed WCDMA frame.

In *CODE CHAN AUTOSEARCH MODE*, a data channel is considered to be active if the required pilot symbols (see 3GPP specification) are at the end of each slot. In addition, the channel should have a minimum power (see *INACT CHAN THRESHOLD* softkey). At an analyzer equipped with R&S® FSIQK74, channels do not necessarily have to contain pilot symbols. Instead, channels have to fulfill special quality criteria to be recognized active. In *CODE CHAN PREDEFINED* mode, all channels that are included in the user defined channel table are marked as active.

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



The *SYMBOL CONST DIAG* 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).

It is possible to display the constellation diagram 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.

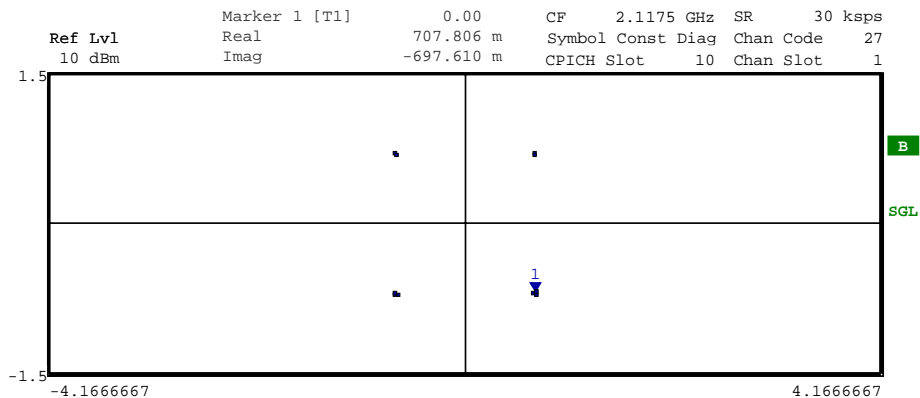


Fig. 6-23 Symbol Constellation Diagram

For data channels of HSDPA the modulation type can vary according to 3GPP. If the analyzer is equipped with R&S® FSIQK74, this will be considered by switching the diagram according to modulation type of the channel.

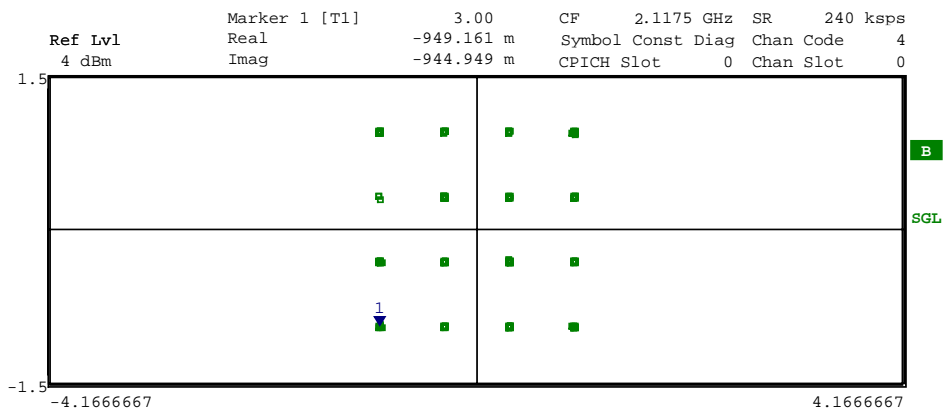
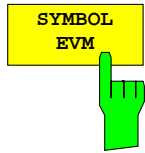


Fig. 6-24 Symbol Constellation Diagram (16QAM)

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



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.

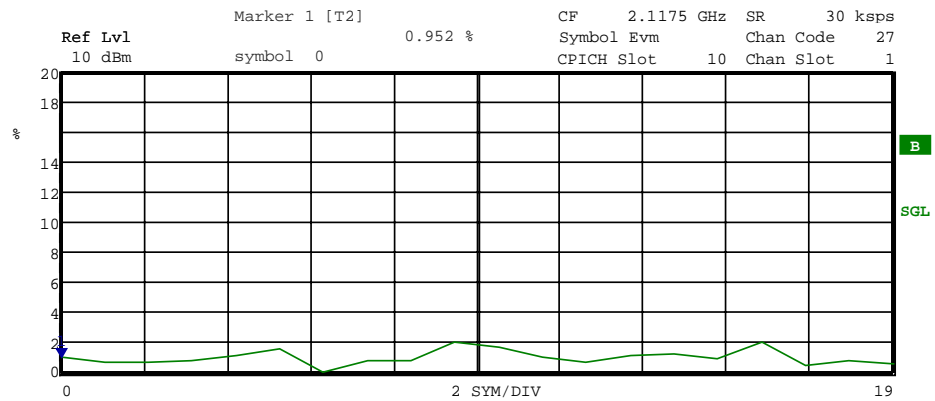


Fig. 6-25 Error Vector Magnitude for the selected slot of the selected channel

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



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).

Depending on the channel type and the symbol rate at which the channel is transmitted, specific symbols can be "switched off" in a slot, i.e. power 0 is transmitted instead of these symbols. The results of the bit decision are invalid for such symbols. Such invalid bits are marked by "x" in the diagram.

While it is possible to display the bitstream for unused codes (red marking in the CDP diagram 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.

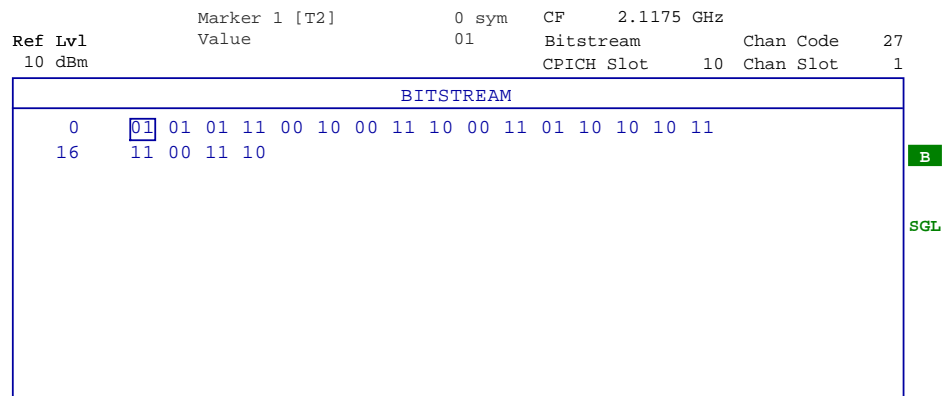


Fig. 6-26 Demodulated bits for the selected slot of the selected channel

For data channels of HSDPA, the modulation type can vary. Depending on the modulation type the number of bits that belong to one symbol will change. At an analyzer equipped with R&S® FSIQK74 the diagram will be switched according to the modulation type of the channel.

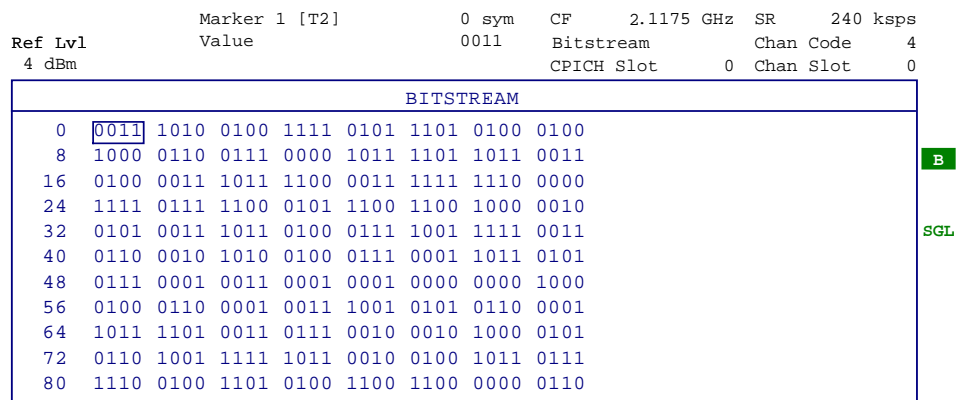
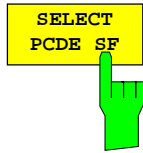


Fig. 6-27 Demodulated bits for the selected slot of the selected channel (16QAM)

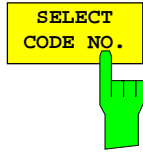
IEC/IEEE-bus command: :CALCulate2:FEED "XTIM:CDP:BSTream"



The *SELECT PCDE SF* softkey activates the entry of the class of codes onto which the error vector is to be projected for the *PEAK CODE DOMAIN ERROR* display. The entry of the spreading factor is only possible for this display mode, it has no effect on any other display mode.

IEC/IEEE-bus command:

```
: [SENSe:]CDPower:SFActor 4|8|16|32|64|128|256|512
```



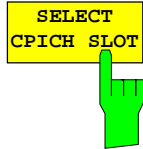
The *SELECT CODE NO* softkey activates the selection of a channel for the display modes *CDP PWR RELATIVE/ABSOLUTE*, *CODE PWR ZOOM*, *POWER VS SLOT*, *SYMBOL CONST DIAG*, *SYMBOL EVM*.

The entry is made on the basis of the code class with spreading factor 512. The number of the spreading code which the required channel has at its actual transmission rate has to be converted into spreading factor 512. The entered code correlates with the channel marked in red in the CDP diagram.

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.

IEC/IEEE-bus command: `: [SENSe:]CDPower:CODE 0 to 511`



The *SELECT CPICH SLOT* softkey activates the selection of the slot number for the display modes *POWER VS SLOT*, *SYMBOL CONST DIAG*, *SYMBOL EVM*.

To avoid ambiguities that may occur due to the permissible timing offsets, the slot number is defined on the basis of the CPICH (i.e. calculated in steps of 2560 chips starting from the beginning of the frame). The desired slot of the selected channel has to be converted according to its timing offset.

Example:

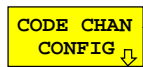
Slot 0 of the CPICH is set. The selected channel (red marker in the CDP diagram) has a timing offset of 2816 chips, i.e. slot 0 of the channel is delayed by 2816 chips against the frame start. Slot 0 of the CPICH therefore corresponds to slot 1 of the channel.

When the slot number is entered, the red marking in the power-versus-slot diagram changes its position in steps of 2560 chips.

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

Measurement Configuration

CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE CHAN CONFIG sub menu



CODE CHAN
CONFIG

CODE CHAN
AUTOSEARCH

CODE CHAN
PREDEFINED



EDIT CHAN
CONF TABLE

NEW CHAN
CONF TABLE

DEL CHAN
CONF TABLE

COPY CHAN
CONF TABLE

RESTORE
TEST MOD.

PAGE UP

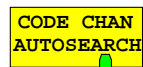
PAGE DOWN

The *CODE CHAN CONFIG* softkey opens a submenu with different configurations for measurements. In this submenu, predefined channel tables can be selected and edited as a basis for code domain measurements.

When the softkey 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?
```



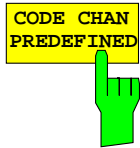
The *CODE CHAN AUTOSEARCH* softkey allows code domain power measurements in the automatic search mode. In this mode, the whole code domain (all permissible symbol rates and channel numbers) is searched for active channels. If the analyzer is equipped with R&S® FSIQK72 only, detecting an active channel is performed by a comparison with the pilot symbols to be expected after despreading. Only channels with pilot symbols can be detected as active channels. An exception to this rule are control channels SCCPCH and PICH, which can be recognized as active even though they do not contain pilot symbols. If the analyzer is additionally equipped with R&S® FSIQK74 channels without pilot symbols can also be recognized as active if they fulfill special quality criteria. If a channel without pilot symbols can be fully recognized (e.g. a HS-PDSCH, if it has modulation type 16QAM) its channel type will be determined. All other channels without pilot symbols are of channel type CHAN.

Synchronization channels CPICH, PCCPCH, PSCH and SSCH are assumed to be present by the CDP analysis and added to the channel table for each measurement.

The *CODE CHAN AUTOSEARCH* mode is the preset search mode 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 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. The selected channel table is marked by a tick.

FSIQK72/K74 comes ready with the following channel tables stored on the measuring instrument:

Channel model 1 to 3GPP with 16/32/64 channels

Channel model 2 to 3GPP

Channel model 3 to 3GPP with 16/32 channels

Channel model 4 with CPICH

Channel model 4 to 3GPP without CPICH

If the analyzer is equipped with R&S® FSIQK74 the following channel tables will be offered additionally:

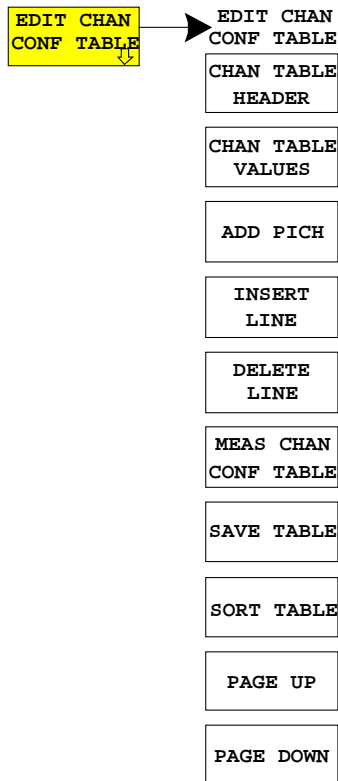
Channel model 5 to 3GPP with 2/4/8 HS-PDSCH and 6/14/30 DPCH

The predefined channel tables can be restored in case they have been accidentally overwritten (see softkey *RESTORE TEST MOD.*).

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 submenu giving access to the softkeys required for editing the channel table. The channel table is opened simultaneously for editing. The user can modify the channel configuration in the selected channel table

EDIT CHANNEL TABLE							
NAME:	3GB_1_16						
COMMENT:	3GPP Base Station Test Model 1 16 Channels						
CHANNEL TYPE	SYMBOL RATE [kpsps]	CHAN #	USE TFCI	TIMING OFFS. [CHIPS]	PILOT BITS	CDP REL. [dB]	STATUS
CPICH	15.0	0			---	0.0	ACTIVE
PCCPCH	15.0	1			---	0.0	ACTIVE
SCCPCH	15.0	3	NO	0	8	0.0	ACTIVE
DPCH	30.0	2	NO	22016	8	0.0	ACTIVE
DPCH	30.0	11	NO	34304	8	0.0	ACTIVE
DPCH	30.0	17	NO	13312	8	0.0	ACTIVE
DPCH	30.0	23	NO	11520	8	0.0	ACTIVE
DPCH	30.0	31	NO	36608	8	0.0	ACTIVE
DPCH	30.0	38	NO	28672	8	0.0	ACTIVE
DPCH	30.0	47	NO	15104	8	0.0	ACTIVE
DPCH	30.0	55	NO	5888	8	0.0	ACTIVE
DPCH	30.0	62	NO	256	8	0.0	ACTIVE
DPCH	30.0	69	NO	22528	8	0.0	ACTIVE
DPCH	30.0	78	NO	7680	8	0.0	ACTIVE
DPCH	30.0	85	NO	4608	8	0.0	ACTIVE
DPCH	30.0	94	NO	7680	8	0.0	ACTIVE
DPCH	30.0	102	NO	15616	8	0.0	ACTIVE
DPCH	30.0	113	NO	32768	8	0.0	ACTIVE
DPCH	30.0	119	NO	36608	8	0.0	ACTIVE

Date: 15.APR.2004 05:57:14

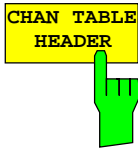
Fig. 6-28 Table for editing a channel configuration

The user has the possibility of modifying any of the channel tables stored in the instrument. The edited table is not stored automatically on the instrument hard disk but only after the user has activated the *SAVE TABLE* softkey. This prevents inadvertent overwriting of a table (e.g. one of the channel models).

If the user edits the table that is currently taken as a basis for the CDP analysis, the edited table is used for the next measurement immediately after storage. The effects of modifications in the table are therefore visible at once. The edited table is stored on the instrument hard disk only after the user has activated the *SAVE TABLE* softkey.

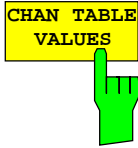
If the user edits a table that is stored on the instrument hard disk but currently not activated, the modifications are visible after storage (*SAVE TABLE* softkey) and subsequent activation.

If the *SYMBOL RATE* or *CHAN NO* of a channel is modified, a check for code domain conflicts is performed after the entry has been confirmed (unit hardkeys). If a code domain conflict is detected, the associated channels are marked by an asterisk. The user has the possibility of eliminating the code domain conflicts. When a table containing code domain conflicts is used for a CDP analysis, the results are invalid.



The *CHAN TABLE HEADER* softkey enables the user to edit the table header. The table name can be changed to prevent overwriting stored tables. The name of a table may not contain more than 8 characters.

IEC/IEEE command: `:CONFigure:WCDPower[:BTS]:CTABLE:NAME
"NEW_TAB"`



The *CHAN TABLE VALUES* softkey enables the user to edit the entries in the channel table. The following entries are available for each channel contained in the table (entry is confirmed using the unit hardkeys):

SYMBOL RATE:

symbol rate at which the channel is transmitted. This entry cannot be edited for channels whose symbol rate is defined in the standard (e.g. synchronization channels). In the case of special channels, the channel type is entered instead of the symbol rate.

CHAN NO:

number of the channel in the associated transmission class. The validity of the entered channel number in the selected transmission rate is checked on entry, invalid entries are not permitted.

USE TFCI:

indicates whether the channel contains TCFI symbols. This information is required for determining the slot format of the channel. This entry cannot be edited for channels that contain no TFCI information.

TIMING OFFSET:

timing offset of the channel. The expected timing offset is the channel offset referred to the CPICH, specified in chips. This entry cannot be edited for channels that have no timing offset.

PILOT BITS:

number of pilot bits of the channel. This information is required for determining the slot format. This entry cannot be edited for channels that contain no pilot symbols.

CDP REL.:

information about the relative channel power. This entry cannot be edited and is only available for the *RECENT* table, it is used for detecting low-power channels.

STATUS:

channel status (active/inactive). Modifying the channel status blanks out a channel entered in the table from the CDP analysis without the user having to clear the associated entry from the table. Only channels with an active channel status are used for the CDP analysis.

IEC/IEEE commands:

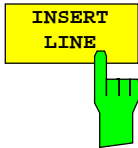
```
:CONFigure:WCDPower[:BTS]:CTABLE:DATA
    8,0,0,0,0,0,1,0.00,8,1,0,0,0,0,1,0.00,7,1,0,256,8,0,
    1,0.00

:CONFigure:WCDPower[:BTS]:CTABLE:COMMENT "Comment for new
table"
```



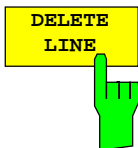
The *ADD SPECIAL* softkey opens a table where the available special channels can be selected. PICH and SCCPCH are available as special channels in the R&S® FSIQK72. They are included in the channel tables of the test models. Each of the two channels can be added once to the channel tables. If the analyzer is equipped with R&S® FSIQK74, the channel types of HSDPA (HSSCCH and HSPDSCH) can be selected and added to the channel table as well.

IEC/IEEE command: included in command :CONF:WCDP:CTAB:DATA



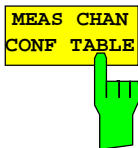
The *INSERT LINE* softkey inserts a new entry into the table. The entries can be made in any order. A channel is taken into account in the CDP analysis only if all required entries are available in the list.

IEC/IEEE command: --



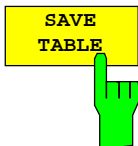
The *DELETE LINE* softkey deletes the marked line from the table. The *MEAS CHAN CONF TABLE* softkey starts a measurement in the *CODE CHAN AUTOSEARCH* mode. The measurement results are entered in the opened channel table.

IEC/IEEE command: --



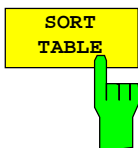
The *MEAS CHAN CONF TABLE* softkey starts a measurement in the *CODE CHAN AUTOSEARCH* mode. The measurement results are entered in the opened channel table. The softkey is only available in *CODE CHANNEL AUTOSEARCH* mode.

IEC/IEEE command: --



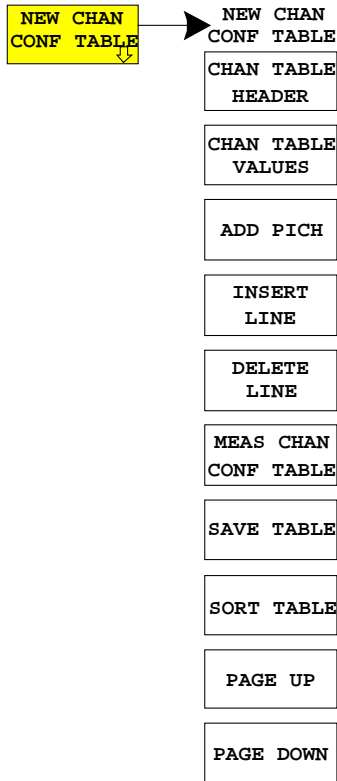
The *SAVE TABLE* softkey saves the table under the specified name. Caution: Editing the channel models and storing them under the initial name overwrites the models.

IEC/IEEE command: -- (automatically executed in remote control)



The *SORT TABLE* softkey sorts the table according to symbol rates in descending order and within a symbol rate according to channel numbers in ascending order.

IEC/IEEE command: --



The *NEW CHAN CONF TABLE* softkey opens a submenu, which is identical to the submenu described for the *EDIT CHAN CONF TABLE* softkey. In contrast to *EDIT CHAN CONF TABLE*, *NEW CHAN CONF TABLE* only adds the synchronization channels to the table for, the table name is still not defined:

EDIT CHANNEL TABLE							
NAME:	NEW						
COMMENT:							
CHANNEL TYPE	SYMBOL RATE[kbps]	CHAN #	USE TFCI	TIMING OFFS. [CHIPS]	PILOT BITS	CDP REL. [dB]	STATUS
CPICH	15.0	0			---		ACTIVE
PCCPCH	15.0	1			---		ACTIVE

Date: 15.APR.2004 05:58:17

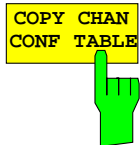
Fig. 6-29 Table for creating a new channel configuration



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

IEC/IEEE command:

```
:CONFigure:WCDPower[:BTS]:CTABLE:DELeTe
```



The *COPY CHAN CONF TABLE* softkey copies the selected table and stores it under a new name.

IEC/IEEE command:

```
:CONFigure:WCDPower[:BTS]:CTABLE:COpy "CTAB2"
```



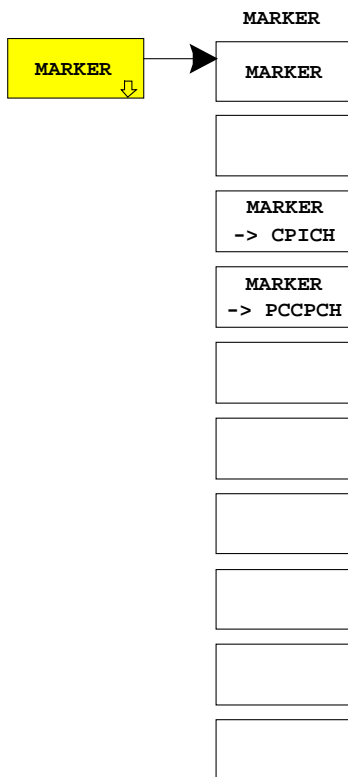
The *RESTORE TEST MOD.* softkey restores the default state when one of the predefined test models has been accidentally overwritten. The channel tables of the 3GPP test models in the current directory are overwritten with the default tables preset upon instrument delivery.

IEC/IEEE command:

```
:CONFigure:WCDPower[:BTS]:CTABLE:REStore
```

MARKER Functions

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*



The *MARKER* softkey opens a submenu with the marker settings.

Markers are not available in the tabulated display modes *RESULT SUMMARY* and *CHANNEL TABLE*.

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

```
Marker 1 [T1]
                -5.00 dB
slot 10 SR  30 ksps chan  23
```

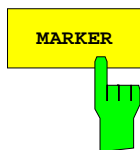
Fig. 6-30 Parameters of the marker info field

Besides the channel power, which is displayed relative to the value specified with *POWER REF TOT/CPICH*, the parameters are:

Slot: Slot number of the channel (unassigned codes have a timing offset of 0 chip referred to beginning of the frame)

SR: Symbol rate of the channel (for unassigned codes 7.5 ksps)

Chan: Number of the spreading code of the channel



The *MARKER* softkey switches the marker on or off.

IEC/IEEE-bus commands:

```
:CALCulate<1|2>:MARKer<1>:STATe ON
:CALCulate<1|2>:MARKer<1>:X <channel_number>
:CALCulate<1|2>:MARKer<1>:Y?
```



The *MARKER -> CPICH* sets the marker to the common pilot channel (code number 0 for spreading factor 256; corresponds to displayed code numbers 0 and 1 of the x-axis).

IEC/IEEE-bus commands: `:CALCulate<1|2>:MARKer<1>:FUNCTION:CPICH`
`:CALCulate<1|2>:MARKer<1>:Y?`



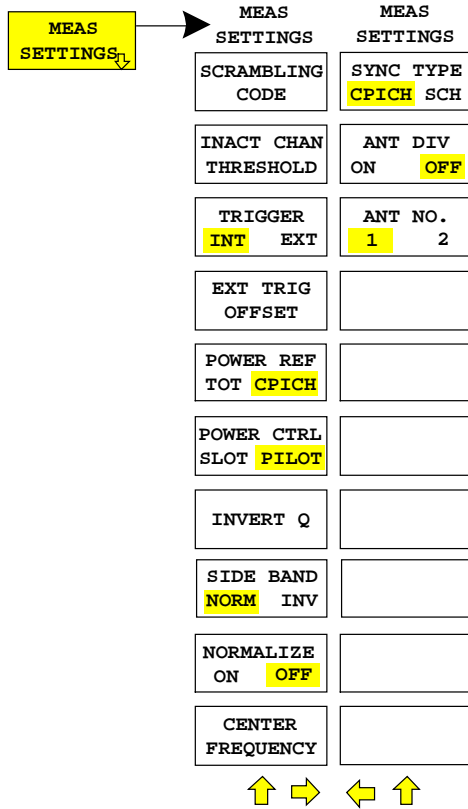
The *MARKER -> PCCPCH* sets the marker to the primary common control physical channel (code number 1 for spreading factor 256; corresponds to displayed code numbers 2 and 3 of the x-axis).

IEC/IEEE-bus commands:

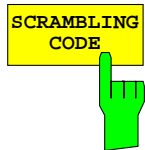
```
:CALCulate<1|2>:MARKer<1>:FUNCTION:PCCPch
:CALCulate<1|2>:MARKer<1>:Y?
```

Configuration of CDP Measurement – MEAS SETTINGS

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER



The MEAS SETTINGS softkey opens a submenu with setting parameters for the CDP measurement.



The SCRAMBLING CODE softkey opens a window for entering the scrambling code. The scrambling code is output 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



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.

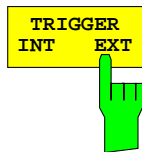
Channels which are below the specified threshold are considered to be not active irrespective of whether they contain pilot symbols or not. Channels that are not active appear in blue colour in the CDP diagram.

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 -20 dB which allows all channels of signals like the 3 GPP test signals to be detected in the CDP analysis. If not all channels in the signal are automatically detected, *INACT CHAN THRES* has to be decremented.

IEC/IEEE-bus command:

```
: [SENSe:]CDPower:ICTReshold -50dB to +10dB
```



The *TRIGGER INT EXT* softkey switches between internal (*FREE RUN*) and external triggering.

For internal triggering, at the beginning of the measurement a section (approx. 20 ms) of the signal, which must contain at least one frame of the WCDMA signal, is recorded and analyzed at a moment which cannot be determined by the user. The start of the next complete WCDMA frame is searched for in the recorded signal section and the signal is measured from this point.

In case of external triggering, R&S® FSIQK72/K74 expects a trigger at the beginning of the WCDMA frame (frame trigger). There is no search for the beginning of the frame in the recorded signal section. The start of the WCDMA frame is only searched for within the first 2560 chips after the trigger event.

Because of the power control which according to the 3GPP standard is performed for always one slot at the beginning of the pilot symbols of the previous slot (power group), the data record must contain 1024 chips for CDP analysis before the start of a WCDMA frame. Because of the chips required before the start, the CDP analysis cannot be started at slot 0 of a WCDMA frame when the trigger offset is 0 in the case of external triggering. Slot 1 of the next frame is selected instead as a start slot for the analysis. When a negative trigger offset of $-266.67 \mu\text{s}$ is entered (default setting of R&S® FSIQK72/K74), the CDP analysis starts with slot 0 of the next WCDMA frame. The start slot of the analysis is displayed as the first slot in the *COMPOSITE EVM* and *PEAK CODE DOMAIN ERROR* diagrams.

For external triggering the trigger output of the base station has to be connected to the R&S® FSIQ trigger input at the rear panel of the instrument.

Since with internal triggering the start of the next complete WCDMA frame is located in the middle of the recorded signal section (after approx. 10 ms) in the worst case, an external frame trigger reduces the search time for the frame start and consequently the computing time for the overall measurement.

IEC/IEEE-bus command:

```
:TRIGger[:SEquence]:SOURce IMMEDIATE|EXTERNAL
```




The *EXT TRG OFFSET* softkey activates the entry of the offset for external triggering (step width 40 ns).

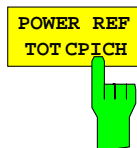
The trigger offset can compensate for the shift of the frame trigger at the actual start of a frame. In the *RESULT DISPLAY* mode, the interval between the trigger event and the start of the WCDMA frame is indicated under "Trg to Frame". An offset of the trigger event influences the interval specified there.

Because of the power control specified by the 3GPP standard, the CDP analysis requires at least 1024 chips before the start of the WCDMA frame. This corresponds to a trigger offset of $-266.67 \mu\text{s}$. This trigger offset permitting the display of *COMPOSITE EVM* and *PEAK CODE DOMAIN ERROR* to be started at slot 0 is set as the softkey default value.

If the trigger offset is set inadequately, the measurement may not be able to detect the start of a WCDMA frame in the search range. In this case, the measurement results are invalid and the code power of each channel is displayed in blue with almost the same level.

A modification of the trigger offset can influence the search range of R&S® FSIQK72/K74 and thus secure the feasibility of the measurement.

IEC/IEEE-bus command: `:TRIGger:SEquence:HOLDoff <num_value>`



The *POWER REF TOT / CPICH* softkey determines the reference power for the relative power displays:

TOT All the relative powers (display modes *CDP RELATIVE* and *POWER VS SLOT*) are referred slot by slot to the total signal power in the slot involved.

CPICH The reference power is that of the CPICH in the relevant slot.

The default setting of the softkey is *CPICH*.

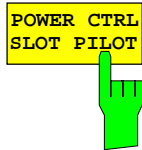
Since 3GPP specifies a slot-specific power control for every channel, the total power of the signal will change from slot to slot in accordance with the power control of the individual channels. As a result, with activated power control and reference to the total power of the signal, a relative CDP display versus the slot number (*POWER VS SLOT*) does not necessarily represent the power control of the selected channel.

Example:

If the signal (theoretically) contains only one data channel whose power is controlled, and if the power is referred to the total power of the signal (which is formed only by the contribution of this data channel), a straight line appears in the *POWER VS SLOT* diagram instead of the expected power staircase. Consequently, the reference value *TOT* of the relative displays is informative only if the signal does not contain power control.

By contrast, the *CPICH* setting also reflects the exact characteristic of the power versus the slot number in a selected channel for signals with power control. Since the CPICH is never power controlled, this yields the same reference value in every slot.

IEC/IEEE-bus command: `: [SENSe:]CDPower:PREference TOTAL|CPICH`



The *POWER CTRL SLOT/PILOT* softkey selects the position of the power control.

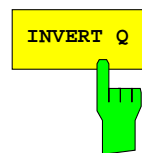
The power control is performed either at the slot limit (*SLOT*) or at the beginning of the pilot symbols (*PILOT*) of the previous slot.

The setting has an effect on all graphics in which the power of a specific channel is plotted versus the time (slot number). The power is determined in the specified limits.

The setting of the power control position has no effect on the following:

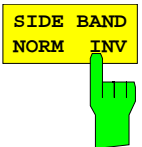
- graphics in which the power of channels is plotted in a defined period of time (e.g. code domain power)
- the measurements Composite EVM and Peak Code Domain Error stipulated in the standard since the results are strictly determined via a slot starting with Frame Start
- all graphics in which parameters of a channel are plotted in a specific slot

IEC/IEEE-bus command: `:[SENSe:]CDPower:PCONtrol PILOt | SLOt`



The *INVERT Q* softkey inverts the sign of the Q component of the signal. The softkey is deactivated in the default setting.

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



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 base station.

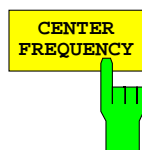
INV The inverted position is useful for measurements on IF modules or components in case of spectral inversion (default setting).

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



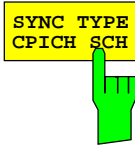
The *NORMALIZE ON / OFF* softkey eliminates the DC offset of the signal. Default setting is OFF.

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



The *CENTER FREQUENCY* activates the input of the center frequency of the WCDMA signal.

IEC/IEEE-bus command: `:[SENSe:]FREQuency:CENTer 870.03 MHz`

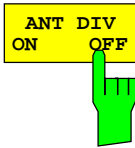


The *SYNC TYPE CPICH/SCH* softkey selects the type of synchronization:

- CPICH Synchronization to CPICH (default). For this kind of synchronization the CPICH must be included in the transmitted signal.
- SCH Synchronization without CPICH. This kind of synchronization is intended for test model 4, which is defined with or without DPICH.

IEC/IEEE-bus command:

: [SENSe<1 | 2>:]CDPower:STYPe CPICH | SCHannel

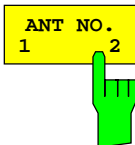


The *ANT DIV ON/OFF* softkey switches the antenna diversity mode on or off.

OFF Antenna diversity mode switched off.

- 1 | 2 According to 3 GPP, the pilot symbols of the channels are different for depending on the antenna used. The CPICH symbols are different and the synchronization channels are transmitted alternately in every second slot.

IEC/IEEE-bus command : [SENSe<1 | 2>:]CDPower:ANTenna OFF | 1 | 2

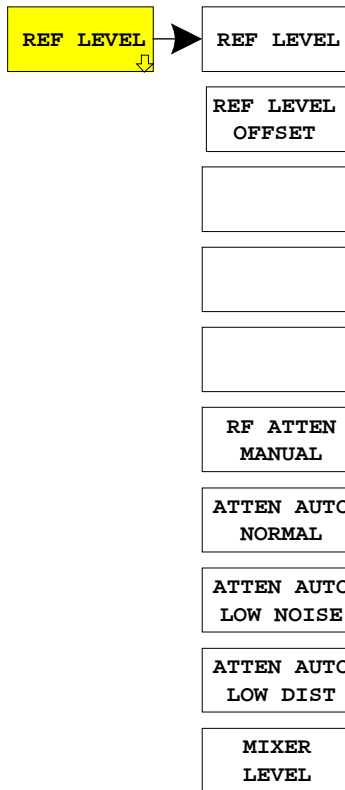


The *ANT NO. 1/2* softkey selects the antenna of the diversity path. The softkey is only available when *ANTENNA DIVERSITY* is *ON*. Antenna No. 1 is the default setting

IEC/IEEE-bus command: : [SENSe<1 | 2>:]CDPower:ANTenna OFF | 1 | 2

Level Settings – REV LEVEL

Submenu: CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER

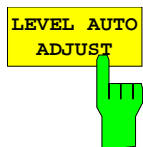


The *REF LEVEL* softkey opens a submenu for level setting.

The softkeys and their function are identical to the *REF LEVEL* menu in the basic unit and are described in the operating manual of the basic instrument.

Automatic Adaptation to Input Level - LEVEL AUTO ADJUST

Submenu: CONFIGURATION- MODE – 3GPP BTS ANALYZER – LEVEL AUTO ADJUST



The *LEVEL AUTO ADJUST* softkey is used for automatically setting the RF attenuation and reference level to the level of the applied signal. Manual re-adjustment is permissible with the *REF LEVEL* softkey.

The instrument is to be switched to the *ATTEN MANUAL* mode so as to set the RF attenuation and reference level to optimum values independently of each other. This mode is maintained after changing from code-domain power measurements to the spectrum analyzer or vector signal analyzer mode.

IEC/IEEE-bus command sequence:

```

*RST
:INSTRument[:SElect] BWCDpower
:INITiate:CONTinuous OFF
:[SENSe:]CDPower:LEVel:ADJust; *OPC?
:INITiate[IMMediate]; *OPC?
:TRACe? TRACE1
  
```

Automatic Setting of CDP Measurement Mode - CDP AUTO ADJUST

Submenu: *CONFIGURATION - MODE - 3GPP BTS ANALYZER - CODE DOM POWER*



The *CDP AUTO ADJUST* softkey automatically adapts the settings of the CDP measurement in such a way that a valid measurement on the signal is possible with high probability. For this purpose

- the following measurement parameters are set to predefined values:

Trigger:	FREE RUN
Marker / delta marker:	OFF
Code number:	0
Slot number:	0
Symbol rate:	15 ksps (referred to CPICH)
- RF attenuation and reference level are set using *LEVEL AUTO ADJUST*
- a *SINGLE SWEEP* in *CODE CHAN AUTOSEARCH* is carried out.

With these settings, the CDP measurement can be performed with high probability, provided a valid WCDMA signal to 3GPP is applied to the RF input of analyzer. The parameters *CENTER FREQUENCY*, *SCRAMBLING CODE* as well as an external reference for the measurement have to be manually adapted to the signal.

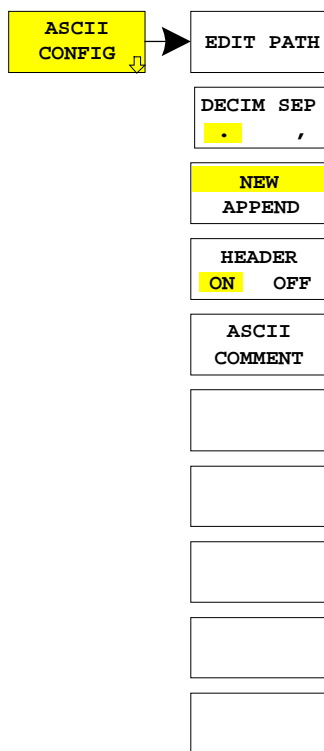
IEC/IEEE-bus command: : [SENSe:]CDPower:PRESet

Trace Settings - TRACE Key Group

The *TRACE MATH* and *DETECTOR* settings are not available in the *TRACE* menu. The remaining softkeys are identical to those of the basic unit and are described in the R&S® FSIQ operating manual. The *DISPLAY MODE CDP* softkey opens the *RESULT DISPLAY* submenu of the CDP measurement mode.

The *TRACE* side menu contains the softkeys for ASCII trace export. Using this softkeys, traces can be stored in files with ASCII format. This way, traces are available for mathematical processing in corresponding programs. These softkeys are used to store traces in a file so that the traces are available in a form that can be processed with mathematical programs.

The *ASCII EXPORT* softkey stores the corresponding trace in a file with ASCII format. The export function can be configured in the *ASCII CONFIG* submenu.



The *ASCII CONFIG* softkey calls a submenu for various settings for the *TRACE ASCII EXPORT* function.



The *EDIT PATH* softkey defines the directory in which the file is to be stored.

IEC/IEEE-bus command --

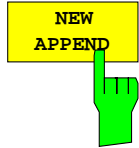


The *DECIM SEP* softkey selects the decimal separator for the ASCII file. The choice is '.' (decimal point) or ',' (comma).

This means that the decimal separator used in various language versions of evaluation programs (e.g. MS-Excel) can be selected so that the packages are supported.

IEC/IEEE-bus command

:FORMat:DEXPort:DSEParator POINT|COMMa

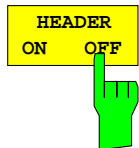


The *APPEND NEW* softkey defines whether output data are to be written to an existing file or a new file.

- With *APPEND*, the data are added to an existing file.
- With *NEW*, either a new file is generated or an existing file is overwritten by storage of the data.

IEC/IEEE-bus command

:FORMat:DEXPort:APPend ON | OFF



The *HEADER ON/OFF* softkey defines whether important instrument settings should be stored at the beginning of the file. The general device settings entered in the file header allow test results to be reproduced. A file header may impair data processing by mathematical programs.

IEC/IEEE-bus command

:FORMat:DEXPort:HEADer ON|OFF



The *ASCII COMMENT* softkey activates the entry of commentary concerning the current ASCII data set. A total of 60 characters are available for this purpose.

IEC/IEEE bus command

:FORMat:DEXPort:COMMENT 'string'



In CDP measurement mode, the *ASCII EXPORT* softkey stores the corresponding trace in a file with ASCII format.

Upon pressing the *ASCII EXPORT* softkey, a file name can be entered. The default name is TRACE.DAT. Then the measured data of the trace are stored.

IEC/IEEE-bus command

:MMEORY:STORe:TRACe

1..4,<Pfad mit Filenamen>

Structure of the ASCII file for CDPower measurements and measurements of signal spectrum:

The file consists of the header containing important scaling parameters and a data section containing the trace data. The data of the file header consist of three columns, each separated by a semicolon: parameter name; numeric value; basic unit

The data section starts with the keyword " Trace <n> " (<n> = number of stored trace), followed by the measured data in one or several columns (depending on measurement) which are also separated by a semicolon.

This format can be read in from spreadsheet calculation programs, eg MS-Excel. It is necessary to define ';' as a separator.

1) Format for CDP measurements

	Content of file	Description
File header	Type;FSIQ 7; Version;4.10; Date;26.Mar 2001; Comment;ASCII file; Mode;CDP; Measurement;Code Domain Power; Digital Standard;WCDMA 3GPP FWD; Center Freq;2117500000.000000;Hz; Freq Offset;0.000000;Hz; Ref. Level;-6.000000;dBm; Level Offset;0.000000;dB; RF Att;10.000000;dB; y per div;2;dB; Ref Value y-Axis;0;dB; Ref Value Position;100.000000;% Sweep Count;0; Spreading Factor;256; Reference Slot;0; Channel Slot;0; First Slot;0; Code Number;0; Scrambling Code;0000H; Scr Type;N/A; Channel Threshold;-20; Invert Sideband;OFF; Normalize;OFF; Invert Q;OFF;	Instrument model Firmware version Date record storage date Comment Instrument operating mode Display mode (CDP, bitstream, ...) Digital standard (3GPP REV, 3GPP FWD) Center frequency Frequency offset Reference level Level offset Input attenuation Scaling of y axis per division Scaling of y axis, reference value Scaling of y axis, position of reference value Number of sweeps set Spreading factor Slot of the reference channel (CPICH) Channel slot First slot Code number: 0 to 511 Scrambling code: 0000 to 1FFFH Scrambling type: N/A Channel threshold Sideband; ON, OFF; Normalize;ON, OFF; Invert Q;ON, OFF; N/A
Data section of the file (CDP abs / CDP rel / Channel Table)	Trace 1: Trace Mode;CLR/WRITE; Values;238; 8;0;-13.643795;-3.643795;0;0;-; 7;32;-21.409958;-11.409958;256;8;-; 7;33;-23.137810;-13.137810;15360;8;-; 7;34;-15.651539;-5.651539;3328;8;-; 7;35;-21.930389;-11.930389;32768;8;-; 7;36;-18.120872;-8.120872;0;8;-; ...	Trace Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD Number of data blocks / measurement values <CodeClass>;<CodeNumber>;<yabs>;<yrel>; <TimingOffset>;<PilotLength>;<Mapping>; in R&S® FSIQK72/K74 the mapping value is not relevant, therefore a minus '-' is output

	Content of file	Description
Data section of the file (Result Summary)	Trace 2: Trace Mode:CLR/WRITE; 3.135467;%; -52.303844;dB; -9.127991;Hz; -5.221600;ppm; -7.365761;dBm; -122.502686;ms; 5.236792;%; 2.605927;%; 0.010436;%; 0.938106;%; 8; 0; -2.310928; 0.000000; 0.000000; 8; -;	Trace Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD Peak value composite EVM Peak value PCDE Frequency error (carrier deviation) Chip rate error Total power of signal Trigger offset to frame start Peak value EVM RMS value EVM IQ offset IQ imbalance Code class Code number Y absolute Y relative Timing offset Pilot length Mapping (for R&S® FSIQK72/K74: '-')
Data section of the file (Power versus Slot / Peak Code Domain Error / Composite EVM)	TRACE 2: Trace Mode:CLR/WRITE; Values;15; 0;16.843128; 1;0.554786; 2;11.818155; 3;15.885643;	Trace Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD Number of data blocks / measurement values <Slot>; <LevelValue>;
Data section of the file (Symbol Constellation)	TRACE 2: Trace Mode:CLR/WRITE; Values;10; -0.293423;1.388842; 0.038587;-0.735293; 0.961711;-1.217144; 2.015055;-0.696284;	Trace Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD Number of data blocks / measurement values <LevelValue Real>;<LevelValue Imag>;
Data section of the file (Bitstream)	TRACE 2: Trace Mode:CLR/WRITE; Values;160; 0;1;0;1;1;1;0;1;1;0; 0;0;1;1;0;0;1;0;1;0; 0;1;9;9;9;9;9;9;9;9; 1;0;1;0;0;1;1;0;0;0;	Trace Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD Number of data blocks / measurement values <Symbol>;

	Content of file	Description
Data section of the file (Symbol EVM)	TRACE 2: Trace Mode;CLR/WRITE;	Trace Display mode of trace: CLR/WRITE, AVERAGE, MAXHOLD, INHOLD
	Values;10; 5.288429; 1.950043; 3.740749; 2.073324;	Number of data blocks / measurement values <Level/Value>;

2) Format for CCDF measurements

	Content of file	Description
File header	Type;FSIQ 7; Version;4.10 ; Date;26.Mar 2001; Comment;ASCII-File; Mode;CCDF; Center Freq;211750000.000000;Hz Freq Offset;0.000000;Hz x-Axis;LIN; Ref. Level;-20.000000;dBm Level Offset;0.000000;dBm RF Att;10.000000;dB RBW;10000000.000000;Hz SWT;0.074000;s Detector;AUTOPEAK;	Instrument model Firmware version Date record storage date Comment Instrument operating mode Center frequency Frequency offset Scaling of x axis linear (LIN) or logarithmic (LOG) Reference level Level offset Input attenuation Resolution bandwidth Sweep time Detector set: AUTOPEAK, MAXPEAK, MINPEAK, AVERAGE, RMS, SAMPLE
	Sweep Count;0; Sample Count;0; y max;0; y min;0; Averaging;OFF;	Number of sweeps set Number of samples set Maximum level Minimum level Averaging ON/OFF
Data section of the file	TRACE 1: Trace Mode;CLR/WRITE; x-Unit;dB; Values;500; 0.000000;-12.450729;-106.249130 26052104.208417;-74.768776;-108.954018 52104208.416834;-74.841995;-107.017891 78156312.625251;-74.569473;-103.686615 ...	Trace Unit of x values: Mean Pwr + ... dB; Number of measurement points <x value>, <y1>, <y2> <y2> being available only with AUTOPEAK detector and containing in this case the smaller of the two measured values for a measurement point.

3) Format for Spectrum Emmission Mask measurements

	Content of file	Description
File header	Type;FSIQ 7 Version;4.10; Date;26.Mar 2001; Comment;ASCII-File; Mode;SEM; Start;0.000000;Hz Stop;7000000000.000000;Hz Center Freq;2117500000.000000;Hz Span;7000000000.000000;Hz Freq Offset;0.000000;Hz x-Axis;LIN; y-Axis;LOG; Level Range;100.000000;dB Ref. Level;-20.000000;dBm Level Offset;0.000000;dBm Max. Level;-20.000000;dBm RF Att;10.000000;dB RBW;STD; VBW;3000000.000000;Hz SWT;0.074000;s Detector;RMS; Sweep Count;0; Channel Power; 0; Limit Line; P>31;	Instrument model Firmware version Date record storage date Comment Instrument operating mode Start/stop of the display range. Unit: Hz for span > 0, s for span = 0, Center frequency Frequency range (0 Hz for zero span) Frequency offset Scaling of x axis linear (LIN) or logarithmic (LOG) Scaling of y axis linear (LIN) or logarithmic (LOG) Display range in y direction. Unit: dB for x axis LOG, % for x axis LIN Reference level Level offset Maximum level Input attenuation Resolution bandwidth Video bandwidth Sweep time Detector set: AUTOPEAK, MAXPEAK, MINPEAK, AVERAGE, RMS, SAMPLE Number of sweeps set Channel power Selected limit line
Data section of the file	TRACE 1: Trace Mode;CLR/WRITE; x-Unit;Hz; y-Unit;dBm; Values;500; 6487500000.000000;-90.754356; 6487550100.200400;-90.956367; 6487600200.400802;-90.655090; 6487650300.601202;-91.537399; ...	Trace Unit of x values: Hz for span > 0; s for span = 0; dBm/dB for statistics measurements Unit of y values: dB*V/AW depending on the selected unit for y axis LOG or % for y axis LIN Number of measurement points Measured values: <x value>, <y1>, <y2> <y2> being available only with AUTOPEAK detector and containing in this case the smaller of the two measured values for a measurement point.

Overview of Other Menus

SYSTEM Key Group

The *PRESET*; *CAL* and *INFO* menus in the code domain measurement mode are identical to the corresponding menus in the basic unit and are described in the R&S® FSIQ operating manual.

The parameters marked with grey are not available in the *DISPLAY* menu. The screen display is set to *SPLIT SCREEN* in the code domain measurement mode. The remaining softkeys are identical to those of the basic unit and are described in the R&S® FSIQ operating manual.

CONFIGURATION Key Group

The *MODE* menu enables selection of the mode. The analyzer, vector analyzer and tracking generator modes are described in the operating manual for the R&S® FSIQ basic unit. The code domain measurement mode is described in the present manual.

The *SETUP* menu in the code domain measurement mode is identical to the corresponding menu in the basic unit and is described in the R&S® FSIQ operating manual.

FREQUENCY Key Group

In the *CENTER* menu, the center frequency can be set for synchronization with the DUT and a frequency offset entered.

The *SPAN*, *START* and *STOP* keys have no function in the code domain measurement mode.

LEVEL Key Group, INPUT Key

The *REF*, *RANGE* and *INPUT* menus in the code domain measurement mode are identical to the corresponding menus in the basic unit and are described in the R&S® FSIQ operating manual.

MARKER Key Group

The *NORMAL* menu in the code domain measurement mode is identical to the *CONFIGURATION MODE – 3GPP BTS ANALYZER – CODE DOM POWER* submenu.

The *DELTA* menu in the code domain measurement mode is identical to the corresponding menu in the vector analyzer mode and is described in the R&S® FSIQ operating manual.

The *SEARCH* and *MKR* → keys have no function in the code domain measurement mode.

LINES Key Group

The *LIMIT LINES* and *D-LINES* keys have no function in the code domain measurement mode.

SWEEP Key Group

The softkeys *FREE RUN*, *EXTERN*, *TRIGGER OFFSET* and *SLOPE POS/NEG* are available in the *TRIGGER* menu.

In the *SWEEP* menu only the parameters *SINGLE SWEEP* and *CONTINUOUS SWEEP* are available.

The *COUPLING* key has no function in the code domain measurement mode.

HCOPY and MEMORY Key Group

The *SETTINGS*, *RECALL* and *CONFIG* menus in the code-domain measurement mode are identical to the corresponding menus in the basic unit and are described in the R&S® FSIQ operating manual.

The *SAVE* menu offers the possibility to store the WCDMA channel tables. To this end, selection "WCDMA channel table" is included in the *ITEMS TO SAVE* selection list. The corresponding data set file has the extension *.ctb.

7 Remote-Control Commands

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 and vector signal analyzer modes as well as the system settings, are described in the operating manual of the analyzer.

CALCulate Subsystem

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

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

Parameter: <string>::= 'XPOW:CDP' |
 'XPOW:CDP:RAT' |
 '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:DDEM:MEAS' (vector signal analysis)
 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>)
'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:ESpectrum:MODE AUTO | MANUal | USER

This command switches on or off the automatic selection of limit lines for spectrum emission mask measurements.

Parameter:

AUTO	the set limit line depends on the measured channel power
MANUAL	one out of four fixed limit line is activated. The selection is done with command <code>CALC:LIM:ESP:VAL</code>
USER	only query possible, user-defined limit lines are switched on (see manual of instrument for description of limit line functions)

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

Features:

*RST value:	AUTO
SCPI:	device-specific

:CALCulate:LIMit:ESpectrum:VALue <numeric_value>

This command switches to manual selection of limit lines. The limit line is selected by entering the expected power as a value. Depending on the value entered, one of four possible limit lines is selected:

Expected power in dBm	name of selected limit line	retrieved value
value \geq 43	"P \geq 43"	43
$39 \leq$ value < 43	"39 \leq P < 43"	39
$31 \leq$ value < 39	"31 \leq P < 39"	31
value < 31	"P < 31"	0

Example: `" :CALC:LIM:ESP:VAL 39 "` selects limit line "39 \leq P < 43"

Features:

*RST value:	0
SCPI:	device-specific

:CALCulate<1|2>:MARKer<1>:FUNction:CPIC

This command sets the marker to channel 0 (Common Pilot Channel).

Example: `" :CALC:MARK:FUNC:CPIC "`

Features:

*RST value:	—
SCPI:	device-specific

This command is an <Event> and has therefore neither *RST value nor query. Only the numeric suffix 1 is permissible in `MARKer`.

The numeric suffix in `CALCulate` that is required or permissible depends on the selected display mode for which the marker is to be valid and has to coincide with it:

`CALCulate<1>` for CDP absolute and relative

`CALCulate2` for composite EVM, peak code domain error, power versus slot, bit stream, symbol constellation and EVM

:CALCulate<1|2>:MARKer<1>:FUNCTION:PCCPch

This command sets the marker to channel 1.

Example: " : CALC : MARK : FUNC : PCCP "

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

This command is an <Event> and has therefore neither *RST value nor query. Only the numeric suffix 1 is permissible in MARKer.

The numeric suffix in CALCulate that is required or permissible depends on the selected display mode for which the marker is to be valid and has to coincide with it:

CALCulate<1> for CDP absolute and relative

CALCulate2 for composite EVM, peak code domain error, power versus slot, bit stream, symbol constellation and EVM

CALCulate<1>:MARKer<1>:FUNCTION:CRESt?

Queries the Crest factor in the time domain measurement. Only the numeric suffix 1 is permissible in CALCulate and MARKer.

Example: "CALC : MARK : FUNC : CRES? "

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

:CALCulate<1|2>:MARKer<1...4>:FUNCTION:WCDPower[:BTS]:RESult?

PTOTAL | FERRor | TFRame | TOFFset | MACCuracy | PCDerror | EVMRms | EVMPeak |
CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFFset | IQIMbalance |
MTYPE

This command queries the measured and calculated results of the WCDMA code domain power measurement.

PTOTAL	total power	FERRor	frequency error in Hz
TFRame	trigger to frame	TOFFset	timing offset
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
MTYPE	modulation type (2: QPSK, 4: 16QAM, 15: slot switched off)		

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

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

:CALCulate:MARKer:Y:PERCent 0 to 100%

This command positions the marker in CCDF measurements to the selected percent value of the y-axis scaling (probability).

Example: " : CALC : MARK : Y : PERC 40 "

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.

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			
[:BTS]			
:CCDF			
[:STATe]	<Boolean>		
:NSAMples	<numeric_value>	--	
:SCALe			
:Y			
:UPPer	<numeric_value>	--	
:LOWer	<numeric_value>	--	

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

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

Example: "CALC:STAT: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 statistical 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 the 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.

CONFigure<1>:WCDPower[:BTS]:MEASurement POWER | ACLR | ESPectrum | OBANdwith | OBWidth | WCDPower | FDOMain | TDOMain | CCDF

This command selects the WCDMA base station tests. The settings of the predefined measurements are described for the associated softkey in chapter 6.

Parameter:	POWER	Channel power measurement (standard 3GPP WCDMA Forward) with predefined settings
	ACLR	Adjacent channel power measurement (standard 3GPP WCDMA 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.
	FDOMain	Overview measurement in the frequency domain with predefined settings
	TDOMain	Measurement of crest factor in the time domain with predefined settings
	CCDF	Measurement of Complementary Cumulative Distribution Function

Example: "CONF:WCDP:MEAS POW"

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

CONFigure:WCDPower[:BTS]: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:CTABLE:SElect.

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

Example: ":CONF:WCDP:CTAB ON"

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

CONFigure:WCDPower[:BTS]: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:CTABLE ON"
":CONF:WCDP:CTAB:SEL '3GB_1_32'"

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

:CONFigure:WCDPower[:BTS]: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[:BTS]:CTABLE:DATA

2..9 , 0..511 , 0|1 , <numeric_value> | AUTO, 2|4|8|16 , 0|1|2|3|4|5 , <numeric_value>...

This command defines the values of the selected channel table.

Each line of the table consists of 8 values:

<code class>,<code number>,<use TFCI>,<timing offset | AUTO>,<pilot length>,<channel type>,<status>,<CDP relative [dB]>....

Code class: 2 to 9
Code number: 0 to 511
use TFCI: 0: not used, 1: used
Timing offset: 0 to 38400, for code class 9, the step width is 512, else 256,
for AUTO, the timing offset is calculated by the instrument
Pilot length: code class 9: 4
code class 8: 2, 4, 8
code class 7: 4, 8
code class 5/6: 8
code class 2/3/4 16
Channel Type: 0: DPCH Dedicated Physical Channel
1: PICH Paging Indication Channel
2: SCCPCH Secondary Common Control Physical Channel
3: HS_SCCH HSDPA: High Speed Shared Control Channel
4: HS_PDSCH HSDPA: High Speed Physical Downlink Shared Channel
5: CHAN jeder andere Kanal ohne Pilotsymbole
Status: 0: not active, 1:active
CDP relative: for setting commands any value, for query CDP relative value

Channels CPICH and PCCPCH may only be defined once. They have the same channel type like data channels. However, they can be determined via their channel numbers. If channel CPICH or PCCPCH 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 : CTAB : NAME.

Example: " : CONF : WCDP : CTAB : DATA 8,0,0,0,0,0,1,0.00,
8,1,0,0,0,0,1,0.00,7,1,0,256,8,0,1,0.00 "
2 channels are defined: CPICH, PCCPCH and a channel in code class 7

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

:CONFigure:WCDPower[:BTS]: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 : CTAB : NAME and the values of the table have to be defined with command
CONF : WCDP : CTAB : DATA .

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

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

:CONFigure:WCDPower[:BTS]: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:CTAB:NAME`.

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

Example: " : CONF : WCDP : 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[:BTS]:CTABLE:DELeTe

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

Example: " : CONF : WCDP : 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[:BTS]:CTABLE:REStore

This command restores the default channel tables preset upon instrument delivery.

Example: " : CONF : WCDP : CTAB : REST "

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[:BTS]: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 : CTAB : CAT ? "

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

INSTrument Subsystem

:INSTrument[:SElect] SANalyzer | DDEMod | ADEMod | BGSM | MSGM | CDPower | **WCDPower|BWCDpower**

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

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

Example: " :INST BWCD "

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.

:[SENSE:]CDPower:SFACTor 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512

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

Example: " :SENS:CDP:SFACTor 16 "

Features: *RST value: 512
SCPI: device-specific

:[SENSE:]CDPower:CODE 0 to 511

This command sets the code number. The code number refers to code class 9 (spreading factor 512).

Example: " :SENS:CDP:CODE 30 "

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

:[SENSE:]CDPower:NORMALize ON | OFF

This command switches normalization of the unit circle with the IQ offset on or off.

Example: " :SENS:CDP:NORM OFF "

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

Mode: WCDP

:[SENSe<1|2>:]CDPower:PCONtrol PILot | SLOt

This command sets the power control position. A distinction is made between a power control at the slot limit (SLOt) and a power control at the beginning of pilot symbols (PILot).

Example: " :CDP:PCON SLOt "

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

:[SENSe:]CDPower:PRESet

This command sets the parameters of the WCDMA measurement to predefined values (see softkey *CDP AUTO ADJUST* in chapter 6).

Example: " :CDP:PREs "

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

This command is an <Event> and has therefore neither *RST value nor query.

:[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:]CDPower:SLOt 0 to 14

This command sets the slot number of the common pilot channels (CPICH).

Example: " :SENS:CDP:SLOt 3 "

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

Mode: WCDP

:[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:ICTReshold -50 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: -20 dB
SCPI: device-specific

:[SENSe:]CDPower:LEVel:ADJust

This command is used for setting automatically the RF attenuation and IF gain to the level of the applied signal. The instrument is to be switched to the *ATTEN MANUAL* mode so as to set the RF attenuation and IF gain separately to optimum values. This mode is maintained after changing from code domain power measurements to the analyzer or vector analyzer modes.

Example: " :CDP:LEV:ADJ "

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

This command is an <Event> and has therefore neither *RST value nor query.

:[SENSe:]CDPower:PREference TOTal | CPICH

This command switches between the use of total power or CPICH power as reference for the relative CDP measurement values.

Example: " :SENS:CDP:PREF CPIC "

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

:[SENSe<1|2>:]CDPower:STYPe CPICH | SCHannel

This command selects the type of synchronization.

CPICH Synchronizaton to CPICH (default). The CPICH has to be contained in signal.

SCHannel Synchronization without CHICH. This type of synchronization is provided for test model 4 which is defined with or without CPICH.

Example: " :CDP:STYP SCH "

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

:[SENSe<1|2>:]CDPower:ANTenna OFF | 1 | 2

This command switches the antenna diversity mode on or off and selects the antenna of the diversity path.

OFF Antenna diversity mode switched off.

1 | 2 According to 3 GPP, the pilot symbols of the channels are different depending on the antenna used. The CPICH symbols are different and the synchronization channels are transmitted alternately in every second slot.

Example: " :CDP:ANT 1 "

Features: *RSTvalue: OFF
SCPI: device-specific

TRACe Subsystem

:TRACe[:DATA] TRACE1 |TRACE2 | ABITstream | PWCDp | CTABLE | CWCDp

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

Only TRACE1, TRACE2, PWCDp, ABITstream or CTABLE can be queried 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 9 corresponds to the highest spreading factor (512, symbol rate 7.5 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>,<timing offset>,

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 CPICH.
Timing offset	chips

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

1st channel: spreading factor 512, channel number 7, timing offset 0
2nd channel: spreading factor 4, channel number 1, timing offset 256 chips
3rd channel: spreading factor 128, channel number 255, timing offset 2560 hips

This yields the following result: 9,7,-40,-20,0,2,1,-40,-20,256,7,255,-40,-20,2560

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 512.

CODE PWR ABSOLUTE / RELATIVE (PWCDp) , CHANNEL TABLE (PWCDp)

PWCDp can be set only if CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE is selected for Screen A. The pilot length is transmitted in addition to the same five values as transmitted for TRACE1:

< class>,<cannel number>,<absolute level>,<relative level>,<timing offset> or <l/Q-mapping>,<pilot length>,...

The pilot length is given in symbols.

CODE PWR ABSOLUTE / RELATIVE (CWCDp) , CHANNEL TABLE (CWCDp)

TRAC? CWCDp can be set only if CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE is selected for Screen A. The same data as for TRAC? TRACE1 is transmitted, additionally pilot length, channel type, modulation type and a reserved value are given. For each channel therefore 10 values are transmitted.

< class>,<cannel number>,<absolute level>,<relative level>,<timing offset> or <l/Q-mapping>,
<pilot length>,<channel type>,<modulation type>,<reserved>,...

Channel Type:

- 0 - DPCH **D**edicated **P**hysical **C**hannel
- 1 - PICH **P**aging **I**ndication **C**hannel
- 2 - CPICH **C**ommon **P**ilot **C**hannel
- 3 - PSCH **P**rimary **S**ynchronisation **C**hannel
- 4 - SSCH **S**econdary **S**ynchronisation **C**hannel
- 5 - PCCPCH **P**rimary **C**ommon **C**ontrol **P**hysical **C**hannel
- 6 - SCCPCH **S**econdary **C**ommon **C**ontrol **P**hysical **C**hannel
- 7 - HS_SCCH HSDPA: **H**igh **S**peed **S**hared **C**ontrol **C**hannel
- 8 - HS_PDSCH HSDPA: **H**igh **S**peed **P**hysical **D**ownlink **S**hared **C**hannel
- 9 - CHAN channel without pilot symbols

Modulation Type:

- 2 - QPSK
- 4 - 16QAM
- 15 – slot switched off

<reserved> {0} reserved for future extensions

CODE PWR ABSOLUTE / RELATIVE (CTABLE) , CHANNEL TABLE (CTABLE)

CTABLE can be set for only if CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE is selected for Screen A. The channel status (0 = inactive; 1 = active) is transmitted in addition to the same six values as transmitted for PWCDp:

< class>,<cannel number>,<absolute level>,<relative level>,<timing offset> or <l/Q-mapping>,
<pilot length> , <channel status>...

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>,<timing offset>,
<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 CPICH.
Carr freq error : Hz
Chip Rate Error ppm.
Timing offset chips
Trg to Frame μs.

POWER VS SLOT (TRACE2)

16 pairs of slot (slotnumber of CPICH) and level values (for 16 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 512	5 values
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 level values are always transferred.

PEAK CODE DOMAIN ERR: <slot number>, <level value in dB>,.....

COMPOSITE EVM: <slot number>, <level value in %>,

SYMBOL CONST DIAG(TRACE2)

The real and the imaginary part are transferred as a pair:

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

The number of level values depends on the spreading factor:

Spreading factor 512	5 values
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". The number of bits of a 16QAM modulated channel is twice the number of bits of a QPSK modulated channel.

Example for a bitstream trace: 0,1,0,9,0,1,

BITSTREAM (ABITstream)

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.

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:[SENSe:]CDPower:PREference	TOTAL CPICH	79
:[SENSe:]CDPower:STYPe	CPICH SCHannel	79
:[SENSe:]CDPower:ANTenna	OFF 1 2	79
:TRACe[:DATA]	TRACE1 TRACE2 ABITstream PWCDp CTABLE CWCDp	80

Table of Softkeys with Assignment of IEC/IEEE Commands

CONFIGURATION Key Group

MODE	
3GPP BTS ANALYZER	:INSTrument:SElect BWCDpower
POWER	:CONFigure<1>:WCDPower:MEASurement PWeR Query of results: :CALCulate<1>:MARKer<1>:FUNctIon:POWeR:RESult? CPWeR
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 und MANUAL.	
OCCUPIED BANDWIDTH	:CONFigure<1>:WCDPower:MEASurement OBANdwidth Query of results: :CALCulate<1>:MARKer<1>:FUNctIon:POWeR:RESult? OBANdwidth
SPECTRUM	:CONFigure<1>:WCDPower:MEASurement FDOMain Query of results: -- (visual evaluation)
TIME DOMAIN	:CONFigure<1>:WCDPower:MEASurement TDOMain Query of results: :CALCulate<1>:MARKer<1>:FUNctIon:CREST? :CALCulate<1>:MARKer<1>:FUNctIon:SUMMery:RMS:RESult? :CALCulate<1>:MARKer<1>:FUNctIon:SUMMery[:STATe] ON
CCDF	:CONFigure:WCDPower:MEASurement CCDF or :CALCulate:STATistics[:BTS]:CCDF[:STATe] ON Query of results: CALCulate:MARKer:X?

PERCENT MARKER	:CALCulate:MARKer:Y:PERCent 1 to 100%
NO OF SAMPLES	CALCulate:STATistics:NSAMamples 1 to 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 to 1
Y MIN	:CALCulate:STATistics:SCALE:Y:LOWer 1E-6 to 0.1
CODE DOM POWER	:INSTrument<1>[:SElect] WCDPower
	Query of results:
	:TRACe:DATA? TRACE1 TRACE2 ABITstream PWCDp 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 MARKER submenu)
CONTINUOUS SWEEP	:INITiate<1>:CONTInuous ON; INITiate<1>[:IMMediate]
SINGLE SWEEP	:INITiate<1>:CONTInuous OFF; INITiate<1>[:IMMediate]
RESULT DISPLAY	--
CODE PWR RELATIVE	:CALCulate<1>:FEED `XPOW:CDP:RAT`
CODE PWR ABSOLUTE	:CALCulate<1>:FEED `XPOW:CDP`
CODE PWR ZOOM	--
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"
	Result query:
	:CALCulate:MARKer:FUNctIon:WCDPower[:BTS]:RESult? PTOTal FERRor TFRame TOFFset MACCuracy PCDerror EVMRms EVMPeak CERRor CSLot SRATe CHANnel CDPabsolute CDPRelative IQOFFset IQIMbalance
SELECT PCDE SF	:[SENSe:]CDPower:SFACtor 4 8 16 32 64 128 256 512
SELECT CODE NO.	:[SENSe:]CDPower:CODE 0 to 511
SELECT CPICH SLOT	:[SENSe:]CDPower:SLOT 0 to 14

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"
CODE CHAN CONFIG	--
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	(automatically executed in remote control)
SORT TABLE	--
NEW CHAN CONF TABLE	See 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"
RESTORE TEST MOD.	:CONFigure:WCDPower[:BTS]:CTABLE:REStore
MARKER	--
MARKER	:CALCulate<1 2>:MARKEr<1>[:STATE] ON OFF; :CALCulate<1 2>:MARKEr<1>:X <numeric_value>; :CALCulate<1 2>:MARKEr<1>:Y?
MARKER -> CPICH	:CALCulate<1 2>:MARKEr<1>:FUNctioN:CPICH; :CALCulate<1 2>:MARKEr<1>:Y?
MARKER -> PCCPCH	:CALCulate<1 2>:MARKEr<1>:FUNctioN:PCCPCH; :CALCulate<1 2>:MARKEr<1>:Y?

MEAS SETTINGS	--
SCRAMBLING CODE	:[SENSE:]CDPower:LCODE[:VALue) #H0 to #H1fff <hex>
INACT CHAN TRESH	:[SENSE:]CDPower:ICTReshold -50 dB to +10 dB
TRIGGER INT EXT	:TRIGger[:SEquence]:SOURce IMMEDIATE EXTERNAL
EXT TRG OFFSET	:TRIGger<1>[:SEquence]:HOLDoff <num_value>
POWER REF TOT CPICH	:[SENSE:]CDPower:PREference TOTAL CPICH
POWER CTRL SLOT PILOT	:[SENSE:]CDPower:PCONTrol SLOT PILOT
INVERT Q	:[SENSE:]CDPower:QINvert ON OFF
SIDE BAND NORM INV	:[SENSE:]CDPower:SBAND NORMAL INVERSE
NORMALIZE ON OFF	:[SENSE:]CDPower:NORMALize ON OFF
CENTER FREQUENCY	:[SENSE:]FREquency:CENTer <num_value>
SYNC TYPE CPICH SCH	:[SENSE:]CDPower:STYPe CPICHh SCHannel
ANT DIV ON OFF	:[SENSE:]CDPower:ANTenna OFF 1 2
ANT NO. 1 2	:[SENSE:]CDPower:ANTenna OFF 1 2
REF LEVEL	--
REF LEVEL	:DISPlay[:WINDow<1 2>]:TRACe<1 2>:Y[:SCALE]:RLEVEL <num_value>
REF LEVEL OFFSET	:DISPlay[:WINDow<1 2>]:TRACe<1 2>:Y[:SCALE]:RLEVEL:OFFSet <num_value>
RF ATTEN MANUAL	:INPut<1 2>:ATTenuation <num_value>
ATTEN AUTO NORMAL	:INPut<1 2>:ATTenuation:AUTO:MODE NORMAL; :INPut<1 2>:ATTenuation:AUTO ON
ATTEN AUTO LOW NOISE	:INPut<1 2>:ATTenuation:AUTO:MODE LNOise; :INPut<1 2>:ATTenuation:AUTO ON
ATTEN AUTO LOW DIST	:INPut<1 2>:ATTenuation:AUTO:MODE LDISTortion; :INPut<1 2>:ATTenuation:AUTO ON
MIXER LEVEL	:INPut<1 2>:MIXer <num_value>
LEVEL AUTO ADJUST	:[SENSE:]CDPower:LEVel:ADJust
CDP AUTO ADJUST	:[SENSE:]CDPower:PRESet

STATus:QUESTionable:SYNC Register

This register comprises information about error status of the CDP measurements of application R&S® FSIQK72/K74.

It can be queried with commands `STATus:QUESTionable:SYNC:CONDition?` and `"STATus:QUESTionable:SYNC[:EVENT]?"`.

Table 1 Meaning of bits in STATus:QUESTionable:SYNC register

Bit No.	Meaning
0 to 5/7	not used in R&S® FSIQK72/K74
6	K72/K74 Check Pilot Symbols This bit is set if invalid sequences were found during the check of the pilot symbols of the data channels.
8	K72/K74 Evaluation Error This bit is set if an error that the subsequent bits do not describe in greater detail has occurred during the data evaluation for the code domain power analysis.
9	K72/K74 Bad long code number This bit is set if an invalid scrambling code was entered.
10	K72/K74 Frame sync failed This bit is set if the synchronization to a frame was not possible.
11	K72/K74 Slot format not supported This bit is set if the channel table contains an invalid slot format.
12	K72/K74 Channel type not supported This bit is set if the channel table contains an invalid channel type. Supported channel types are DPCH and PICH.
13	K72/K74 No active channel This bit is set if no active channel was found.
14	K72/K74 No waveQual symbols on This bit is set if the EVM measurement is aborted because ON symbols are not available
15	This bit is always 0.

8 Performance Test

- Switch off R&S® FSIQ 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 R&S® FSIQ 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 R&S® FSIQ 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 SMIQ:

```

[PRESET]
[LEVEL :            0 dBm]
[FREQ:             2.1175 GHz]
DIGITAL STD
WCDMA 3GPP
TEST MODELS ...
TEST1_32
SELECT BS/MS
BS 1 ON
PICH STATE: OFF
STATE: ON
  
```

Trigger output: *RADIO FRAME*

Check set channels against the following table:

CHNO	TYPE	SYM.R	CH.CD	POW	DATA	TOFFS	PILOT	TPC	MC	STATE
0	P-CPICH	15	0	-10.0					OFF	ON
2	P-SCH	15		-13.0					OFF	ON
3	S-SCH	15		-13.0					OFF	ON
4	P-CCPCH	15	1	-10.0	PN9					ON
11	DPCH	30	2	-13.0	PN9	86	8	PATTOFF		ON
12	DPCH	30	11	-13.0	PN9	134	8	PATTOFF		ON
13	DPCH	30	17	-14.0	PN9	52	8	PATTOFF		ON
14	DPCH	30	23	-15.0	PN9	45	8	PATTOFF		ON
15	DPCH	30	31	-17.0	PN9	143	8	PATTOFF		ON
16	DPCH	30	38	-14.0	PN9	112	8	PATTOFF		ON
17	DPCH	30	47	-16.0	PN9	59	8	PATTOFF		ON
18	DPCH	30	55	-18.0	PN9	23	8	PATTOFF		ON
19	DPCH	30	62	-16.0	PN9	1	8	PATTOFF		ON
20	DPCH	30	69	-19.0	PN9	88	8	PATTOFF		ON
21	DPCH	30	78	-17.0	PN9	30	8	PATTOFF		ON
22	DPCH	30	85	-15.0	PN9	18	8	PATTOFF		ON
23	DPCH	30	94	-17.0	PN9	30	8	PATTOFF		ON
24	DPCH	30	102	-22.0	PN9	61	8	PATTOFF		ON
25	DPCH	30	113	-20.0	PN9	128	8	PATTOFF		ON
26	DPCH	30	119	-24.0	PN9	143	8	PATTOFF		ON
27	DPCH	30	7	-20.0	PN9	83	8	PATTOFF		ON
28	DPCH	30	13	-18.0	PN9	25	8	PATTOFF		ON
29	DPCH	30	20	-14.0	PN9	103	8	PATTOFF		ON
30	DPCH	30	27	-14.0	PN9	97	8	PATTOFF		ON
31	DPCH	30	35	-15.0	PN9	56	8	PATTOFF		ON
32	DPCH	30	41	-19.0	PN9	104	8	PATTOFF		ON
33	DPCH	30	51	-18.0	PN9	51	8	PATTOFF		ON
34	DPCH	30	58	-17.0	PN9	26	8	PATTOFF		ON
35	DPCH	30	64	-22.0	PN9	137	8	PATTOFF		ON
36	DPCH	30	74	-19.0	PN9	65	8	PATTOFF		ON
37	DPCH	30	82	-19.0	PN9	37	8	PATTOFF		ON
38	DPCH	30	88	-16.0	PN9	125	8	PATTOFF		ON
39	DPCH	30	97	-18.0	PN9	149	8	PATTOFF		ON
40	DPCH	30	108	-15.0	PN9	123	8	PATTOFF		ON
41	DPCH	30	117	-17.0	PN9	83	8	PATTOFF		ON
42	DPCH	30	125	-12.0	PN9	5	8	PATTOFF		ON

all other channels STATE OFF

Default settings on
R&S® FSIQ:

[PRESET]
[CENTER: 2.1175 GHz]
[REF: 10 dBm]
[MODE: 3GPP BTS ANALYZER: CODE DOM POWER
 MEAS SETTINGS SCRAMBLING CODE 0
 MEAS SETTINGS TRIGGER EXT
 RESULT DISPLAY CHANNEL TABLE

Test setup and other settings

- Connect external trigger input of R&S® FSIQ to SMIQ

[TRIGGER: TRIGGER OFFSET: 0μs]

- Connect external reference output of R&S® FSIQ to SMIQ

SMIQ UTILITIES

REF OSC

SOURCE: EXT

FSIQ [SETUP:

REFERENCE INT]

The display of the R&S® FSIQ should show the following:



Ref Lvl 10 dBm CF 2.1175 GHz SR 15 ksps
 Channel Table Chan Code 0
 CPICH Slot 0 Chan Slot 0

CHANNEL TABLE										
Type	Symb R.	Code#	Status	TFCI	PilotL	PWR ABS	PWR REL	T	Offs	
CPICH	15 ksps	0	Active	---	--	-11.59	0.00	---	---	
PSCH	15 ksps	---	Active	---	--	---	---	---	---	
SSCH	15 ksps	---	Active	---	--	---	---	---	---	
PCCPCH	15 ksps	1	Active	---	--	-11.59	0.01	---	---	
DPCH	30 ksps	2	Active	OFF	8	-14.61	-3.02	22016		
DPCH	30 ksps	7	Active	OFF	8	-21.54	-9.94	21248		
DPCH	30 ksps	11	Active	OFF	8	-14.59	-3.00	34304		
DPCH	30 ksps	13	Active	OFF	8	-19.61	-8.01	6400		
DPCH	30 ksps	17	Active	OFF	8	-15.57	-3.97	13312		
DPCH	30 ksps	20	Active	OFF	8	-15.60	-4.01	26368		
DPCH	30 ksps	23	Active	OFF	8	-16.59	-4.99	11520		

A

SGL

Ref Lvl 10 dBm CF 2.1175 GHz SR 15 ksps
 Result Summary Chan Code 0
 CPICH Slot 0 Chan Slot 0

RESULT SUMMARY			
GLOBAL RESULTS			
Total PWR	-1.72 dBm	Carr Freq Err	69.00 mHz
Chip Rate Err	-0.04 ppm	Trg to Frame	70 ns
IQ Offset	0.00 %	IQ Imbalance	0.58 %
Modulation Acc	2.62 % rms	Pk Code Dom Err	-54.12 dB rms
CPICH Slot Number	0		(7.5 ksps)
CHANNEL RESULTS			
Symb Rate	15 ksps	Timing Offset	0 Chips
Channel Code	0	Chan Slot Number	0
Chan Pow rel.	0.00 dB	Chan Pow abs.	-11.59 dBm
Error Vector Mag	0.58 % rms	Error Vector Mag	0.86 % Pk

B

SGL

Date: 3.JAN.2001 08:24:45

- Transfer the measurement results indicated in the channel table to the performance test protocol (read the parameters of all channels by scrolling).

Performance Test Report

Note: The values specified in the data sheet are guaranteed limits. To these limits, the tolerances of the instruments used in the performance test must be added because of their measurement uncertainty.

Table 8-2 Performance Test Report

Channel No	Type	Symbol rate	Channel No	Timing offset	Number of pilot-bits	Power (rel.) min value	Power actual value	power (rel.) max value
1	CPICH	15	0	--	--	-0.0		-0.0
2	PCCPCH	15	1	--	--	-0.1		+0.1
3	DPCH	30	2	22016	8	-3.1		-2.9
4	DPCH	30	7	21248	8	-10.1		-9.9
5	DPCH	30	11	34304	8	-3.1		-2.9
6	DPCH	30	13	6400	8	-8.1		-7.9
7	DPCH	30	17	13312	8	-4.1		-3.9
8	DPCH	30	20	26368	8	-4.1		-3.9
9	DPCH	30	23	11520	8	-5.1		-4.9
10	DPCH	30	27	24832	8	-4.1		-3.9
11	DPCH	30	31	36608	8	-7.1		-6.9
12	DPCH	30	35	14336	8	-5.1		-4.9
13	DPCH	30	38	28672	8	-4.1		-3.9
14	DPCH	30	41	26624	8	-9.1		-8.9
15	DPCH	30	47	15104	8	-6.1		-5.9
16	DPCH	30	51	13056	8	-8.1		-7.9
17	DPCH	30	55	5888	8	-8.1		-7.9

Channel No	Type	Symbol rate	Channel No	Timing offset	Number of pilot-bits	Power (rel.) min value	Power actual value	power (rel.) max value
18	DPCH	30	58	6656	8	-7.1		-6.9
19	DPCH	30	62	256	8	-6.1		-5.9
20	DPCH	30	64	35072	8	-12.1		-11.9
21	DPCH	30	69	22528	8	-9.1		-8.9
22	DPCH	30	74	16640	8	-9.1		-8.9
23	DPCH	30	78	7680	8	-7.1		-6.9
24	DPCH	30	82	9472	8	-9.1		-8.9
25	DPCH	30	85	4608	8	-5.1		-4.9
26	DPCH	30	88	32000	8	-6.1		-5.9
27	DPCH	30	94	7680	8	-7.1		-6.9
28	DPCH	30	97	38144	8	-8.1		-7.9
29	DPCH	30	102	15616	8	-12.1		-11.9
30	DPCH	30	108	31488	8	-5.1		-4.9
31	DPCH	30	113	32768	8	-10.1		-9.9
32	DPCH	30	117	21248	8	-7.1		-7.9
33	DPCH	30	119	36608	8	-14.1		-13.9
34	DPCH	30	125	1280	8	-2.1		-1.9

9 Glossary

CPICH	<p>Common pilot channel (spreading code number 0 with spreading factor 128)</p> <p>The channel constantly contains the symbol (1,1) throughout the total length of the WCDMA frame. For the measurements, the CPICH (Primary CPICH) is used for synchronization. For this reason, the CPICH must be contained in the signal to be measured.</p>
Crest factor	Ratio of peak to average value of the signal.
DPCH	Dedicated physical channel, data channel. The data channels which can be sent at different transmission rates are automatically recognized during the measurement.
Inactive Channel Threshold	Minimum power that a single channel must have as compared to the total signal to be recognized as an active channel
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.
PCCPCH	<p>Primary common control physical channel (spreading code number 1 with spreading factor 128)</p> <p>The channel is used for synchronizing the measurements. For this reason, it must be contained in the signal to be measured.</p>
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.
PICH	<p>Paging indication channel</p> <p>This special channel is defined in the test models to 3GPP for measurements on base station signals. Since it does not contain any pilot symbols, it cannot automatically be recognized during the measurement. Therefore this channel must be deactivated for CDP measurements.</p>
SCH	<p>Synchronization channel, divided into P-SCH (Primary Synchronization Channel) and S-SCH (Secondary Synchronization Channel).</p> <p>The two channels are required for synchronizing the measurement. Therefore they must always be contained in the signal to be measured.</p>
Timing offset	Offset between the start of the first slot of a channel and the start of the analyzed WCDMA frame (in multiples of 256 chips).

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