R&S®FS-K84
1xEV–DO Base Station Test
Software Manual

1157.2868.42 – 06

Test and Measurement

Software Manual

ROHDE&SCHWARZ

This Software Manual describes the Applikations Firmware R&S® FS-K84 for the following models:

- R&S®FMU
- R&S®FSG
- R&S®FSMR
- R&S®FSP
- R&S®FSQ
- R&S®FSU
- R&S®FSUP

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1xEV-DO Base Station Test Application Firmware R&S FS-K84

When configured with Application Firmware R&S FS-K84, the analyzer performs code domain power measurements on forward link signals (base station) on the basis of the 3GPP2 Standard (Third Generation Partnership Project 2) 3GPP2 Standard (Third Generation Partnership Project 2) High Rate Packet Data. This Standard, which was defined for packet-oriented data communications, is generally referred to as 1xEV-DO (First EVolution Data Only). This name is also used in Application Firmware R&S FS-K84.

In this Standard, the expressions "access network" (AN) and "access terminal" (AT) are used for the base station and the mobile terminal, respectively. To retain the similarity with the CDMA2000 BTS application firmware, the expression "base station" is also used in connection with the 1xEV-DO FS-K84 application firmware.

The 1xEV-DO BTS application firmware is based on the **"CDMA2000 High Rate Packet Data Air Interface Specification"** of version C.S0024 v.3.0 dated December 2001 and the **"Recommended Minimum Performance Standards for CDMA2000 High Rate Packet Data Access Network"** of version C.S0032-0 v.1.0 dated December 2001.

These standard documents are published as TIA 856 (IS-856) and TIA 864 (IS-864), respectively. The application firmware supports code domain measurements on 1xEV-DO signals. This code domain power analyzer provides the following analyses, among others: Code Domain Power, Channel Occupancy Table, EVM, Frequency Error and RHO Factor. All four channel types (PILOT, MAC, PREAMBLE and DATA) are supported and the modulation types in the DATA channel type are detected automatically. The signals needing to be measured may contain different modulation types or preamble lengths in each slot, thus making it possible to perform measurements on base stations while operation is in progress.

In addition to the code domain measurements described in the 1xEV-DO Standard, the application features measurements in the spectral range such as channel power, adjacent channel power, occupied bandwidth and spectrum emission mask with predefined settings.

The 1xEV-DO Standard has been developed from the CDMA2000 Standard, which in its turn was an extension of cdmaOne (IS 95). All these standards are based on the same RF parameters, this being the reason why the RF measurements of CDMA2000 and 1xEV-DO are identical. In the code domain, however, CDMA2000 and 1xEV-DO are not compatible, since the chips for 1xEV-DO are assigned chronologically one after the other to the different channel types, and in the DATA channel type 8-PSK and 16-QAM modulation methods are used in addition to QPSK. With CDMA2000, there are only BPSK and QPSK modulation methods. Furthermore, a slot is always assigned to precisely one node with 1xEV-DO, whereas with CDMA2000 several nodes communicate with the base station simultaneously. For further details refer to the chapter entitled "Code-Domain", starting on page 66.

1 Installing and Enabling the Application Firmware

1.1 Installation

If Application Firmware R&S FS-K84 has not been installed on the device, a firmware update will have to be performed. This will have been done already if the application software was installed at the factory.

Before the application firmware can be installed, a corresponding basic firmware of the basic device has to be installed on the analyzer. Refer to the release notes of the current Application Firmware R&S FS-K84 for the latest versions.

If the basic firmware has to be updated, start the firmware update from the current floppy disks of the basic firmware by successively pressing *SETUP → NEXT → FIRMWARE UPDATE*.

If the correct basic firmware is installed, the firmware update for the firmware application is started from the floppy disks of the Firmware Application R&S FS-K84 using the same key sequence - *SETUP → NEXT → FIRMWARE UPDATE*.

Following installation, the application firmware has to be enabled as described below.

1.2 Enabling

Application Firmware R&S FS-K84 is enabled on the *SETUP → GENERAL SETUP* menu by entering a keyword. The keyword is supplied with the application firmware. When the application software is installed before the device leaves the factory, the application firmware will already have been enabled.

GENERAL SETUP **menu:**

OPTIONS

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

INSTALL OPTION

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

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

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

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

2 Getting Started

The following chapter explains basic 1xEV-DO base station tests using a test setup with the Signal Generator R&S SMIQ as the device under test. It describes how operating and measuring errors can be avoided by means of correct default settings.

The measurement screen is presented in Chapter 6 for the different measurements.

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

Measurement 1:　　　　Measuring the signal spectrum

Measurement 2:　　　　Measuring the spectrum emission mask

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

　Setting:　　　Center frequency

Measurement 4:　　　　Triggered measurement of relative code domain power

　Setting:　　　Trigger offset

　Setting:　　　PN offset of base station

Measurement 5:　　　　Measurement of composite EVM

Measurement 6:　　　　Measurement of peak code domain error

Measurement 7:　　　　Measurement of RHO factor

The 1xEV-DO raw data are created with the R&S WinIQSIM software and loaded into the arbitrary waveform generator of the R&S SMIQ.

The measurements are performed with the following instruments and aids:

● Spectrum Analyzers R&S FSU, R&S FSP or Signal Analyzer R&S FSQ with Application Firmware R&S FS-K84 (base station test for 1xEV-DO).
● Vector Signal Generator SMIQ with hardware options data generator B11 / modulation coder B20 and arbitrary waveform generator B60 together with firmware version 5.70 or higher with enabled option K17 1xEV-DO and SMIQ-Z5 PARDATA BNC ADAPTER for external trigger signal.
● PC that is either connected by means of a serial cable to the SMIQ, or has an IEC/IEEE bus card and connected by means of an IEC/IEEE bus cable to the SMIQ. R&S WinIQSIM Software 3.91 or higher is installed on that PC. The software can be downloaded from the Rohde & Schwarz web site on the Internet at http://www.rohde-schwarz.com.
● 1 coaxial cable, 50 Ω, approximately 1 m, N connector
● 2 coaxial cables, 50 Ω, approximately 1 m, BNC connector

2.1 Generating a 1xEV-DO forward link signal with WinIQSIM

The WinIQSIM software can be downloaded at http://www.rohde-schwarz.com and is installed on a PC. The WinIQSIM software can be used to generate 1xEV-DO forward link signals, which are the transferred on an SMIQ or AMIQ. An explanation is given below of how the test signal described in the 1xEV-DO Standard is generated. WinIQSIM version 3.91 or higher is assumed.

1. Selecting Start and Standard::

   a. Start **WinIQSIM.exe**.
   b. On the **File** menu, select the **New** option and select **1xEV-DO** from the list that follows. The 1xEV-DO dialog box appears.
   c. Select **BS1** in the dialog box to configure base station 1 and the following dialog box is opened:
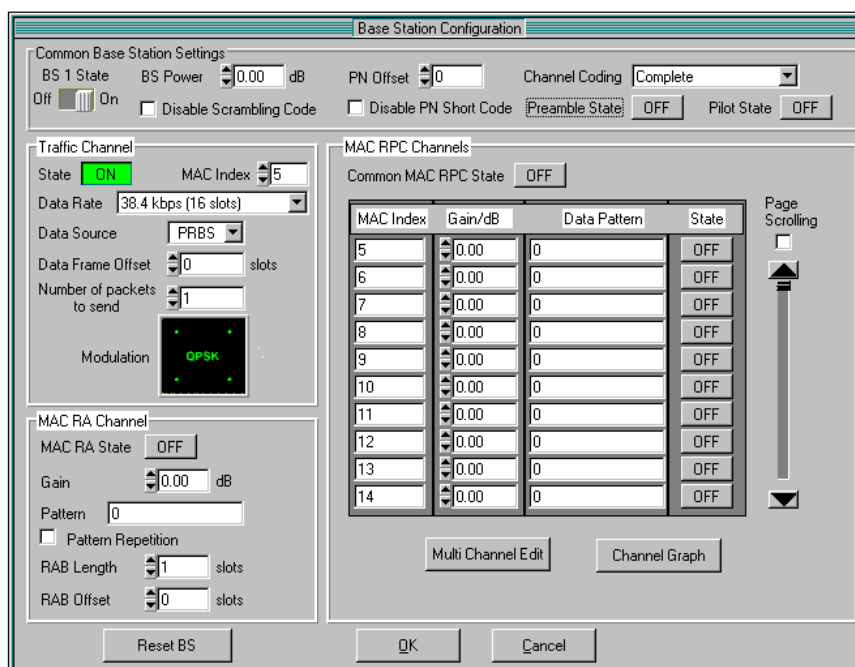
Fig. 1 WinIQSIM base station configuration prior to settings

2. Activate channel types:

   In this **base station configuration**, the following settings are performed so that a full-slot signal of the maximum data rate is generated at 14 assigned MAC indices. This model is specified as a test standard for some tests in the 1xEV-DO Standard.

   a. Set **Preamble State** to **ON** so that a preamble is contained in the signal and set **Pilot State** to **ON** so that the pilot is sent.
   b. At **Traffic Channel**, select **Data Rate '2457.6 kbps (1 slot)'; this is a** 16-QAM modulated data signal for a preamble length of 64 chips.
   c. At **MAC RA Channel**, the **MAC RA State** must be set to **ON** and the **RAB Length** set to **16 Slots**.

d. In the **MAC RPC Channels** section, set the **Common MAC RPC State** to **ON**.
    Use the **Multi Channel Edit** key to open the following dialog box, which allows
    a rapid MAC Index entry:
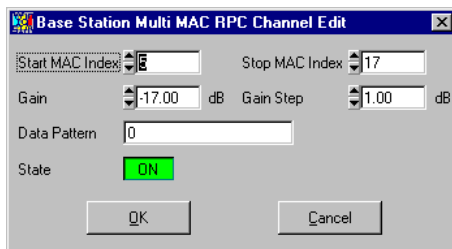
Fig. 2 WinIQSIM - Multi MAC RPC Channel Edit

e. To activate 13 more MAC codes for the test model, enter a **5** at **Start MAC
    Index**, and **17** at **Stop MAC Index**, and then set the **State** to **ON**. So that the
    RPC channels differ in terms of power, enter -17 dB at Gain and 1 dB at Gain
    Step. After you click **OK**, the **base station configuration** will look as follows:
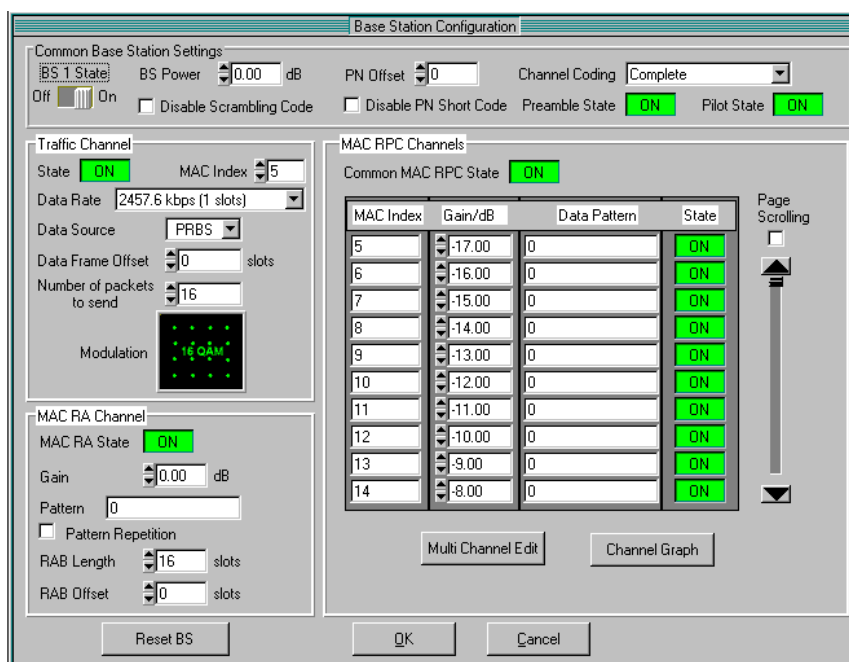
Fig. 3 WinIQSIM base station configuration of the finished model

3. Define trigger settings:

a. Then, set the trigger settings on the **SMIQ** menu by choosing the option
    Trigger Output Settings. For the **Current Mode**: **Mode 1** the **Restart Clock
    (SEQUENCE)** is defined. This means that the trigger at the slot limit is
    available every 80 ms at TRIG1 of the SMIQ Z5 BNC adapters.
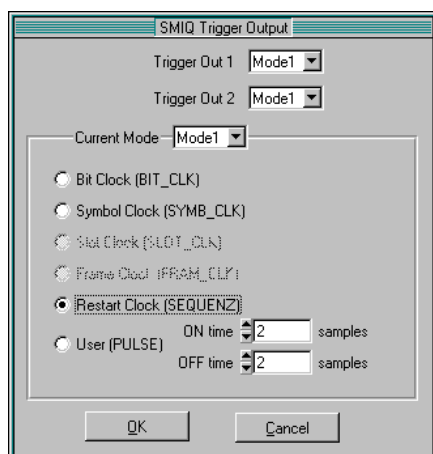
Fig. 4 WinIQSIM base station configuration of the finished model

4. Save and download to R&S SMIQ:

    a. Save this 1xEV-DO configuration by choosing **File|Save** as file
        'DO_FFULL.IQS' (1xEV-<u>DO</u> <u>F</u>orward Link <u>FULL</u> Slot).
    b. Connect the R&S SMIQ either serially or by means of an IEC/IEEE bus card
        and IEC/IEEE bus cable to the R&S SMIQ and, on the **SMIQ|TRANSMISSION**
        menu, load the generated signal under the name 'DO_FFULL' onto the SMIQ.

2.2   Default settings in 1xEV-DO BTS operating mode

At the default setting after PRESET, the analyzer is in SPECTRUM mode. The
following basic settings of the code domain measurement are not activated until the
1xEV-DO BTS operating mode is selected by operating hotkey *1xEVDO BS*.

Table 1 Default setting of code domain measurement after preset

Parameter	Setting
Digital standard	CDMA 2000 MC1 (where MC1 stands for Multi Carrier 1 and thus describes CDMA2000 1X, that is a carrier and consequently also applicable to 1xEV-DO, since the RF parameters such as occupied bandwidth and channel spacings are compatible with CDMA2000)
Band class	Band Class 0 (800 MHz band)
Sweep	CONTINUOUS
CDP modus	CODE CHAN AUTOSEARCH
CDP average	OFF (the CDP measurement is performed slot by slot and is not averaged for all slots)
Trigger setting	FREE RUN
Trigger offset	0 s
PN offset	0 Chips
Threshold value	-40 dB
Channel type	PILOT

Mapping	AUTO (consequently, for channel type PILOT the I or Q branch is evaluated, depending on SELECT I/Q)
SELECT I/Q	I (the I branch is evaluated)
Code number	0
Slot number	0
Capture Length	3 slots (where one slot contains 2048 chips and lasts 1.666 ms)
Evaluation	Screen A: CODE PWR RELATIVE Screen B: GENERAL RESULTS

● The following conventions apply for displaying settings on the analyzer:

[***<Key>***]   Press a key on the front panel such as ***[SPAN]***

[<SOFTKEY>]   Press a softkey such as *[MARKER -> PEAK]*

[<nn unit>]   Enter a value and terminate by entering the unit such as *[12 kHz]*

● The following conventions apply for displaying settings on the SMIQ:

[***<Key>***]   Press a key on the front panel such as ***[FREQ]***

<MENÜ>   Choose a menu, parameter or a setting such as *DIGITAL STD.* The menu level is identified by indenting.

<nn unit>   Enter a value and terminate by entering the unit such as *12 kHz*

2.3 Measurement 1: Measuring the signal power

Measurement of the spectrum provides an overview of the 1xEV-DO signal and the carrier-oriented spurious emissions.

Test setup

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

Setting on R&S SMIQ:

[PRESET]
[LEVEL: 0 dBm]
[FREQ: 833.49 MHz]
ARB MOD
        SET SMIQ ACCORDING TO WAVEFORM ...
                SET SMIQ ACCORDING TO WAVEFORM   ON
                    IQ SWAP (VECTOR MODE)   ON
                    TRIGGER OUT MODE   ON

(*These three settings are only required once after generator preset and are used to apply, in VECTOR MODE, the IQ SWAP and, in ARB MOD, the trigger setting automatically from the waveform file generated by WinIQSIM. This is particularly present when a switch is made between different waveforms.*)

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

Setting on analyzer:

[PRESET]
[FREQUENCY: *878.49 MHz]*
[AMPT: *0 dBm]*
[1xEVDO BS]
[MEAS: *POWER]*

Measurement on analyzer:

The following are displayed:

● The spectrum of the 1xEV-DO signal
● The channel power of the signal within the 1.2288 MHz channel bandwidth

2.4 Measurement 2: Measuring the spectrum emission mask

The 1xEV-DO specification calls for a measurement which monitors compliance with a spectral mask in a range of at least ±4.0 MHz around the 1xEV-DO carrier. To assess the power emissions within the specified range, signal power is measured with a 30 kHz filter. The ensuing trace is compared with the limit line defined in the 1xEV-DO specification depending on the selected band class.

Test setup

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

Setting on R&S SMIQ:

Settings as for measurement 1

Setting on analyzer:

[PRESET]   *Band class 0 is thus selected*
[FREQUENCY: *878.49 MHz]*
[AMPT: *0 dBm]*
[1xEVDO BS]
[MEAS: *SPECTRUM EM MASK]*

Measurement on analyzer:

The following are displayed:

- The spectrum of the 1xEV-DO signal
- The channel power
- The limit line defined in the standard
- Information on limit line violations (passed/failed)

2.5 Measurement 3: Measuring the relative code domain power and the frequency error

A measurement of the code domain power is shown in the following. In this case the basic parameters of the CDP measurements, which allow analysis of the signal, reset successively from values adjusted to the test signal to those that have not been adjusted in order to demonstrate the resulting effects.

Setting on R&S SMIQ

► Connect the RF output of the SMIQ to the RF Input of the analyzer.

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

Setting on R&S SMIQ

Settings as for measurement 1

Setting on analyzer

:*[PRESET]*
[FREQUENCY: *878.49 MHz]*
[AMPT: *10 dBm]*
[1xEVDO BS]

Measurement on analyzer

The following are displayed:

Screen A: Code domain power of signal

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

2.6   Setting: Synchronizing the reference frequencies

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

Test setup

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

Setting on R&S SMIQ:

Settings as for measurement 1

Setting on analyzer:

As for measurement 3, plus

[SETUP: *REFERENCE EXT]*

Measurement on analyzer:

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

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

2.7   Setting: Behavior with deviating center frequency setting

In the following setting, the behavior of the DUT and analyzer on a deviating center frequency setting is shown.

Setting on R&S SMIQ:

► Tune the center frequency of the signal generator in 1 kHz steps and watch the analyzer screen:

Measurement on analyzer:

- Up to about 8.0 kHz frequency error, a CDP measurement is still possible on the analyzer. A difference in the measurement accuracy of the CDP measurement is not discernible up to this frequency error.
- Above a frequency error of 8.0 kHz, the probability of an impaired synchronization increases. The 'SYNC FAILED' message appears.
- Above a frequency error of 10 kHz , a CDP measurement becomes impossible. The 'SYNC FAILED' message appears.

Setting on R&S SMIQ:

► Set the signal generator center frequency again to 878.49 MHz:

[FREQ: *878.49 MHz]*

> **The center frequency of the analyzer must agree with the frequency of the device under test to within a 8.0 kHz offset.**

2.8 Measurement 4: Triggered measurement of relative code domain power

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

Test setup

1. Connect the RF output of the SMIQ to the RF input of the analyzer

2. Connect the reference frequencies (refer to measurement 2)

3. Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Setting on R&S SMIQ:

Settings as for measurement 1

Setting on analyzer:

As for measurement 3, plus

[TRIG: EXTERN]

Measurement on analyzer:

The following are displayed:

Screen A: Code domain power of signal

Screen B: Numeric results of CDP measurement

Trg to Frame: Timing offset between trigger event and start of the slot

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

2.9 Setting: Trigger offset

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

Setting on analyzer:

As for measurement 3, plus

[TRIG:]
[TRIG OFFSET   100 μs]

Measurement on analyzer:

The parameter "Trg to Frame" in the numeric results table (screen B) changes:

Trg to Frame   -100 μs

A trigger offset compensates analog delays of the trigger event.

2.10 Setting: Behavior with wrong PN offset

A valid CDP measurement can only be performed with an external trigger if the PN offset set on the analyzer agrees with that of the transmit signal.

Setting on R&S SMIQ

Settings as for measurement 1

Setting on analyzer:

► Set PN offset to the new value:

[SETTINGS: PN-OFFSET 200]

Measurement on analyzer:

The 'SYNC FAILED' message appears.

Setting on analyzer:

► Set PN offset to the new value:

[SETTINGS: PN-OFFSET 0]

Measurement on analyzer:

The CDP display shows the test model again.

> **The setting of the PN offset on the analyzer must agree with the PN offset of the signal to be measured. The TRG TO FRAME value of the general results analysis is correct only if the PN offset agrees.**

2.11 Measurement 5: Measuring the composite EVM

Composite EVM is the measurement of the mean square error of the total signal of a channel type. An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other; the squared deviation produces the Composite EVM measurement.

Test setup

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

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

3. Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Setting on R&S SMIQ:

Settings as for measurement 1

Setting on analyzer:

[PRESET]
[FREQUENCY: *878.49 MHz***]**
[AMPT: *10 dBm***]**
[1xEVDO BS]

[*TRIG*   *EXTERN*]

[RESULTS   COMPOSITE EVM]

Measurement on analyzer:

The following are displayed:

Screen A: Code domain power of signal

Screen B: Composite EVM (EVM for total signal)

2.12 Measurement 6: Measuring the peak code domain error

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

Test setup

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

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

3. Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Setting on R&S SMIQ:

Settings as for measurement 1

Setting on analyzer:

[PRESET]
[FREQUENCY: *878.49 MHz]*
[AMPT: *0 dBm]*
[1xEVDO BS]
[TRIG   *EXTERN]*
[RESULTS   *PEAK CODE DOMAIN ERR]*

Measurement on analyzer:

The following are displayed:

Screen A: Code domain power of signal

Screen B: Peak code domain error

2.13 Measurement 7: Measurement of the RHO factors

A measurement of the RHO factors is shown in the following. The Standard specifies measurement of 3 RHO factors: RHO Pilot (only in the Pilot channel type), RHO $_{overall-1}$ (RHO over all slots with start of averaging at the half slot boundary) and RHO $_{overall-2}$ (RHO over all slots with start of averaging at the half slot boundary).

Setting on R&S SMIQ:

1. Connect the RF output of the SMIQ to the RF Input of the analyzer.

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

Setting on R&S SMIQ:

Settings as for measurement 1

Setting on analyzer:

[PRESET]
[FREQUENCY: *878.49 MHz]*
[AMPT: *10 dBm]*
[1xEVDO BS]

Measurement on analyzer:

The following are displayed:

Screen A: Code domain power of signal

Screen B: Numeric results of CDP measurement including the RHO factors

3 Test Setup for Base Station Tests

> **NOTICE**
>
> **Instrument damage caused by disregarding the following precautions!**
>
> Any non-compliance with the following precautions may cause damage to the instrument. Prior to putting the instrument into operation, check the following:
>
> - The covers of the housing are in place and screwed on.
>
> - Vents are not obstructed. Make sure that the air can escape freely through the vents at the sides. The minimum distance to the wall should therefore be at least 10 cm.
>
> - The signal levels at the inputs do not exceed permissible limits.
>
> - The outputs of the instrument are not overloaded or incorrectly connected. This particularly applies to the maximum permissible back-feed at the outputs, which is specified in the data sheet
>
> - The ambient temperature must not exceed the range specified in the data sheet.

This chapter describes the default settings of the analyzer for operation as a 1xEV-DO base station tester. A condition that has to be met before measurements can start is that the analyzer is correctly configured and supplied with power, as described in Chapter 1 of the operating manual for the basic device. Furthermore, Application Firmware R&S FS-K84 must be enabled. Installation and enabling of the application firmware are explained in Chapter 1 of this software manual.

3.1 Standard Test Setup
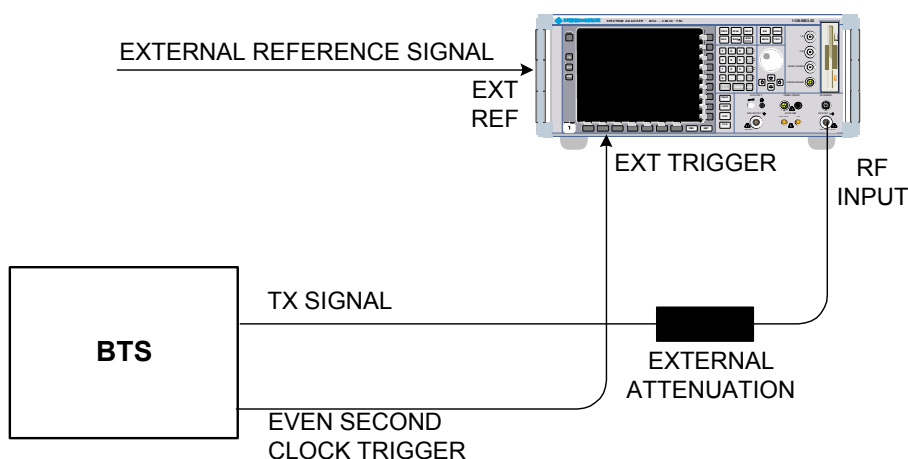
Fig. 5 BTS test setup

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

Maximum power	Recommended external attenuation
≥ 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 maintain the error limits called for in the 1xEV-DO specification during frequency measurement on base stations, the analyzer has to be operated on an external reference. The reference source might be a rubidium frequency standard, for example.
● If the base station has a trigger output, connect the trigger output of the base station to the rear trigger input of the analyzer (*EXT TRIG GATE*).

3.2 Default settings

1. Enter the external attenuation.   *[AMPT] [NEXT] [REF LVL OFFSET]*.

2. Enter the reference level.   *[AMPT]*

3. Enter the center frequency.   *[FREQUENCY]*

4. Set the trigger.   *[TRIG]*

5. During use, switch on external reference. *[SETUP] [REF: EXT]*

6. Select the standard and the desired measurement.
   [1xEVDO BS] [RESULTS]

7. Set the PN offset.   *[SETTINGS] [PN OFFSET]*

4 Predefined Channel Tables

By default, the application firmware works in automatic Channel Search mode (softkey *CODE CHAN AUTOSEARCH*). However, there is also the option of using predefined channel tables and taking the code domain analysis as a basis. To do this, select the channel table and enable the predefined search mode (softkey *CODE CHAN PREDEFINED*). As an example or basis for customer-specific channel tables, some tables have been defined already. They are listed below. With redefined channel tables, it is assumed that the signals needing to be investigated have the same configuration in each slot (known as 1 slot signals). Should channels other than those that appear in the predefined channel tables of the firmware application be used, the original tables should be copied and the channels adapted in the copy. (Refer to the hotkey *CHAN CONF* on page 90)

Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type QPSK in channel type DATA and the following listed active codes in channel types. (File name DOQPSK.)

Table 2   Base station channel table DOQPSK with QPSK modulation in DATA area

Channel type	Number of channels	Code channel (Walsh Code.SF)	Modulation/ mapping
PILOT	1	0.32	BPSK-I
MAC	5	2.64 (RA) 3.64 4.64 34.64 35.64	BPSK-I BPSK-I BPSK-I BPSK-Q BPSK-Q
PREAMBLE 64 chips long	1	3.32	BPSK-I
DATA	16	0.16 1.16 2.16 ... 13.16 14.16 15.16	QPSK QPSK QPSK ... QPSK QPSK QPSK

Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type 8-PSK in channel type DATA and the following listed active codes in channel types. (File name DO8PSK).

Table 3 Base station channel table DO8PSK with 8-PSK modulation in DATA area

Channel type	Number of channels	Code channel (Walsh Code.SF)	Modulation/ mapping
PILOT	1	0.32	BPSK-I
MAC	5	2.64 (RA) 3.64 4.64 34.64 35.64	BPSK-I BPSK-I BPSK-I BPSK-Q BPSK-Q
PREAMBLE 64 chips long	1	3.32	BPSK-I
DATA	16	0.16 1.16 2.16 ... 13.16 14.16 15.16	8-PSK 8-PSK 8-PSK ... 8-PSK 8-PSK 8-PSK

Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type 16-QAM in channel type DATA and the following listed active codes in channel types. (File name DO16QAM.)

Table 4 Base station channel table DO8PSK with 8–PSK modulation in DATA area

Channel type	Number of channels	Code channel (Walsh Code.SF)	Modulation/ mapping
PILOT	1	0.32	BPSK-I
MAC	5	2.64 (RA) 3.64 4.64 34.64 35.64	BPSK-I BPSK-I BPSK-I BPSK-Q BPSK-Q
PREAMBLE 64 chips long	1	3.32	BPSK-I
DATA	16	0.16 1.16 2.16 ... 13.16 14.16 15.16	16-QAM 16-QAM 16-QAM ... 16-QAM 16-QAM 16-QAM

Channel table with channel types PILOT/MAC - known as IDLE slot, since it does not contain any active channels in the DATA channel type. (File name DO_IDLE.)

Table 5 Base station test model DO_IDLE for idle slot configuration

Channel type	Number of channels	Code channel (Walsh Code.SF)	Modulation/ mapping
PILOT	1	0.32	BPSK-I
MAC	1	2.64 (RA)	BPSK-I

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

The channel abbreviations are defined in Chapter Glossary **.**

5 Menu Overview

Application Firmware R&S FS-K84 (1xEV–DO base station tests) adds RF measurements and code domain power measurements for the 1xEV–DO Forward Link mobile radio standard to the analyzer.

SPECTRUM	CDMA2k BS	1xEVDO BS				SCREEN B
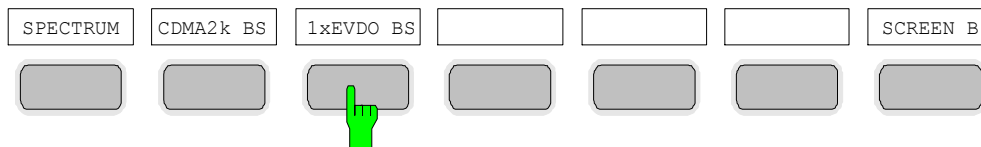
Fig. 6 Hotkey bar with enabled Application Firmware R&S FS–K82 and R&S FS-K84

After the application firmware has been called by operating hotkey *1xEVDO BS* a new hotkey bar is displayed at the bottom edge of the screen and the code domain analyzer is selected and started.

EXIT EVDO	MEAS		CHAN CONF	SETTINGS	RESULTS	SCREEN B

POWER	CODE CHAN AUTOSEARCH		BAND CLASS		CODE DOM POWER	CHANNEL TABLE	COMPOSITE CONST	
ACLR	CODE CHAN PREDEFINED		REVISION 0 A		CODE DOM ERROR	PEAK CODE DOMAIN ERR	SYMBOL CONST	
MULT CARR ACLR			PN OFFSET	MULTI CARRIER	COMPOSITE EVM	POWER VS CHIP	SYMBOL EVM	
SPECTRUM EM MASK	EDIT CHAN CONF TABLE		CAPTURE LENGTH		GENERAL RESULTS	POWER VS SYMBOL		
OCCUPIED BANDWITH	NEW CHAN CONF TABLE		INACT CHAN THRESHOLD		CHANNEL RESULTS	BITSTREAM		
CODE DOM ANALYZER	DEL CHAN CONF TABLE		CHAN TYPE MAC-I		CHAN TYPE MAC-I	CHAN TYPE MAC-I	CHAN TYPE MAC-I	
SIGNAL STATISTIC	COPY CHAN CONF TABLE		CODE PWR ABS REL	INVERT Q ON OFF	SELECT CODE	SELECT CODE	SELECT CODE	
POWER VS TIME			CDP AVG ON OFF	SIDE BAND NORM INV	SELECT	SELECT	SELECT	
	RESTORE STD TABLES		TIME/PHASE ON OFF	NORMALIZE ON OFF	ADJUST REF LVL	ADJUST REF LVL	ADJUST REF LVL	

HEADERS VALUES		MULTI CARRIER	PILOT	CAPTURE LENGTH
INSERT MAC		ENHANCED ALGORITHM	MAC	SET COUNT
INSERT PREAMBLE			PREAMBLE	SET TO ANALYZE
DELETE LINE		MC FILTER ON OFF	DATA	
MEAS CHAN CONF TABLE		FILT TYPE LOWPA RRC	CODE DOM OVERVIEW	
SAVE TABLE		ROLL OFF	MAPPING AUTO	CHAN TYPE MAC-I
SORT TABLE		CUT OFF FREQUENCY	MAPPING COMPLEX	SELECT CODE
PAGE UP			MAPPING I OR Q	SELECT SLOT
PAGE DOWN			SELECT I Q	

Fig. 7 Overview of the menus in Application Firmware R&S FS-K84

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

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

Selection of the *CHAN CONF* or *RESULTS* hotkey automatically results in switching to the code domain analyzer.

Pressing the **EXIT EVDO** hotkey once exits R&S FS-K84. The hotkey bar of the basic device is displayed again and the analyzer goes to SPECTRUM, the default mode.

Transition from the SPECTRUM operating mode to the application firmware:

The following user-specific settings are not modified so that the adaptation to the device under test is retained:
 	
        Reference Level + Rev Level Offset
 	
        Center Frequency + Frequency Offset
 	
        Input Attenuation + Mixer Level
 	
The following user-specific settings are transferred as follows:
 	
        External trigger sources are retained, while all other trigger sources result in Free Run mode.
        Additional trigger settings are retained.

Transition from the application firmware to the SPECTRUM operating mode:

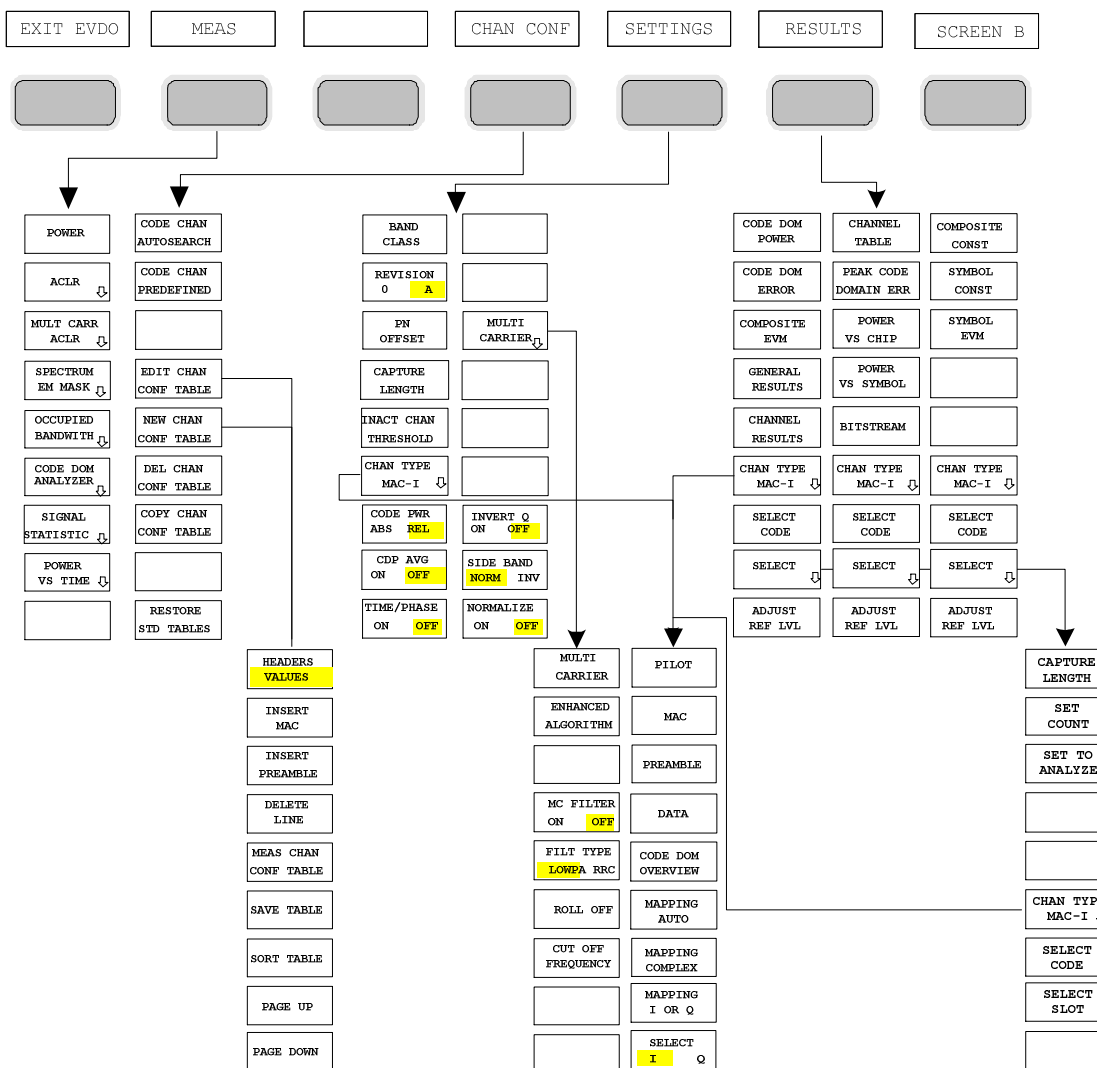| |
|---|
| The following user-specific settings are not modified so that the adaptation to the device under test is retained:
        Reference Level + Rev Level Offset
        Center Frequency + Frequency Offset
        Input Attenuation + Mixer Level
The following user-specific settings are transferred as follows:

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

The measurements available in R&S FS-K84 can be selected by means of the *MEAS* hotkey or the *MEAS* key:
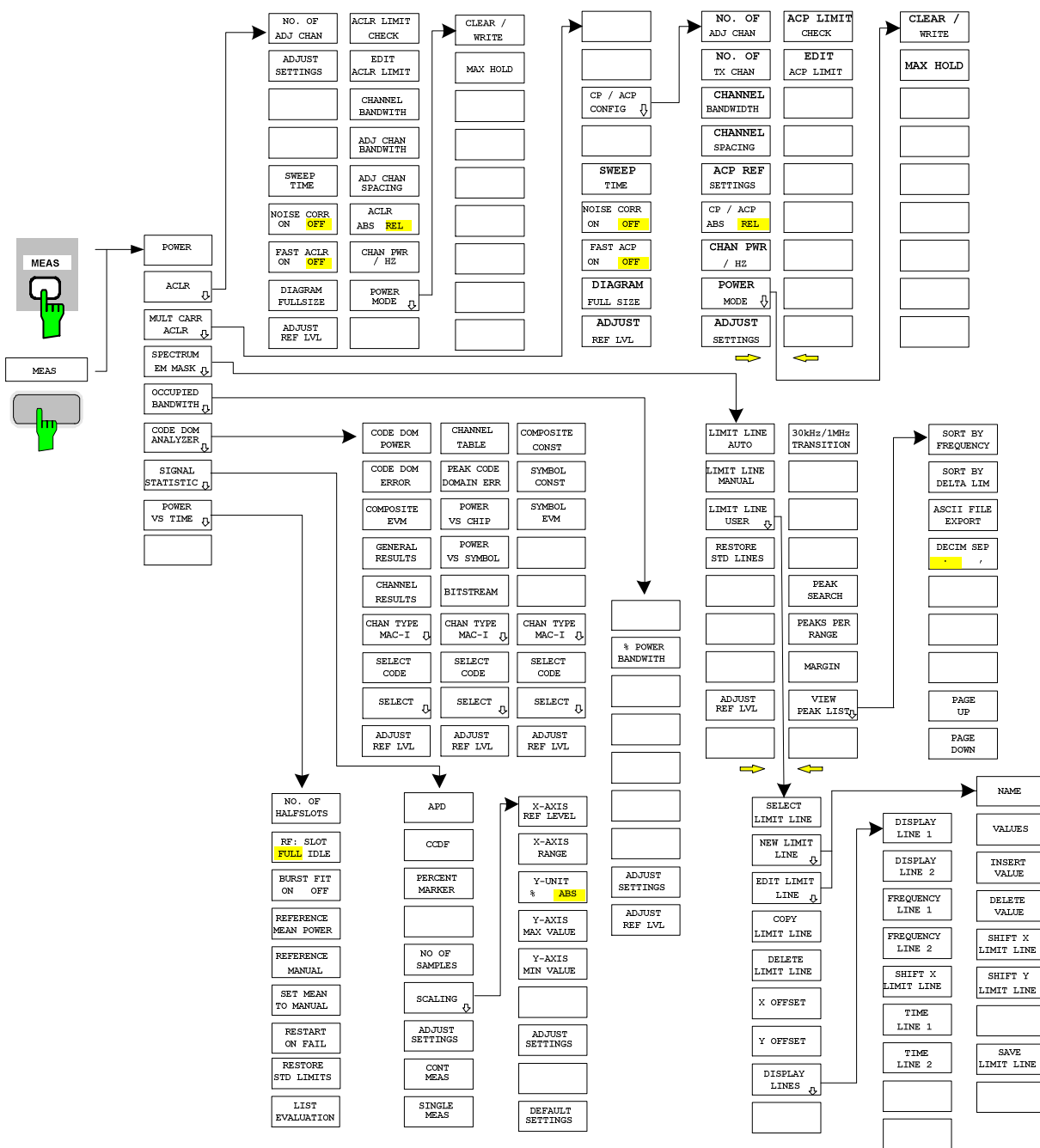
Fig. 8   Overview of menus

6 Configuration of 1xEV-DO Measurements

The most important measurements of the 1xEV-DO specification for base stations can be selected by means of the *MEAS* hotkey and *MEAS* key. They will be explained below on the basis of the softkey functions.

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

The *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH*, and *STATISTICS* softkeys activate base station measurements with predefined settings, which are performed in SPECTRUM mode of the basic device. The measurements are performed with the parameters contained in the 1xEV-DO specification. The settings can be modified later.

MEAS key or MEAS hotkeys

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

- POWER enables the channel power measurement with defined default values in SPECTRUM mode.
- ACLR enables the adjacent channel power measurement with defined default values in SPECTRUM mode.
- MULTI CARRIER ACLR enables the multi carrier adjacent channel power measurement with defined default values in SPECTRUM mode.
- SPECTRUM EM MASK compares the signal power in different offset ranges of the carrier with the maximum values laid down in the 1xEV-DO specification.
- OCCUPIED BANDWIDTH enables measurement of the bandwidth assigned to the signal.
- CODE DOM ANALYZER enables the code domain analyzer and opens another menu for choosing the analysis type. All other menus of the analyzer are adapted to the functions of the code domain analyzer mode. The code domain analyzer is described in a separate chapter starting on page 66.
- STATISTICS analyzes the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).
- POWER VS TIME activates the measurement of power versus time for FULL or IDLE slot signals.

6.2 Measuring channel power

POWER

The *POWER* softkey enables measurement of the channel power of the 1xEV-DO signal.

The analyzer measures the RF signal power in the 1.2288 MHz bandwidth. The power is calculated by summation of the values at the trace points. The bandwidth and the associated channel power are displayed beneath the measurement screen.
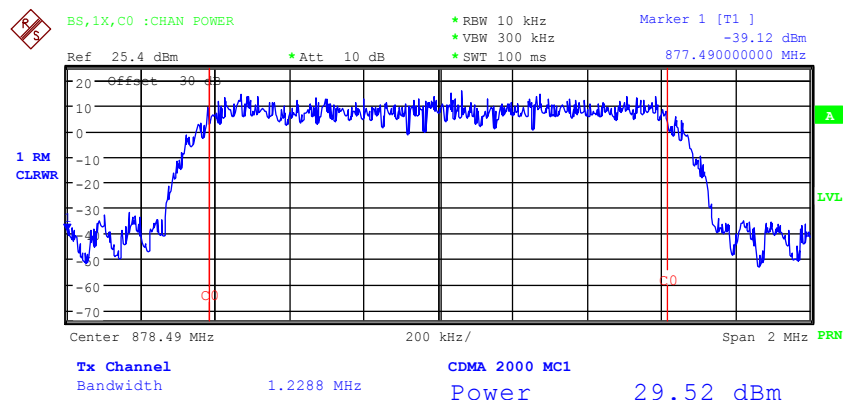
Fig. 9   Power measurement in the 1.2288 MHz transmission channel

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting	
Level parameters Center Frequency + Frequency Offset Trigger settings	
ADJACENT CHAN POWER	ON
ACP STANDARD	CDMA2000 MC1 (MC1 simply stands for multi carrier, i.e. a carrier)
NO OF ADJ CHANNELS	0 (main channel only)
FREQUENCY SPAN	2 MHz

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

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on <u>re–entering</u> this measurement:
      Level parameters
      RBW, VBW
      Sweep time
      Trigger settings

```
Remote: CONF:CDP:MEAS POW

Query of results: CALC:MARK:FUNC:POW:RES? CPOW
```

6.3 Measuring adjacent channel power - ACLR

MEAS key or *MEAS* hotkey

NO. OF ADJ CHAN
ADJUST SETTINGS
NOISE CORR ON/OFF
FAST ACLR
DIAGRAM FULL SIZE
ADJUST REF LVL

The ACLR (Adjacent Channel Leakage Power Ratio) softkey enables measurement of the adjacent channel power. The settings and limit values are taken from the spurious measurement defined in the 1xEV-DO specification.

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

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

The ACLR limit check can be enabled or disabled by means of the *ACLR LIMIT CHECK* softkey.
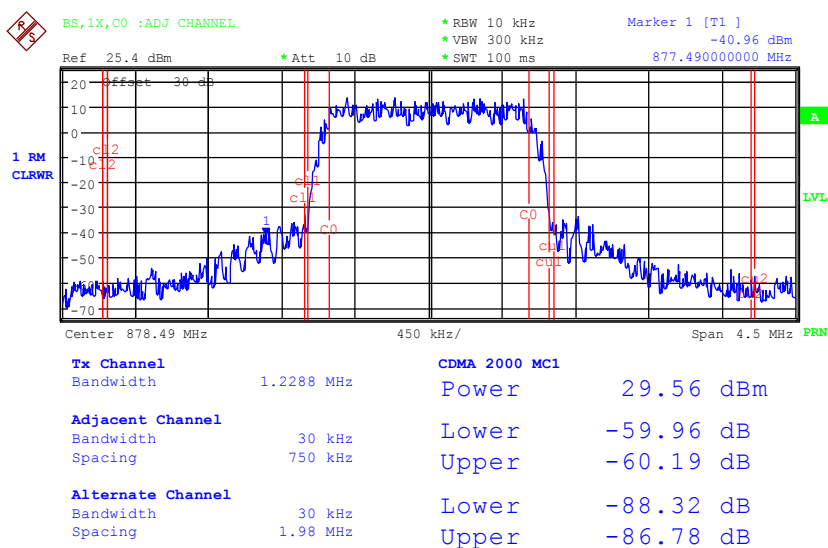
Fig. 10 Measuring adjacent channel power

The softkey enables SPECTRUM mode with defined settings:

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

Table 6   ACLR settings for band classes 0, 2, 3, 5, 9, 10, 11, 12

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	750 kHz	30 kHz	-45 dBc	none
Alternate	1.98 MHz	30 kHz	-60 dBc	-27 dBm
Alternate2	4.00 MHz	30 kHz	-60 dBc	-27 dBm

Table 7   ACLR settings for band class 7

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	750 kHz	30 kHz	-45 dBc	none
Alternate	1.98 MHz	30 kHz	-60 dBc	-27 dBm
Alternate2	4.00 MHz	30 kHz	none	-39.2 dBm

Table 8   ACLR settings for band classes 1, 4, 8

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	885 kHz	30 kHz	-45 dBc	none
Alternate	1.25 MHz	30 kHz	-45 dBc	-9 dBm
Alternate2	1.98 MHz	30 kHz	-55 dBc	-22 dBm

Table 9   ACLR settings for band class 6

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	885 kHz	30 kHz	-45 dBc	none
Alternate	1.25 MHz	30 kHz	none	-13 dBm
Alternate2	1.45 MHz	30 kHz	none	-13 dBm

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

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

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

```
Remote: CONF:CDP:MEAS ACLR
Query of results: CALC:MARK:FUNC:POW:RES? ACP
```

NO. OF ADJ CHAN

The *NO. OF ADJ CHAN* softkey enables input of the number ±n of adjacent channels which are taken into account for the adjacent channel power measurement.

0 to 12 can be entered.

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

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

With higher numbers the procedure is expanded accordingly.

```
Remote:        SENS:POW:ACH:ACP 2
```

ADJUST SETTINGS

The ADJUST SETTINGS softkey automatically optimizes the settings of the analyzer for the selected power measurement. All the analyzer settings relevant to power measurement within a specific frequency range (channel bandwidth) are then optimally set as a function of the channel configuration (channel bandwidth, channel spacing):

● Frequency span:
  - The frequency span must include all the channels to be analyzed as a minimum.
  - The double channel bandwidth is set as the span for measuring the channel power.
  - The span setting depends for adjacent channel power measurement on the channel spacing and the channel bandwidth of the adjacent channel ADJ, ALT1 or ALT2 farthest away from the transmission channel.
● Resolution bandwidth RBW $\leq$ 1/40 of channel bandwidth
● Video bandwidth   VBW $\geq 3 \times$ RBW
● Detector   RMS detector

The trace mathematics and the trace averaging are disabled.

The reference level is not affected by *ADJUST SETTINGS*. It has to be set separately by means of *ADJUST REF LVL*.

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

```
Remote:        SENS:POW:ACH:PRES ACP|CPOW|OBW
```

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

Frequency span

The frequency span must include at least all the channels needing to be measured. This is the channel bandwidth when channel power is measured.
If the frequency span is large compared with the analyzed frequency section (or frequency sections), only a few pixels on the trace are available for the measurement.

Resolution bandwidth (RBW)

To ensure an acceptable measurement speed and also the necessary selection (for inhibiting spectral components outside the channel you want to measure, especially the adjacent channels), the resolution bandwidth must be selected so that it is neither too small nor too large. As a rule of thumb, the resolution bandwidth has to be set to values between 1% and 4% of the channel bandwidth. A larger resolution bandwidth can be set when the spectrum within and around the channel to be measured has an even characteristic.

Video bandwidth (VBW)

For a correct power measurement, the video signal must not be limited in terms of bandwidth. A band limitation of the logarithmic video signal would result in averaging and thus in a display of the power that would be too low (-2,51 dB at very small video bandwidth). The video bandwidth must therefore be at least three times higher than the resolution bandwidth.

The *ADJUST SETTINGS* softkey sets the video bandwidth (VBW) as a function of the channel bandwidth as follows

$VBW \geq 3 \times RBW$.

Detector

The *ADJUST SETTINGS* softkey selects the RMS detector.

The RMS detector is selected because it always indicates the power correctly, irrespective of the characteristics of the signal you want to measure. Generally speaking, the sample detector would also be possible. However, it results in unstable results by virtue of the limited number of trace pixels for calculation of the power in the channel. An averaging, which is often performed to stabilize the measurement results, produces a level display that is too low and must therefore be avoided. The lower level display depends on the number of averagings and the signal characteristic in the channel needing to be measured.

SWEEP TIME

The *SWEEP TIME* softkey enables entry of the sweep time. A longer sweep time results in more stable measurement results with the RMS detector.

This setting is identical to the *SWEEP TIME MANUAL* on the *B*W menu.

```
Remote: SWE:TIME <value>
```

NOISE CORR ON/OFF

The NOISE CORR ON/OFF softkey enables correction of the measurement results by the background noise of the device, thus raising the dynamic range.

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

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

```
Remote: SENS:POW:NCOR ON
```

FAST ACLR ON/OFF

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

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

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

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

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

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

With 1xEV-DO the measurement bandwidth is 10 kHz, i.e. measured values at an interval of 10 µs are assumed to be uncorrelated. Thus a measurement time (sweep time) of 50 ms per channel is required for 500 measured values. This is the default sweep time which the analyzer sets in coupled mode. Approximately 5000 measured values (i.e. the measurement time has to be extended to 500 ms) are required for a reproducibility of 0.1 dB (99% of all measurements are within 0.1 dB of the true measured values).

```
Remote: SENS:POW:HSP ON
```

DIAGRAM FULL SIZE

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

```
Remote:       -
```

ADJUST REF LVL

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

Since the measurement bandwidth is distinctly narrower for power channel measurements than the signal bandwidth, the signal branch can be overloaded, even though the trace is still well below the reference level.

```
Remote:       SENS:POW:ACH:PRES:RLEV
```

ACLR LIMIT CHECK

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

```
Remote:       CALC:LIM:ACP ON
              CALC:LIM:ACP:ACH:RES?
              CALC:LIM:ACP:ALT1..11:RES?
```

EDIT ACLR LIMIT

The default settings of limits are defined at the start of the adjacent channel power measurement as a function of the selected band class (refer to the BAND CLASS softkey), as in the tables on page 31. Similarly, the values in these tables are restored on a change of band class. After the band class has been selected, a table can be opened in the ACLR measurement, however, by means of the EDIT ACLR LIMITS softkey and the limits for the ACLR measurement can be modified in the table.

ACP LIMITS				
CHAN	RELATIVE LIMIT CHECK		ABSOLUTE LIMIT CHECK	
	VALUE	ON	VALUE	ON
ADJ	-45 dBc	x	0 dBm	
ALT1	-60 dBc	x	-27 dBm	
ALT2	-60 dBc	x	-27 dBm	x

The following rules apply to limits:

● A separate limit can be defined for each of the adjacent channels. The limit applies simultaneously to the lower and upper adjacent channels.
● A relative limit and/or an absolute limit can be defined. Checks of both limits can be enabled independently of each other.
● Compliance with the active limits is checked independently of whether the limits are absolute or relative and whether the measurement itself is performed at absolute levels or at relative signal intervals. If both checks are active and if the higher of the two limits has been exceeded, the measured value concerned is identified.

> ℹ️ Measured values which violate the limit are preceded by an asterisk and identified in red.

```
Remote:  CALC:LIM:ACP ON
         CALC:LIM:ACP:ACH 0dB,0dB
         CALC:LIM:ACP:ACH:STAT ON |OFF
         CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm
         CALC:LIM:ACP:ACH:ABS:STAT ON
         CALC:LIM:ACP:ALT1 0dB,0dB
         CALC:LIM:ACP:ALT1:STAT ON
         CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm
         CALC:LIM:ACP:ALT1:ABS:STAT ON
         CALC:LIM:ACP:ALT2..11 0dB,0dB
         CALC:LIM:ACP:ALT2..11:STAT ON
         CALC:LIM:ACP:ALT2..11:ABS -10dBm,-10dBm
         CALC:LIM:ACP:ALT2..11:ABS:STAT ON
```

CHANNEL BANDWIDTH

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

The useful channel bandwidth is normally determined by the transmission procedure. With 1xEV-DO measurements are performed at the default setting with a channel bandwidth of 1.2288 MHz.

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

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

```
Remote: SENS:POW:ACH:BWID 1.2288MHz
```

ADJ CHAN BANDWIDTH

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

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

When measuring by the IBW method (FAST ACLR OFF), the bandwidths of the different adjacent channels have to be entered numerically. Since it is common for all adjacent channels to have the same bandwidth, the other channels Alt1 and Alt2 are set to the bandwidth of the adjacent channel when the adjacent channel bandwidth (ADJ) is entered.

Thus only one value needs to be entered in the case of equal adjacent channel bandwidths. The procedure is the same for the Alt2 channels (Alternate Channels 2) when the bandwidth of the Alt1 channel (Alternate Channel 1) is entered.

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

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

```
Remote:   SENS:POW:ACH:BWID:ACH 30kHz
          SENS:POW:ACH:BWID:ALT1 30kHz
          SENS:POW:ACH:BWID:ALT2..11 30kHz
```

ADJ CHAN SPACING

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

CHANNEL SPACING	
CHAN	SPACING
ADJ	750 kHz
ALT1	1.98 MHz
ALT2	4.00 MHz

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

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

```
Remote:   SENS:POW:ACH:SPAC:ACH 750kHz
          SENS:POW:ACH:SPAC:ALT1 1.98MHz
          SENS:POW:ACH:SPAC:ALT2..11 4MHz
```

ACLR ABS/REL

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

ACLR ABS The absolute value of the power in the transmission channel and the adjacent channels is displayed in the unit of the Y axis such as dBm or dBμV.

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

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

```
Remote: SENS:POW:ACH:MODE ABS
```

CHAN PWR / HZ

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

The conversion factor is

$$10 \cdot \lg \frac{1}{Channel \cdot Bandwidth}.$$

```
Remote: CALC:MARK:FUNC:POW:RES:PHZ ON|OFF
```

POWER MODE

The *POWER MODE* sub menu allows to change between the normal (*CLEAR/WRITE*) and the max hold power mode. In the *CLEAR/WRITE* the channel power and the adjacent channel powers are calculated directly from the current trace. In *MAX HOLD* mode the power values are still derived from the current trace, but they are compared with a maximum algorithm to the previous power value. The greater value is remained.

```
Remote: CALC:MARK:FUNC:POW:MODE WRIT|MAXH
```

6.4 Measurement of Multi Carrier Adjacent-Channel Power - MULT CARR ACLR

Taste *MEAS* or Hotkey *MEAS*

CP/ACP CONFIG
SWEEP TIME
NOISE CORR ON/OFF
FAST ACP ON/OFF
FULL SIZE DIAGRAM
ADJUST REF LVL

The *MULT CARR ACLR* (Multi Carrier Adjacent Channel Leakage Power Ratio) softkey enables measurement of the multi carrier adjacent channel power. The settings and limits are taken from the spurious emissions measurement defined in the 1xEV-DO specification.

The analyzer measures the power of the 4 useful channels and of the adjacent channels on the left and right sides. In the default setting, only two adjacent channels are taken into account. Measurement results are displayed beneath the measurement screen.

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

The ACLR limit check can be enabled or disabled by means of the *ACLR LIMIT CHECK* softkey:

The following user-specific settings are not modified on the first access following presetting:
 	
     Level parameters
     All trigger settings
 	
The center frequency setting is adjusted on first entry by ½ of the TX spacing, thus the measurement on the TX channel can continue.	

ADJACENT CHAN POWER	ON
MC ACP STANDARD	cdma2000 MC1
NO OF TX CHANNELS	4
NO OF ADJ. CHANNELS	2
Furthe band class depended settings are identical to the ACLR measurement.	

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

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

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

Remote: CONF:CDP:MEAS MCAC
Query of results: CALC:MARK:FUNC:POW:RES? MCAC

CP/ACP CONFIG

NO. OF ADJ CHAN
NO. OF TX CHAN
CHANNEL BANDWIDTH
CHANNEL SPACING
ACP REF SETTINGS
CP/ACP ABS/REL
CHAN PWR / HZ
ADJUST SETTINGS
ACP LIMIT CHECK
EDIT ACLR LIMIT
POWER MODE
ADJUST REF LVL

The *CP/ACP CONFIG* softkey opens a submenu for configuration of the multi carrier adjacent channel power measurement.

The channel configuration includes the number of channels to be measured, the channel bandwidths (*CHANNEL BANDWIDTH*), and the channel spacings (*CHANNEL SPACING*).

Limit values can additionally be specified for the adjacent-channel power (*ACP LIMIT CHECK* and *EDIT ACP LIMITS*) which are checked for compliance during the measurement.

NO. OF ADJ CHAN

This softkey behaves as in the adjacent channel power measurement - ACLR. Refer there.

NO. OF TX CHAN

The *NO. OF TX CHAN* softkey enables the entry of the number of carrier signals to be considered.

Numbers from 1 to 12 can be entered.

Remote: SENS:POW:ACH:TXCH:COUN 4

CHANNEL BANDWIDTH

The *CHANNEL BANDWIDTH* softkey opens a table for defining the channel bandwidths for the transmission channels and the adjacent channels.

```
Remote:   SENS:POW:ACH:BWID:CHAN 1.2288MHz
          SENS:POW:ACH:BWID:ACH 30kHz
          SENS:POW:ACH:BWID:ALT1 30kHz
          SENS:POW:ACH:BWID:ALT2..11 30kHz
```

CHANNEL SPACING

The *CHANNEL SPACING* softkey opens a table for defining the channel spacings of the TX channel and the adjacent channels.

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

```
Remote:   SENS:POW:ACH:SPAC:CHAN 1.25MHz
          SENS:POW:ACH:SPAC:ACH 750kHz
          SENS:POW:ACH:SPAC:ALT1 1.98MHz
          SENS:POW:ACH:SPAC:ALT2..11 4MHz
```

ACP REF SETTINGS

The *ACP REF SETTINGS* softkey opens a table for selecting the transmission channel to which the adjacent-channel relative power values should be referenced.

```
ACP REFERENCE CHANNEL
✓ TX CHANNEL 1
  TX CHANNEL 2
  TX CHANNEL 3
  TX CHANNEL 4
  TX CHANNEL 5
  TX CHANNEL 6
  TX CHANNEL 7
  TX CHANNEL 8
  TX CHANNEL 9
  TX CHANNEL 10
  TX CHANNEL 11
  TX CHANNEL 12
  MIN POWER TX CHANNEL
  MAX POWER TX CHANNEL
  LOWEST & HIGHEST CHANNEL
```

TX CHANNEL 1-12	Selection of one of channels 1 to 12.
MIN POWER TX CHANNEL	The transmission channel with the lowest power is used as a reference channel.
MAX POWER TX CHANNEL	The transmission channel with the highest power is used as a reference channel.

LOWEST & HIGHEST
CHANNEL

The outer lefthand transmission channel is the reference channel for the lower adjacent channels, the outer righthand transmission channel that for the upper adjacent channels.

```
Remote:   SENS:POW:ACH:REF:TXCH:MAN 1
          SENS:POW:ACH:REF:TXCH:AUTO MIN
          POW:ACH:REF:TXCH:AUTO MAX
          POW:ACH:REF:TXCH:AUTO LHIG
```

CP/ACP ABS/REL

The *CP/ACP ABS/REL* softkey (channel power absolute/relative) switches between absolute and relative power measurement in the adjacent channels.

```
Remote: SENS:POW:ACH:MODE ABS
```

CHAN PWR / HZ

This softkey behaves as in the adjacent channel power measurement - ACLR. Refer there.

ADJUST SETTINGS

The ADJUST SETTINGS softkey automatically optimizes the instrument settings for the selected power measurement (see below).

All instrument settings relevant for a power measurement within a specific frequency range (channel bandwidth) are optimized for the selected channel configuration (channel bandwidth, channel spacing).

```
Remote: SENS:POW:ACH:PRES MCAC
```

ACP LIMIT CHECK

This softkey behaves as the `ACLR LIMIT CHECK` softkey in the adjacent channel power measurement - ACLR. Refer there.

EDIT ACLR LIMIT

This softkey behaves as in the `EDIT ACLR LIMIT` softkey in the adjacent channel power measurement - ACLR. Refer there.

SWEEP TIME

The function of the softkey is identical to the softkey *SWEEP TIME MANUAL* in the menu *BW*.

```
Remote: SWE:TIM <value>
```

NOISE CORR ON/OFF

This softkey behaves as in the adjacent channel power measurement - ACLR. Refer there.

FAST ACP ON/OFF

This softkey behaves as in the adjacent channel power measurement - ACLR. Refer there.

FULL SIZE DIAGRAM

This softkey behaves as in the adjacent channel power measurement - ACLR. Refer there.

POWER MODE

The *POWER MODE* sub menu allows to change between the normal (*CLEAR/WRITE*) and the max hold power mode. In the *CLEAR/WRITE* mode the channel power and the adjacent channel powers are calculated directly from the current trace. In *MAX HOLD* mode the power values are still derived from the current trace, but they are compared with a maximum algorithm to the previous power value. The greater value is remained.

```
Remote: CALC:MARK:FUNC:POW:MODE WRIT|MAXH
```

ADJUST REF LVL

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

Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

```
Remote: SENS:POW:ACH:PRES:RLEV
```

6.4.2 Signal power check - SPECTRUM EM MASK

MEAS key or MEAS hotkey

The *SPECTRUM EM MASK* (Spectrum Emission Mask) softkey measures the signal power in defined offsets from the carrier and compares the power values with the spurious emission mask, specified in the cdma2000/1xEV-DO specification, in the near-carrier range from -4 MHz to 4 MHz.

LIMIT LINE AUTO
LIMIT LINE MANUAL
LIMIT LINE USER
RESTORE STD LINES
LIST EVALUATION
ADJUST REF LVL
30kHz/1MHz TRANSITION
PEAK SEARCH
MARGIN
VIEW PEAK LIST

The limits depend on the band class setting (*BAND CLASS* softkey).
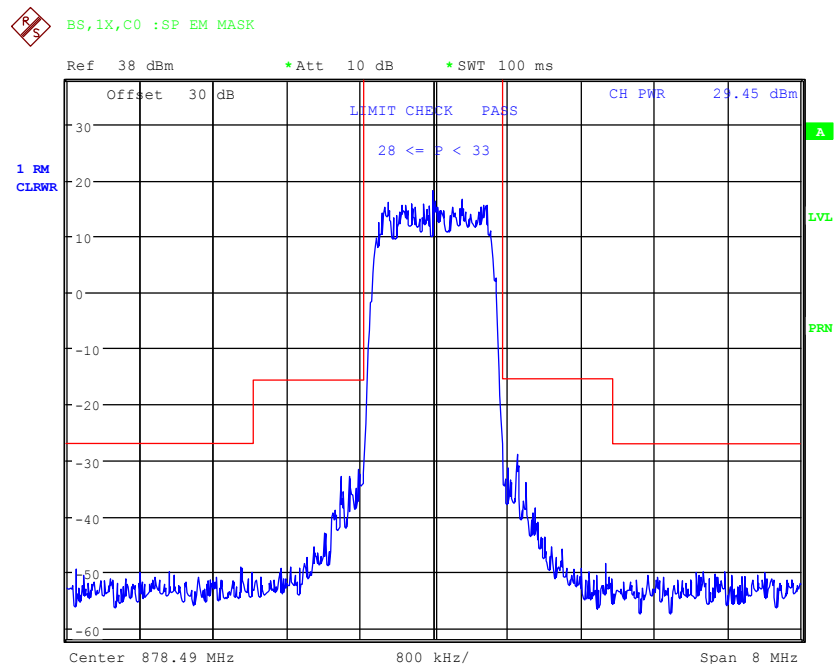
Fig, 11 Measuring the spectrum emission mask

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting:
Level parameters
Center Frequency + Frequency Offset
All trigger settings

ADJACENT CHAN POWER	ON
ACP STANDARD	cdma2000 MC1
NO OF ADJ. CHANNELS	0
FREQUENCY SPAN	8 MHz
SWEEP TIME	100 ms
DETECTOR	RMS

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode. Changes to the RBW and VBW are limited, because they are specified by definition of the limits.

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on <u>re-entering</u> this measurement:
Level parameters
Sweep time
SPAN
Trigger settings

Remote: `CONF:CKP:MEAS ESP`

Query of results of limit line: `CALC:LIM:FAIL?`

Query of results of worst fail: `CALC:LIM:ESP:CHEC:X?`
`CALC:LIM:ESP:CHEC:Y?`

LIMIT LINE AUTO

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

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

Remote: `CALC:LIM:ESP:MODE AUTO`

LIMIT LINE MANUAL

The LIMIT LINE MANUAL softkey gives you an opportunity to select the limit line manually. If this softkey is selected, the channel power measurement is not used for selecting the limit line but for determining its relative components. The power for the different frequency offsets is compared with the limit line specified by the user.

The softkey opens a table containing all predefined limit lines on the device:

- Name of limit line
- P >= 33 dBm
- 28 dBm <= P < 33 dBm
- P < 28 dBm

The name of the limit line specifies the range for the expected power, for which the limit line was defined.

Remote: `CALC:LIM:ESP:MODE MAN`
`CALC:LIM:ESP:VAL 28`
`'selects line 28 dBm` **<=** `P < 33 dBm`

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

Table 10 Band classes 0, 2, 3, 5, 9, 10, 11, 12 for carrier power P<28 dBm

Offset frequency	Limit	Type/name DOB0CR	RBW
-4.00 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-55 dBc	relative to carrier power	30 kHz
+4.00 MHz	-55 dBc	relative to carrier power	30 kHz

Table 11 Band classes 0, 2, 3, 5, 9, 10, 11, 12 for carrier power 28 dBm <= P < 33 dBm

Offset frequency	Limit	Type/name DOB0BA und DOB0BR	RBW
-4.00 MHz	-27 dBm	Absolute	30 kHz
-1.98 MHz	-27 dBm	Absolute	30 kHz
-1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
-750 kHz	-45 dBc	Relative to carrier power	30 kHz
+750 kHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-27 dBm	Absolute	30 kHz
+4.00 MHz	-27 dBm	Absolute	30 kHz

Table 12 Band classes 0, 2, 3, 5, 9, 10, 11, 12 for carrier power 28 dBm <= P < 33 dBm

Offset frequency	Limit	Type/name DOB0AR	RBW
-4.00 MHz	-60 dBc	Relative to carrier power	30 kHz
-1.98 MHz	-60 dBc	Relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
-750 kHz	-45 dBc	Relative to carrier power	30 kHz
+750 kHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-60 dBc	Relative to carrier power	30 kHz
+4.00 MHz	-60 dBc	Relative to carrier power	30 kHz

The limits for band class 7 are derived from band class 0, but a -46 dBm/6.25 kHz limit is defined additionally between 3.25 MHz and 4 MHz. This limit is raised by 6.8 dB so that 30 kHz filters can be measured with the resolution filter. More power is "seen" in it, 10 log 30 kHz - 10 log 6.25 kHz = 6.8 dB. Accordingly the limit is -46 dBm + 6.8 dB = -39.2 dBm.

Table 13 Band classes 7 for carrier power P<28 dBm

Offset frequency	Limit	Type/name DOB7CA and DOB7R	RBW
-4.00 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-55 dBc	Relative to carrier power	30 kHz
-1.98 MHz	-55 dBc	Relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
-750 kHz	-45 dBc	Relative to carrier power	30 kHz
+750 kHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-55 dBc	Relative to carrier power	30 kHz
+3.25 MHz	-55 dBc	Relative to carrier power	30 kHz
+3.25 MHz	-39.2 dBm	Absolute	30 kHz
+4.00 MHz	-39.2 dBm	Absolute	30 kHz

Table 14 Band classes 7 for carrier power 28 dBm <= P < 33 dBm

Offset frequency	Limit	Type/name DOB7BA and DOB7BR	RBW
-4.00 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-27 dBm	Absolute	30 kHz
-1.98 MHz	-27 dBm	Absolute	30 kHz
-1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
-750 kHz	-45 dBc	Relative to carrier power	30 kHz
+750 kHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-27 dBm	Absolute	30 kHz
+3.25 MHz	-27 dBm	Absolute	30 kHz
+3.25 MHz	-39.2 dBm	Absolute	30 kHz
+4.00 MHz	-39.2 dBm	Absolute	30 kHz

Table 15 Band classes 7 for carrier power P >= 33 dBm

Offset frequency	Limit	Type/name DOB7AA und DOB7AR	RBW
-4.00 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-60 dBc	Relative to carrier power	30 kHz
-1.98 MHz	-60 dBc	Relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
-750 kHz	-45 dBc	Relative to carrier power	30 kHz
+750 kHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	Relative to carrier power	30 kHz
+1.98 MHz	-60 dBc	Relative to carrier power	30 kHz
+3.25 MHz	-60 dBc	Relative to carrier power	30 kHz
+3.25 MHz	-39.2 dBm	Absolute	30 kHz
+4.00 MHz	-39.2 dBm	Absolute	30 kHz

The limits for band classes 1, 4, 8, 14 and 15 are defined by separate limits. RBW switching is necessary in this instance. The 1 MHz channel filter is used for the 1 MHz segments. The frequency range is divided into three sub-segments. The user's sweep time is distributed over the segments as follows (k = filter sweep rate factor):

Segment1: -4.00 ... -2.25 MHz   RBW = 1 MHz   k = 850 SWT1 = SWT * 1/10

Segment2: -2.25 ... +2.25 MHz   RBW = 30 kHz   k = 2.5 SWT2 = SWT * 8/10

Segment3: +2.25 ... 4.00 MHz   RBW = 1 MHz   k = 850 SWT3 = SWT * 1/10

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

For entering the limit "Stricter from" a check determines whether P - 45 dBc > -9 dBm. If this is the case, the measured value is compared with P - 45 dBc, in all other cases with -9 dBm.

Table 16 Band classes 1, 4, 8, 14 and 15 for carrier power P<28 dBm

Offset frequency	Limit	Type/name DOB1CA and DOB1CR	RBW
-4.00 MHz	-13 dBm	Absolute	1 MHz
-2.25 MHz	-13 dBm	Absolute	1 MHz
-2.25 MHz	-50 dBc	Relative to carrier power	30 kHz
-1.98 MHz	-50 dBc	Relative to carrier power	30 kHz
-1.98 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
-1.25 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
-1.25 MHz	-45 dBc	Relative to carrier power	30 kHz
-885 kHz	-45 dBc	Relative to carrier power	30 kHz
+885 kHz	-45 dBc	Relative to carrier power	30 kHz
+1.25 MHz	-45 dBc	Relative to carrier power	30 kHz
+1.25 MHz	Stricter of: : -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
+1.98 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
+1.98 MHz	-50 dBc	Relative to carrier power	30 kHz
+2.25 MHz	-50 dBc	Relative to carrier power	30 kHz
+2.25 MHz	-13 dBm	Absolute	1 MHz
+4.00 MHz	-13 dBm	Absolute	1 MHz

Table 17 Band classes 1, 4, 8, 14 and 15 for carrier power 28 dBm <= P < 33 dBm

Offset frequency	Limit	Type/name DOB1BA and DOB1BR	RBW
-4.00 MHz	-13 dBm	Absolute	1 MHz
-2.25 MHz	-13 dBm	Absolute	1 MHz
-2.25 MHz	-22 dBm	Absolute	30 kHz
-1.98 MHz	-22 dBm	Absolute	30 kHz
-1.98 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
-1.25 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
-1.25 MHz	-45 dBc	Relative to carrier power	30 kHz
-885 kHz	-45 dBc	Relative to carrier power	30 kHz
+885 kHz	-45 dBc	Relative to carrier power	30 kHz
+1.25 MHz	-45 dBc	Relative to carrier power	30 kHz
+1.25 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
+1.98 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
+1.98 MHz	-22 dBm	Absolute	30 kHz
+2.25 MHz	-22 dBm	Absolute	30 kHz
+2.25 MHz	-13 dBm	Absolute	1 MHz
+4.00 MHz	-13 dBm	Absolute	1 MHz

Table 18 Band classes 1, 4, 8, 14 and 15 for carrier power P >= 33 dBm

Offset frequency	Limit	Type/name DOB1AA and DOB1AR	RBW
-4.00 MHz	-13 dBm	Absolute	1 MHz
-2.25 MHz	-13 dBm	Absolute	1 MHz
-2.25 MHz	-55 dBc	Relative to carrier power	30 kHz
-1.98 MHz	-55 dBc	Relative to carrier power	30 kHz
-1.98 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
-1.25 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
-1.25 MHz	-45 dBc	Relative to carrier power	30 kHz
-885 kHz	-45 dBc	Relative to carrier power	30 kHz
+885 kHz	-45 dBc	Relative to carrier power	30 kHz
+1.25 MHz	-45 dBc	Relative to carrier power	30 kHz
+1.25 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
+1.98 MHz	Stricter of: -45 dBc / -9 dBm	Relative to carrier power /Absolute	30 kHz
+1.98 MHz	-55 dBc	Relative to carrier power	30 kHz
+2.25 MHz	-55 dBc	Relative to carrier power	30 kHz
+2.25 MHz	-13 dBm	Absolute	1 MHz
+4.00 MHz	-13 dBm	Absolute	1 MHz

The limits for band class 6 are derived from the limits of band classes 1, 4 and 8. The difference is that there is no dependence on carrier power and there is a gradient between 1.45 and 2.25 MHz.

Table 19Band class 6 for all carrier power values

Offset frequency	Limit	Type/name DOB0BA and DOB0BR	RBW
-4.00 MHz	-13 dBm	Absolute	1 MHz
-2.25 MHz	-13 dBm	Absolute	1 MHz
-2.25 MHz	-26.6 dBm	Absolute	30 kHz
-1.45 MHz	-13 dBm	Absolute	30 kHz
-1.25 MHz	-13 dBm	Absolute	30 kHz
-1.25 MHz	-45 dBc	Relative to carrier power	30 kHz
-885 kHz	-45 dBc	Relative to carrier power	30 kHz
+885 kHz	-45 dBc	Relative to carrier power	30 kHz
-1.25 MHz	-45 dBc	Relative to carrier power	30 kHz
-1.25 MHz	-13 dBm	Absolute	30 kHz
-1.45 MHz	-13 dBm	Absolute	30 kHz
-2.25 MHz	-26.6 dBm	Absolute	30 kHz
-2.25 MHz	-13 dBm	Absolute	1 MHz
-4.00 MHz	-13 dBm	Absolute	1 MHz

LIMIT LINE USER

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

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

Trace 1, Domain Frequency, X-Scaling Relative, Y-Scaling Absolute, Spacing linear, Unit dBm.

Unlike the default limit lines on the device when the analyzer is supplied from the factory that conform to the standard specifications, the user-specified limit line can be specified for the whole frequency range ($\pm$4.0 MHz from the carrier) only either relatively (referred to the reference level) or absolutely.

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

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

Example of 1xEV-DO band class 0, 2, 3, 5, 9, 10-12 for P<28 dBm:

```
DO     : 1xEV-DO
  B    : base station
   0   : lowest of band classes 0,2,3,5,9,10-12
    C  : lowest of the three power classes
     R : relative line
=========
DOB0CR
```

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

```
Remote:
```
Table of Softkeys with Assignment of IEC/IEEE bus Commands

RESTORE STD LINES

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

```
Remote: CALC:LIM:ESP:REST
```

LIST EVALUATION

The softkey *LIST EVALUATION* reconfigures the SEM output to a split screen. In the upper half the trace with the limit line is shown. In the lower half the peak value list is shown. For every range of the spectrum emission defined by the standard the peak value is listed. For every peak value the frequency, the absolute power, the relative power to the channel power and the delta limit to the limit line is shown. As long as the delta limit is negative, the peak value is below the limit line. A positive delta indicates a failed value. The results are then colored in red, and a star is indicated at the end of the row, for indicating the fail on a black and white printout.

If the list evaluation is active, the peak list function is not available. Since version 4.00 the peak list softkeys are moved to the side menu.

```
Remote: CALC1:PEAK:AUTO ON | OFF
```

With this command the list evaluation which is by default for backwards compatibility reasons off can be turned on.

TRACe1:DATA? LIST

With this command the list evaluation results are queried in the following order:

<no>, <start>, <stop>, <rbw>, <freq>, <power abs>, <power rel>, <delta>, <limit check>, <unused1>, <unused2>

All results are float values:

no	range number
start	start frequency
stop	stop frequency
rbw	resolution bandwidth of range
freq	frequency of peak
power abs	absolute power in dBm of peak
power rel	relative power in dBc (related to the channel power) of peak
delta	distance to the limit line in dB (positive indicates value above the limit, fail)
limit check	limit fail (pass = 0, Fail =1)
unused1	reserved (0.0)
unused2	reserved (0.0)

ADJUST REF LVL

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

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

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

```
Remote: SENS:POW:ACH:PRES:RLEV
```

30kHz/1MHz TRANSITION

The *30kHz/1MHz TRANSITION* softkey specifies the offset frequency at which the resolution bandwidth is changed between 30k and 1MHz.

The default value is dependend on the band class, refer to the tables above. For multi carrier spectrum emission mask measurement this value can be extended. User specific limit lines shall than be defined and used.

```
Remote: CALC:LIM:ESP:TRAN <numeric value>
```

PEAK SEARCH

The *PEAK SEARCH* softkey activates a single evaluation of spectrum emission mask. The limit mask - reduced by an overall margin - is checked against the trace. The fail positions are marked by crosses as long as not a next sweep is preformed. It is recommended to use single sweep. Every value is added to a peak list which can be opened and saved in ASCII format or read out via an IEC/IEEE command.

The peaks are calculated using the same peak search algorithm like markers do. It is possible to define the peak excursion value via *MKR->NEXT*, softkey *PEAK EXCURSION*. In addition the worst fail of each fail area without a peak is marked and added to the peak list.

```
Remote: CALC:PEAK
```

PEAKS PER RANGE

The *PEAKS PER RANGE* softkey defines how many peaks are searched for within one range. The ranges are according to the band class setting (SETTINGS -> BAND CLASS) e.g. for BAND CLASS 0, 2, 3, 5, 9, 10, 11 and 12:

- from -4.00 MHz to -1.98 MHz from the carrier,
- from -1.98 MHz to -0.75 MHz from the carrier,
- the area from -0.75 MHz to +0.75 MHz around the carrier,
- from +0.75 to +1.98 MHz from the carrier
- from +1.98 MHz to +4.00 MHz from the carrier.

The default value of *PEAKS PER RANGE* is 25.

```
Remote: CALC:PEAK:SUBR 1...50
```

MARGIN

The *MARGIN* softkey defines an overall margin which is subtracted from the limit line to make the peak search more stronger. If the values of the trace are above the limit line minus margin value it will be marked with a cross as shown in the peak list. The DELTA LIMIT of the list will be positive thus indicating that only the margin and not the limit itself is reached. A negative sign would indicate the real fail.

The default value of *MARGIN* is 6 dB.

```
Remote:     CALC:PEAK:MARG -200dB...200dB
```

VIEW PEAK LIST

SORT BY FREQUENCY
SORT BY DELTA LIM
ASCII FILE EXPORT
DECIM SEP . ,

The *VIEW PEAK LIST* softkey opens the peak list. The list is empty if either no peak search (see softkey *PEAK SEARCH*) has been done, or if no peaks/fails have been found.

The list shows for every peak value the following entries:

● the range (LOWer side or UPper side from carrier)
● the frequency
● the level in dBc (relative to the carrier channel power)
● the delta level to the limit (negative deltas indicate a fail).

With a high *MARGIN* of e.g. 200 dB and a *PEAKS PER RANGE* of 1 it is possible to obtain the worst point of each range, which can be sorted after pressing the *VIEW PEAK LIST* softkey in the order of the frequencies with *SORT BY FREQUENCY*.

The following figure shows a peak list:

VIEW PEAK LIST			
LOW-UP RANGE /RBW	FREQUENCY	LEVEL dBc	DELTA LIMIT dB
L1.980-4.000M/30k	875.4020 MHz	-54.25	0.74
L0.750-1.980M/30k	876.7620 MHz	-54.41	-9.41
Inner Range /30k	879.2400 MHz	-55.62	-10.62
U0.750-1.980M/30k	880.2180 MHz	-54.07	-9.07
U1.980-4.000M/30k	881.1460 MHz	-53.66	1.33

Fig, 12 Peak list of spectrum emission mask

Remote: TRAC? FIN1

The comma separated values are:
　　　　<freq1>, <level1>, <delta level 1>,
　　　　<freq2>, <level2>, <delta level 2>, ...

SORT BY FREQUENCY

The *SORT BY FREQUENCY* softkey sorts the list in ascending order according to the column FREQUENCY.

Remote:　　　--

SORT BY DELTA LIM

The *SORT BY DELTA LIM* softkey sorts the list in descending order according to the column DELTA LIMIT.

Remote:　　　--

ASCII FILE EXPORT

The *ASCII FILE EXPORT* softkey exports the peak list in ASCII format to a file.

The complete output format is similar to the trace export. The peak values within the file are comma separated in the format:

```
<trace no 1>, <freq1>, <level1>, <delta level 1>,
<trace no 2>, <freq2>, <level2>, <delta level 2>, ...
```

The trace no is always 1.

```
Remote: MMEM:STOR:FIN 'A:\final.dat'
```

DECIM SEP . ,

Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between default separators '.' (decimal point) and ',' (comma) using softkey *DECIM SEP.*

```
Remote: FORM:DEXP:DSEP POIN | COMM
```

6.5 Measuring bandwidth occupied by the signal - OCCUPIED BANDWIDTH

MEAS key or MEAS hotkey

The *OCCUPIED BANDWIDTH* softkey enables measurement of the bandwidth occupied by the signal.

% POWER BANDWIDTH
ADJUST SETTINGS
ADJUST REF LVL

This measurement determines the bandwidth in which - in the initial state - 99% of the signal power are to be found. The percentage of the signal power that has to be included in the bandwidth measurement can be modified. The bandwidth and the frequency markers for the measurement are displayed in the Marker Info field at the top right corner of the display
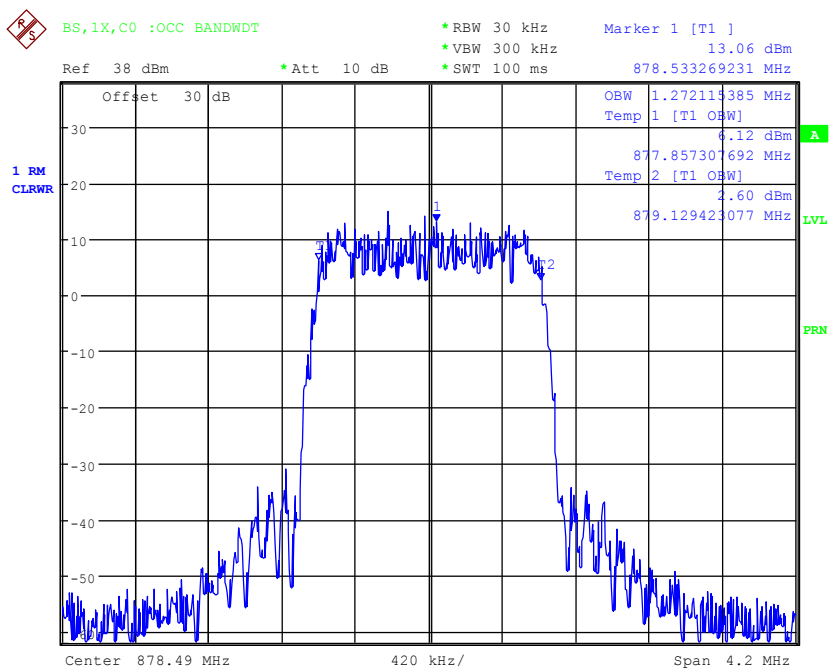
Fig, 13   Measuring occupied bandwidth

The softkey enables SPECTRUM mode with defined settings:

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

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

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

```
Remote: CONF:CDP:MEAS OBAN

Query of results: CALC:MARK:FUNC:POW:RES? OBAN
```

% POWER BANDWIDTH

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

The permissible range is 10% to 99.9%.

```
Remote: SENS:POW:BWID 99PCT
```

ADJUST SETTINGS

The *ADJUST SETTINGS* softkey adjusts the settings of the analyzer to the specified channel bandwidth for measurement of the occupied bandwidth.

All analyzer settings relevant for power measurement within a certain frequency range (channel bandwidth) such as:

- Frequency span   3 x channel width
- Resolution bandwidth   RBW $\leq$ 1/40 of channel bandwidth.
- Video bandwidth   VBW $\geq 3 \times$ RBW.
- Detector   RMS

are optimized.

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

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

```
Remote: SENS:POW:PRES OBW
```

ADJUST REF LVL

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured total signal power.
The softkey becomes active after the first sweep ends with measurement of the occupied bandwidth and thus the total power of the signal becomes known.

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

Since the measurement bandwidth is distinctly narrower for power channel measurements that the signal bandwidth, the signal branch can be overloaded, even though the trace is still well below the reference level. When the measured channel power is identical to the reference level, the signal path is not overloaded.

```
Remote: SENS:POW:ACH:PRES:RLEV
```

6.6 Signal statistics

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

MEAS key or MEAS hotkey

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

For this measurement, a signal section of settable length is recorded continuously in the zero span and the distribution of the signal amplitudes is evaluated. The record length and the display range of the CCDF can be set using the softkeys of the menu. The amplitude distribution is plotted logarithmically as a percentage of the amount by which a certain level is exceeded, starting with the average value of the signal amplitudes.
In addition, the crest factor, i.e. the difference between the maximum value and the mean power, is output in dB.
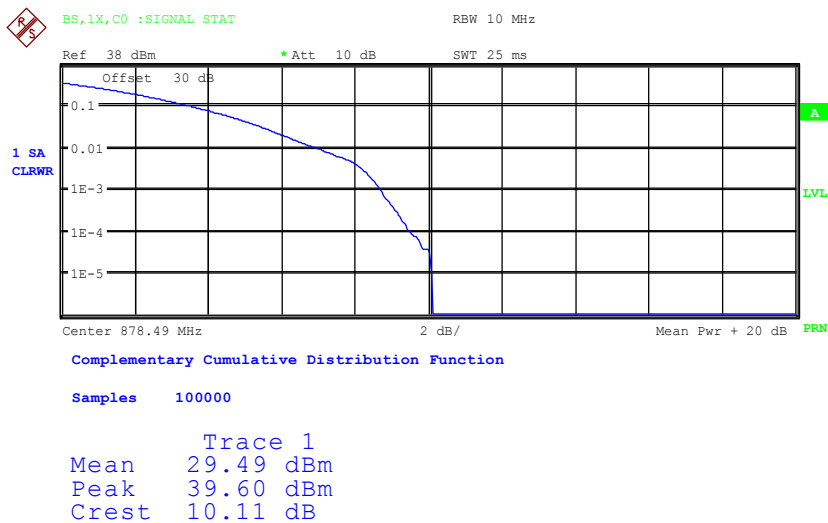

Fig, 14   CCDF of 1xEV-DO signal

The softkey enables SPECTRUM mode with predefined settings:

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

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

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

```
Remote: CONF:CDP:MEAS CCDF
        or
        CALC:STAT:CCDF ON

Query of results: CALC:MARK:X?
                  CALC:STAT:RES? MEAN | PEAK | CFAC | ALL
```

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

PEAK   measured peak power in dBm in the period of observation

CFAC   determined CREST factor (i.e. ratio of peak power to mean power) in dB

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

APD

The *APD* softkey enables the amplitude probability distribution function.

```
Remote: CALC:STAT:APD ON
```

CCDF

The *CCDF* softkey switches the complementary distribution function (complementary cumulative distribution function).

```
Remote: CALC:STAT:CCDF ON
```

PERCENT MARKER

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

If marker 1 is disabled, it is automatically enabled.

```
Remote: CALC:MARK:Y:PERC 0...100%
```

NO OF SAMPLES

The *NO OF SAMPLES* softkey sets the number of power measurement values that have to be taken into account for the distribution measurement function.

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

```
Remote: CALC:STAT:NSAM <value>
```

SCALING

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

| X-AXIS REF LEVEL |
| X-AXIS RANGE |
| Y-AXIS MAX VALUE |
| Y-AXIS MIN VALUE |
| ADJUST SETTINGS |
| DEFAULT SETTINGS |

X-AXIS REF LEVEL

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

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

This value is mapped to the right diagram border for the *APD* function. For the CCDF function, this value is not directly represented in the diagram because the X axis is scaled relative to the measured *MEAN POWER*.

```
Remote: CALC:STAT:SCAL:X:RLEV <value>
```

X-AXIS RANGE

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

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

```
Remote: CALC:STAT:SCAL:X:RANG <value>
```

Y-UNIT % / ABS

The *Y-UNIT % / ABS* defines the scaling type of the y-axis. The default value is absolute scaling.

```
Remote: CALC:STAT:SCAL:Y:UNIT PCT
```

Y-AXIS MAX VALUE

The Y-AXIS MAX VALUE softkey sets the upper limit of the displayed probability range.

The values on the Y axis are normalized, i.e. the maximum value is 1.0. Since the Y axis is logarithmically scaled, the gap between the maximum and minimum values must be at least one decade.

```
Remote: CALC:STAT:SCAL:Y:UPP <value>
```

Y-AXIS MIN VALUE

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

Since the Y axis is logarithmically scaled, the gap between the maximum and minimum values must be at least one decade. Permissible range of values 0 < value < 1.

Remote: CALC:STAT:SCAL:Y:LOW <value>

ADJUST SETTINGS

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

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

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

Remote: CALC:STAT:SCAL:AUTO ONCE

DEFAULT SETTINGS

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

X-axis reference level: -20 dBm
X-axis range for APD: 100 dB
X-axis range for CCDF: 20 dB
Y-axis for upper limit: 1.0
Y-axis for lower limit: 1E-6

Remote: CALC:STAT:PRES

CONT MEAS

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

Remote: INIT:CONT ON;
         INIT:IMM

SINGLE MEAS

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

Remote: INIT:CONT OFF;
         INIT:IMM

6.7 Power versus Time

MEAS key or MEAS hotkey

The *POWER VS TIME* Softkey   enables the power versus time measurement as requested by the "emission envelope mask" measurement of the 1xEV-DO Standard.

NO. OF HALFSLOTS
RF: SLOT FULL/IDLE
BURST FIT ON/OFF
REFERENCE MEAN POWER,
REFERENCE MANUAL,
SET MEAN TO MANUAL
RESTART ON FAIL
RESTORE STD LINES
LIST EVALUATION

Up to 36 halfslots are captured and postprocessed with trace averaging simultaneously. For a standard measurement of 100 halfslots only 3 data captures are necessary. An external trigger should be used in order to trigger on the slot boundary.

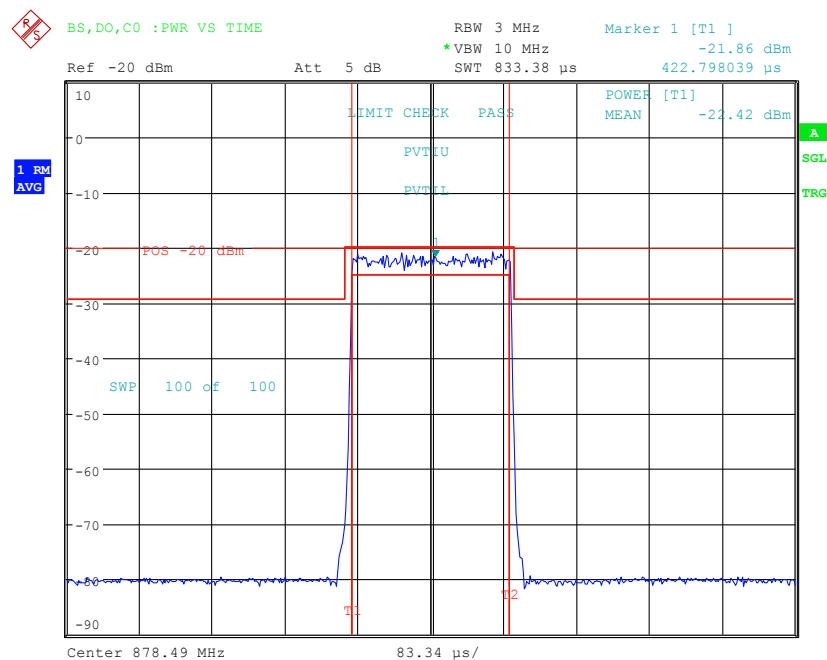**Fig, 15   PVT of a 1xEV–DO IDLE slot signal**

The softkey enables SPECTRUM mode with predefined settings:

The following user-specific settings are not modified so that the adaptation to the device under test is retained:
      Level parameters
      Center Frequency + Frequency Offset
      All trigger settings	

FREQUENCY SPAN	Zero Span 0 Hz
SWEEP TIME	833.38 µs

RBW	3 MHz
VBW	10 MHz
DETECTOR	RMS
TRACE MODE	AVERAGE

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

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

```
Remote: CONF:CDP:MEAS PVT
```

```
Query of results:
```

```
CALC:MARK:FUNC:SUMM:MEAN:RES?
'read the mean power
```

```
TRAC:DAT? TRACE1
''512 points are returned  upon trace request
```

```
CALC:LIM1:FAIL?
'upper line failed
```

```
CALC:LIM2:FAIL?
'lower line failed
```

NO. OF HALFSLOTS

With the softkey *NO. OF HALFSLOTS* the number of halfslots for the averaging can be changed.

Default value is 100.

```
Remote: SENS:SWE:COUN <numeric_value>
```

RF: SLOT FULL/IDLE

The softkey *RF: SLOT FULL/IDLE* defines the expected signal: FULL slot or IDLE slot. Accordingly the limit lines and the borders for calculating the mean power are set. The lower and upper limit line are called `DOPVTFL`/`DOPVTFU` for FULL and `DOPVTIL`/`DOPVTIU` for IDLE mode. It is possible to change these lines with the standard limit line editor.

```
Remote: CONF:CDP:RFS FULL | IDLE
```

BURST FIT ON/OFF

The softkey BURST FIT ON/OFF is available if the RF: SLOT IDLE is selected.

With this softkey it is possible to activate an automatic burst alignment to the center of

the diagram. Default this burst fitting is *OFF*.

If active the burst fit algorithm searches the maximum and minimum gradient, between them the maximum peak is determined, and from this point the 7 dB down points are searched. If these are within plausible ranges the burst is centered in the screen, otherwise nothing will happen.

```
Remote: CONF:CDP:PVT:BURS:CENT ON | OFF
```

REFERENCE MEAN POWER, REFERENCE MANUAL, SET MEAN TO MANUAL

The standard asks for the sequence to first measure the FULL slot with the limit line relative to the mean power of the averaged time response. Therefore the softkey *REFERENCE MEAN POWER* in a FULL slot measurement should be selected. In this mode the mean power is calculated and the limit lines are relative to that mean power value. This value should be used also as the reference for the IDLE slot measurement. With the softkey *SET MEAN TO MANUAL* the current mean power value of the averaged time response is used to set as the fixed reference value for the limit lines. The mode is switched from *REFERENCE MEAN POWER* to *REFERENCE MANUAL*. Now the IDLE slot can be selected and the measurement sequence can be finished.

The manual mode can also be selected via the *REFERENCE MANUAL* softkey. Then a user defined value can be entered as the reference value for the limits.

```
Remote:   CALC:LIM:PVT:REF AUTO|MANUAL|ONCE
          CALC:LIM:PVT:RVAL <value> in dBm
```

RESTART ON FAIL

The function of the softkey *RESTART ON FAIL* will only take effect if the device is in *SINGLE SWEEP*.

Default this function is not active.

If switched on, at the end of the single sweep the limit line over all result is evaluated. The sweep will be restarted if this result is FAILED. If the result is MARGIN or PASSED the sweep is finished.

```
Remote: CONF:CDP:PVT:FRES ON | OFF
```

RESTORE STD LINES

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

```
Remote:  CALC:LIM:PVT:REST
```

LIST EVALUATION

The softkey *LIST EVALUATION* reconfigures the Power versus Time output to a split screen. In the upper half the trace with the limit lines is shown. In the lower half the average, maximum and minimum value list is shown. For every range of the PVT defined by the limit lines x-values the values are listed. If the measured value is not within the limit tolerance the results are colored in red, and a star is indicated at the end of the row, for indicating a fail on a black and white printout.

This function is available since version 4.20.

Start	Stop	Avg		Max		Min	
[μs]	[μs]	[dBm]	[dB]	[dBm]	[dB]	[dBm]	[dB]
0.000	319.335	-77.52	-53.03	-77.03	-52.54	-77.98	-53.49
319.335	326.335	-72.75	-48.26	-70.24	-45.75	-75.07	-50.58
326.335	506.995	-25.14	-0.65	-23.37	1.12	-69.36	-44.87 *
506.995	513.995	-25.22	-0.73	-24.55	-0.06	-26.36	-1.87
513.995	833.375	-60.50	-36.01	-24.02	0.47	-78.02	-53.53 *
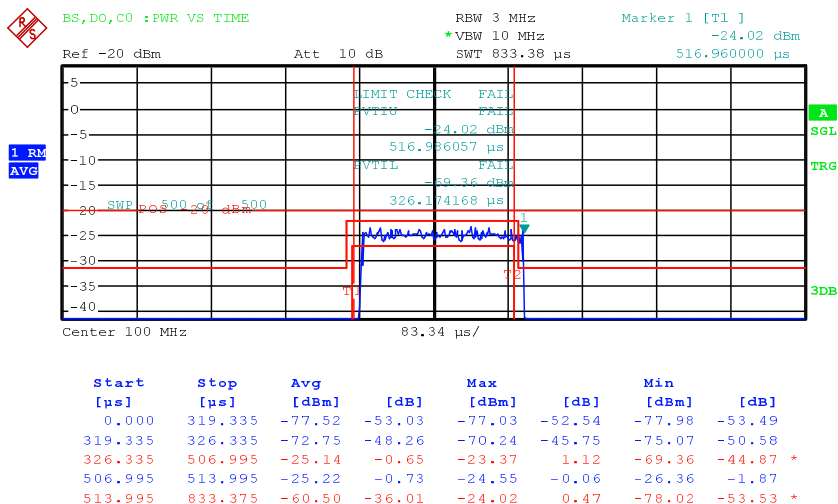
Remote: `CONF:CDP:BTS:PVT:LIST:STAT ON|OFF`

With this command the list evaluation which is off by default for backwards compatibility reasons can be turned on.

Remote: `CONF:CDP:BTS:PVT:LIST:RES?`

With this command the list evaluation results are queried in the following order:

<no>, <start>, <stop>,
<avg power abs>, <avg power rel >,
<max power abs>, <max power rel >,
<min power abs>, <min power rel >,
<limitcheck>, <unused1>, <unused2>

All results are float values.

no	range number
start	start time
stop	stop time
avg power abs	average absolute power in dBm
avg power rel	average relative power in dB (relative to mean power)
max power abs	average absolute power in dBm
max power rel	average relative power in dB (relative to mean power)
min power abs	average absolute power in dBm
min power rel	average relative power in dB (relative to mean power)
limit check	limit fail (pass = 0, fail =1)
unused1	reserved (0.0)
unused2	reserved (0.0)

6.8 Code-Domain Measurements on 1xEV-DO Signals

Application Firmware R&S FS-K84 makes a code domain analyzer available. With its help, the measurements called for in the 1xEV-DO specification in respect of the power of the different codes can be performed. In addition, the modulation quality (EVM and RHO factors), frequency error and trigger-to-frame time, and also peak code domain error are determined. Constellation analyses and bit stream analyses are similarly available. The calculation of the timing and phase offsets of the channels for the first active channel can be enabled (refer to the *TIME/PHASE* softkey). The observation period can be adjusted in multiples of the slot by means of the *CAPTURE LENGTH* softkey.

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

- Results that take the total signal into account over the whole period of observation
- Results that take the total signal into account over a slot
- Results that take a channel type (such as MAC) into account over the whole period of observation
- Results that take a channel type (such as MAC) into account over a slot
- Results that take a code in a channel type (such as MAC) into account over the whole period of observation
- Results that take a code in a channel type (such as MAC) into account over a slot

A slot with 1xEV-DO is a basic time unit of 1.666 ms duration and corresponds to the expression power control group (PCG) with CDMA2000. Every slot consists of two half-slots that are identically structured. Each half-slot contains 1024 chips, which are distributed as shown below according to the different channel types:
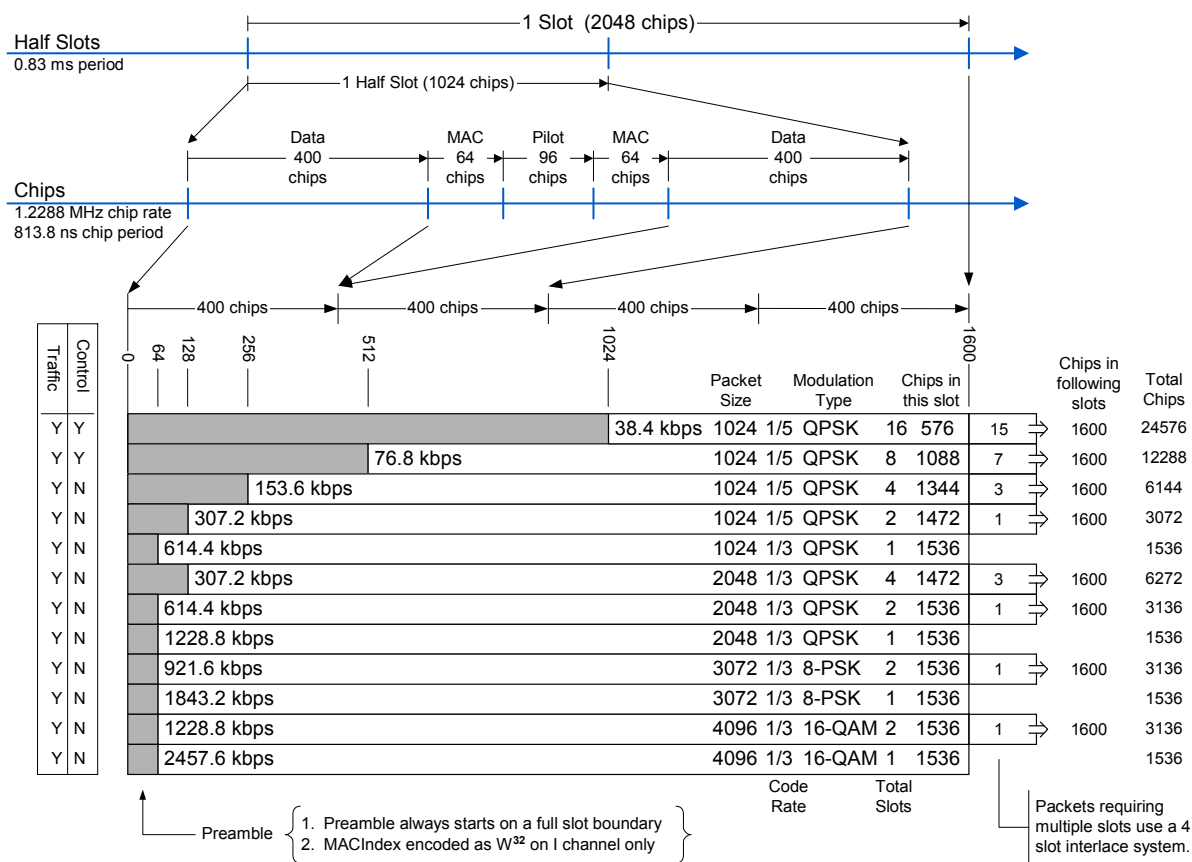
Half Slots — 0.83 ms period — 1 Slot (2048 chips) — 1 Half Slot (1024 chips)

Chips — 1.2288 MHz chip rate — 813.8 ns chip period

Data 400 chips — MAC 64 chips — Pilot 96 chips — MAC 64 chips — Data 400 chips

400 chips | 400 chips | 400 chips | 400 chips

Chip indices: 0, 64, 128, 256, 512, 1024, 1600

Traffic	Control	Data rate	Packet Size	Modulation Type	Code Rate	Total Slots	Chips in this slot	Following slots	Chips in following slots	Total Chips
Y	Y	38.4 kbps	1024	QPSK	1/5	16	576	15	1600	24576
Y	Y	76.8 kbps	1024	QPSK	1/5	8	1088	7	1600	12288
Y	N	153.6 kbps	1024	QPSK	1/5	4	1344	3	1600	6144
Y	N	307.2 kbps	1024	QPSK	1/5	2	1472	1	1600	3072
Y	N	614.4 kbps	1024	QPSK	1/3	1	1536			1536
Y	N	307.2 kbps	2048	QPSK	1/3	4	1472	3	1600	6272
Y	N	614.4 kbps	2048	QPSK	1/3	2	1536	1	1600	3136
Y	N	1228.8 kbps	2048	QPSK	1/3	1	1536			1536
Y	N	921.6 kbps	3072	8-PSK	1/3	2	1536	1	1600	3136
Y	N	1843.2 kbps	3072	8-PSK	1/3	1	1536			1536
Y	N	1228.8 kbps	4096	16-QAM	1/3	2	1536	1	1600	3136
Y	N	2457.6 kbps	4096	16-QAM	1/3	1	1536			1536

Preamble
1. Preamble always starts on a full slot boundary
2. MACIndex encoded as W^{32} on I channel only

Packets requiring multiple slots use a 4 slot interlace system.

Fig, 16 Slot structure, chip distribution and preamble lengths

From the slot structure it can be seen that with the 1xEV-DO forward link there are 4 channel types which are sent at exclusive times in the diagram shown above:

PILOT: The PILOT channel type comprises 96 chips and is located in the center of each half-slot. It must be present in the signal for the base station signal to be detected.
In the PILOT channel type, only the 0.32 channel on the I branch is active.[1]
With spreading factor 32, the BPSK-I and, hypothetically, BPSK-Q modulation are used. Hypothetically because no signal should be present on the Q branch.

MAC: The Medium Access Control channel type is 64 chips in front of and behind the PILOT. The MAC channel type contains the reverse activity (RA) channel and the MAC reverse power control (RPC) channels with which the power of the active terminals is controlled. The MAC indices described in the Standard MAC can be simply transformed into Walsh codes.
For further details refer to the chapter entitled "Relationship between

---

[1] The notation 0.32 means code number 0 at spreading factor 32 (code class 5, because 2^5=32)

Mac Index and Walsh Codes", starting on page 168.
The analysis for the MAC channel type takes place with spreading factor 64. There is BPSK-I and BPSK-Q modulation.

DATA: The DATA channel type is located with a length of up to 400 chips at the beginning and end of each half slot. The useful data proper are transmitted in it. As shown in the figure, there are packets that transmit their data distributed over 1, 2, 4, 8 or 16 slots, depending on the transmission rate. Initially, a PREAMBLE range is transmitted, being between 64 and 1024 chips long - followed by the data. If more than one slot is required for transmission, the other data of this data packet follow at intervals of four slots, then without another preamble. In the DATA channel type, QPSK, 8-PSK and 16-QAM modulation types are used. Analysis takes place with a spreading factor of 16.

PREAMBLE: As can be seen from the figure, the first 64 to 1024 chips of the DATA channel type are replaced at the beginning of a data packet by the PREAMBLE channel type. Depending on the transmission speeds being used and whether the start of data of the packet is missed, there are therefore preambles of different length in the signal. The application firmware detects the preambles automatically. If the PREAMBLE channel type is examined and there is no preamble in the signal, this is indicated by means of 'PREAMBLE MISSING'. Spreading factor 32 applies similarly to the PREAMBLE channel type as for the PILOT channel type. Again, only a BPSK-I modulated channel should occur, but with variable code number.

Depending on the result class, the customer sets the channel type, the slot number and the code number in order to obtain the results for the analyses he requires. In addition, mapping can be set. In this case it is necessary to specify whether just the I branch or just the Q branch or the complex signal consisting of I and Q should be analyzed. The Standard generally expects a separate Code Domain Power analysis for I and Q. The 'Mappings' column in the table below indicates which analyses in the application firmware work with the different mapping modes. For the analyses in which this is possible, there is the option of setting mapping itself and thus analyzing separately for I or Q, or of analyzing the signals as in Complex mode. For the Code Domain Power analysis, there are also the results across all slots demanded by the Standard, in addition to the slot-by-slot method of calculation.

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

The upper screen (screen A) displays analyses which vary by means of the codes. The lower screen (screen B) displays all other analyses.

Table 20 Overview of the analyses

Analyses on screen A	Code dimension			Time dimension		Mappings
	Total signal	One channel type		All slots	One slot	I or Q/ complex/ overview
		All codes	One code			
Code domain power		✓		✓ AVG ON	✓ AVG OFF	I or Q/ complex/ overview
Code domain error power		✓			✓	I or Q/ complex/ overview
Channel table	✓				✓	Not used

Analyses on screen B	Total signal	One channel type		All slots	One slot	I or Q/ complex/ overview
		All codes	One code			
GENERAL RESULTS	✓			✓	✓	Not used
Channel Results		✓	✓		✓	I or Q/ complex
Power versus Chip	✓				✓	Not used
Power versus symbol			✓		✓	I or Q/ complex
Composite EVM (modulation accuracy)	✓			✓		Not used
Composite constellation		✓			✓	Not used
Peak code domain error		✓		✓		I or Q/ complex
Symbol constellation			✓		✓	**DATA**: complex **Others**: I or Q/ complex
Symbol EVM			✓		✓	**DATA**: complex **Others**: I or Q/ complex
Bit stream			✓		✓	**DATA**: Complex **Others**: I or Q, complex

The number of results for the analyses depends with the Code Domain Power analysis, for example, on the spreading factor and with the Bit Stream analysis on the number of bits. At a chip rate of 1.2288 MHz, the symbol rate results as 1.2288MHz/spreading factor. The bit rate depends on how many bits describe a symbol in the modulation type being used. Due to the different PREAMBLE lengths, the DATA area is shortened depending on the PREAMBLE. All relationships can be seen in the table below:

Table 21 Relationship between symbol rate, spreading factor, number of symbols, number of bits, number of chips and channel type

Channel type	Spreading factor	Symbol rate	Modulation type	Chips per slot	Symbols per slot and code	Bits per slot and code	
						Mapping I or Q	Mapping complex
PILOT	32	38.4 ksps	BPSK-I or BPSK-Q	96*2 = **192**	6	6	12
MAC	Rev. 0 64	19.2 ksps	BPSK-I or BPSK-Q	64*4 = **256**	4	4	8
	Rev. A 128	9.6 ksps			2	2	4
PRE-AMBLE	Rev. 0 32	38.4 ksps	BPSK-I or BPSK-Q	Preamble length			
				64:	2	2	4
				128:	4	4	8
				256:	8	8	16
				512:	16	16	32
	Rev. A 64	19.2 ksps	BPSK-I or BPSK-Q	1024:	32	32	64
				64:	1	1	2
				128:	2	2	4
				256:	4	4	8
				512:	8	8	16
				1024:	16	16	32
DATA	16	76.8 ksps	QPSK, 8-PSK, 16-QAM	400*4-PreambleChips= **DataNettoChips**		Mapping always complex Modulation type:	
						QPSK / 8-PSK / 16-QAM	
				1600-0 = **1600**	100	200 / 300 / 400	
				1600-64 = **1536**	96	192 / 288 / 384	
				1600-128 = **1472**	92	184 / 276 / 368	
				1600-256 = **1344**	84	168 / 252 / 336	
				1600-512 = **1088**	68	136 / 204 / 272	
				1600-1024 = **576**	36	72 / 104 / 144	

The channel type for which a result has to be displayed is selected with the help of the *CHAN TYPE* softkey and the code number and the slot for which a result has to be displayed are selected *SELECT CODE* and *SELECT SLOT*. Let us assume that the MAC channel type, code 2.64 (Walsh code number 2 for spreading factor 64) and slot 1 have been selected. On screen A, the Code Domain Power analysis is relative and on screen B the symbol EVM analysis is active. Screen A will thus display the Code Domain Power analysis of slot 1 (with MAC the default setting of the Code Domain Power analysis is that the I branch is displayed). In this instance code 2.64 is shown selected in red. In the lower half of the screen, the EVM symbol for analysis of code 2.64 in slot 1 with, aptly, four values, one for each symbol, can be seen. Incidentally, the MAC reverse activity (RA) channel was examined in this example. In the 1xEV-DO system, it has MAC index 4 as a general rule, which is transmitted as described in the section on the "Relationship between Mac Index and Walsh Codes" (page 168) on the code 2.64 I branch.

The code domain analyzer can be operated in two modes. In CODE CHAN AUTOSEARCH mode it performs an automatic search for active channels in the whole code domain.

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

Messages:

The code domain analyzer expects the presence of pilot channel 0.32 in the PILOT channel type. If it is not detected because the center frequency or the signal level has not been set properly, or because the PN OFFSET or Q-INVERT or SIDE BAND INVERT do not match the signal, or because no valid signal has been applied, the 'SYNC FAILED' message is issued.

If the PREAMBLE channel type (*CHAN TYPE* softkey) is examined, signals may still be applied that do not exhibit a PREAMBLE channel type in every slot or the slot currently being examined. The reason for this is that the PREAMBLE is only ever transmitted in the first slot of a data packet. When signals are transmitted that are not identical in each slot but are repeated with reference to a trigger event, a repetitive measurement is possible by means of external triggering. Otherwise, each sweep produces a new result, which reflects the changing slot assignments.

For it to be possible to detect that, when the PREAMBLE channel type is selected, it is not present in the slot or, in the case of analyses working over all slots, it is not available in at least one of the slots, the 'PREAMBLE MISSING' message is issued.

For remote control, registers are available for these messages and can be interrogated in the status reporting system.

6.8.1 Presentation of analyses - RESULTS

The *RESULTS* hotkey opens the submenu for choosing the analysis. On the main menu, the most important analyses are offered for rapid access, and advanced analyses are available on the side menus.

CODE DOM POWER
CODE DOM ERROR
COMPOSITE EVM
PEAK CODE DOMAIN ERR
POWER VS CHIP
GENERAL RESULTS, CHANNEL RESULTS
CHANNEL TABLE
SYMBOL CONST
SYMBOL EVM
BITSTREAM
COMPOSITE CONST
POWER VS SYMBOL
CHAN TYPE
SELECT
ADJUST REF LVL

> **i** To go to the far side menu, press the NEXT hard key twice!

You can choose from the following analyses:

CODE DOM POWER	Code domain power analysis, depending on the CODE PWR ABS/REL softkey, in relative or absolute scaling.
CODE DOM ERROR	Code domain error power analysis
COMPOSITE EVM	Square difference between the test signal and ideal reference signal
GENERAL RESULTS	Tabulated general results
CHANNEL RESULTS	Tabulated results that do not refer to the channel type or the selected channel
CHANNEL TABLE	Channel occupancy table
PEAK CODE DOMAIN ERR	Projection of the error between the test signal and the ideal reference signal to the spreading factor of the channel type and subsequent summation over the symbols of each slot of the differential signal
POWER VS CHIP	Power of the total signal of a slot at chip level
POWER VS SYMBOL	Power of the selected channel and the selected slot over all symbols
BITSTREAM	Display of decided bits
COMPOSITE CONST	Composite constellation analysis
SYMBOL CONST	Symbol constellation analysis
SYMBOL EVM	Error vector magnitude analysis

The *CHAN TYPE* softkey opens a submenu for setting the channel type, mapping and the I/Q selection.

By entering a code number (*SELECT CODE* softkey), a channel can be selected for the SYMBOL CONST, SYMBOL EVM, BITSTREAM and POWER VS SYMBOL analyses.

Using the *SELECT SLOT* softkey, a slot can be selected for the CODE DOM POWER, CODE ERROR, CHANNEL TABLE, SYMB CONST, SYMBOL EVM, BITSTREAM, COMPOSITE CONST and POWER VS SYMBOL analyses.

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

---

The following user-specific settings are not modified on the first access following presetting:
     Level parameters
     Center Frequency + Frequency Offset
     Input Attenuation + Mixer Level

The following user-specific settings are transferred as follows:
     External trigger sources are retained, while all other trigger sources result in Free Run mode.
     Additional trigger settings are retained.

To restore adjusted level parameters, they are saved on exiting the code domain analyzer and reset on re-entering the code domain analyzer.

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

```
BS,DO,C1 :CODE POWER                    TYPE:    MAC-I

                                        Code     2.64
dB                   CF 1.93125 GHz     Slot        1
```

Fig, 17   ***Function fields of diagrams***

The meanings are as follows:

1st column:	Mobile radio system (base station 1xEV-DO)		`BS,DO`
	Band class (class 0-12) abbreviated	such as	`C1` for 1900 MHz Band
	Name of selected analysis:	such as	`CODE POWER`
	(blank line)		
	Unit of y axis	such as	`dB` for relative power
2nd column:	(blank line)		
	(blank line)		
	Center frequency of the signal:	such as	`CF 1.93125 GHz`
3nd column:	channel type and mapping:	such as	`TYPE:    MAC-I`

CHANNEL TYPE the channel type is specified as follows:

`ALL`	for analysis POWER VS CHIP/GENERAL RESULTS/COMP. EVM
`PILOT`	for channel type PILOT
`MAC`	for channel type MAC
`PREAMB`	for channel type PREAMB
`DATA`	for channel type DATA

MAPPING   the mapping is specified as follows: :
(No text)   for analysis entered as "not used" in Table 20 at mapping

`-IQ`   for analyses that only allow IQ mapping in Table 20 or channel type DATA, or Complex mapping

`-I`   or channel type DATA, or Complex mapping   A

`-Q`   or I or Q mapping and Q selection, or overview screen B

Walsh code and spreading factor of selected code:	for example	`Code 2.64`
Selected slot number		`Slot 1`

CODE DOM POWER

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

With the Code Domain Power analysis, allowance is made for one channel type over precisely one slot. The power values of the different codes are determined and plotted in a diagram. In this diagram, the x axis is the code number and the y axis is a logarithmic level axis. The number of codes on the x axis depends on the channel type. It can be set by means of the *CHAN TYPE* softkey. The slot needing to be analyzed

can be set by means of the *SELECT SLOT* softkey.

If the *CDP AVG* softkey is set to ON, an averaged analysis is performed over all included slots, not just over a single slot. The averaged analysis is called for by the Standard, but assumes with channel types DATA and PREAMBLE that preambles of different length do not occur in the slots.

The power of the channels is referred in the default setting to the total power in the selected channel type (such as MAC).

Apart from this relative display, there is also the option of specifying the absolute power. It can be enabled by means of the CODE PWR ABS/REL softkey. The unit of the y axis is dBm, accordingly, for absolute analysis and dB for relative analysis.

The power values of the active and unassigned codes are displayed in different colors:

● Yellow   active channel
● Cyan   inactive code

A channel in *CODE CHAN AUTOSEARCH mode* (Automatic Channel Search mode) is termed active when the minimum power entered by the user (refer to the *INACT CHAN THRESHOLD* softkey) is exceeded. In *CODE CHAN PREDEFINED* mode, each code channel contained in the user-defined channel table is identified as active.
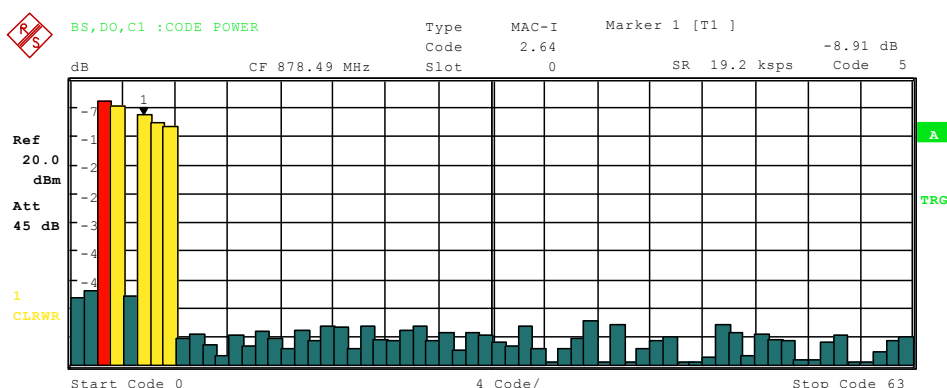
Fig, 18   CDP diagram for MAC-I

Mapping can also be set on the *CHAN TYPE* menu. An AUTO MODE is featured; it causes complex mapping to be analyzed separately for the DATA channel type and mapping for the I or Q branch to be analyzed separately for the other channel types. In the latter case the I/Q selection can be set by means of the *SELECT I/Q* softkey. For an overview of two code domain power measurement for separate analysis of the I and Q branches, there is similarly the *CODE DOM OVERVIEW* softkey on the *CHAN TYPE* menu, which can be used to switch to Overview mode. In Overview mode, the I branch is analyzed on screen A and the Q branch on screen B.
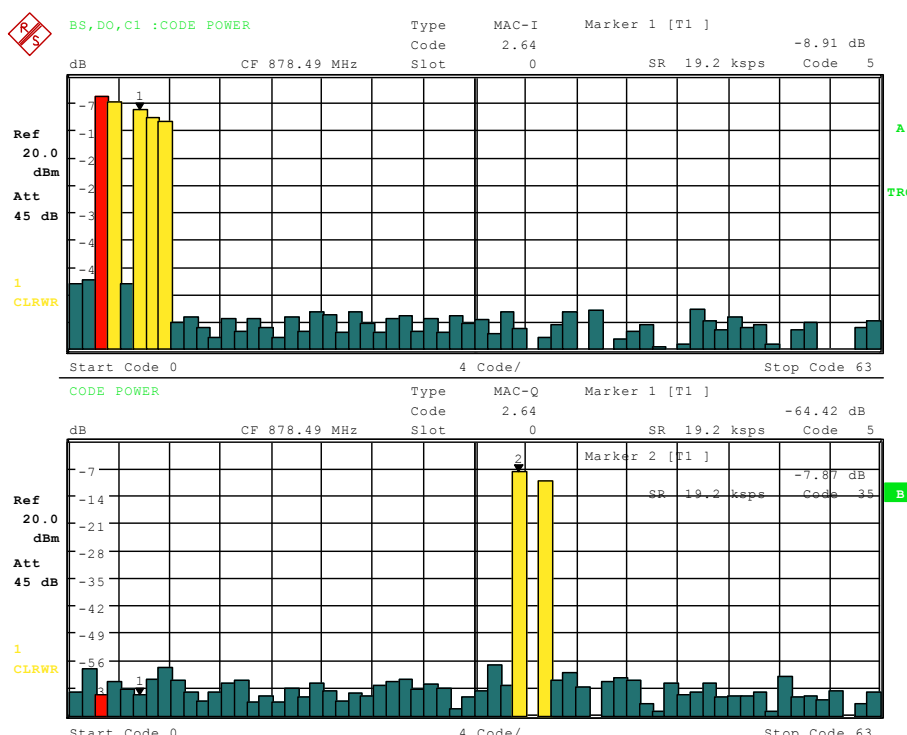
Fig, 19   CDP diagram in Overview mode for MAC

Another option for obtaining an overview of the CDP is to enable *MAPPING COMPLEX*, since the code domain power is then constantly displayed as a complex analysis on screen A for the selected channel type.
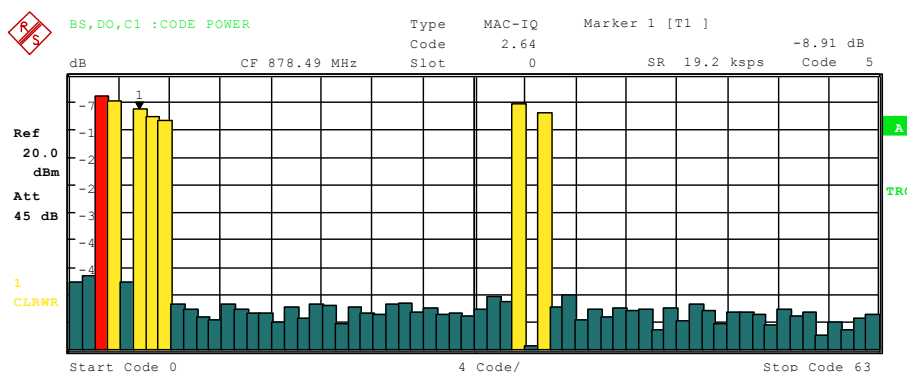

Fig, 20   CDP complex analysis diagram for MAC-IQ

If the DATA channel type is examined (not shown in these figures), it will be seen that the complex analysis is approximately 3 dB higher than the separate I or Q analysis. This is absolutely correct, for 50% of the power values are distributed to I and Q, respectively, for the complex modulation types of the DATA channel type.

By entering a code number (refer to the *SELECT CODE* softkey), a code can be highlighted for more detailed displays. The code is displayed in red.

The selection of more detailed analyses (such as SYMBOL CONSTELLATION) for unassigned codes is possible but not meaningful, since the results are not valid.

Remote: CALC<1>:FEED "XPOW:CDP:RAT" (relative)
   CALC<1>:FEED "XPOW:CDP" (absolute)
                                 CDP:OVER ON | OFF

CODE DOM ERROR

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

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

With the code domain error-power analysis, allowance is made for one channel type over precisely one slot and the error powers are determined for the different codes and plotted in a diagram. In this diagram, the x axis is the code number and the y axis is a logarithmic level axis, dB being the unit. The number of codes on the x axis depends on the channel type. It can be set by means of the *CHAN TYPE* softkey. The slot needing to be analyzed can be set by means of the *SELECT SLOT* softkey. Averaging over all slots, as with the Code Domain Power analysis, cannot be enabled.

The power values of the active and unassigned codes are displayed in different colors:

- Yellow   active channel
- Cyan   inactive code

A channel in *CODE CHAN AUTOSEARCH mode* (Automatic Channel Search mode) is termed active when the minimum power entered by the user (refer to the *INACT CHAN THRESHOLD* softkey) is exceeded. In *CODE CHAN PREDEFINED* mode, each code channel contained in the user-defined channel table is identified as active.
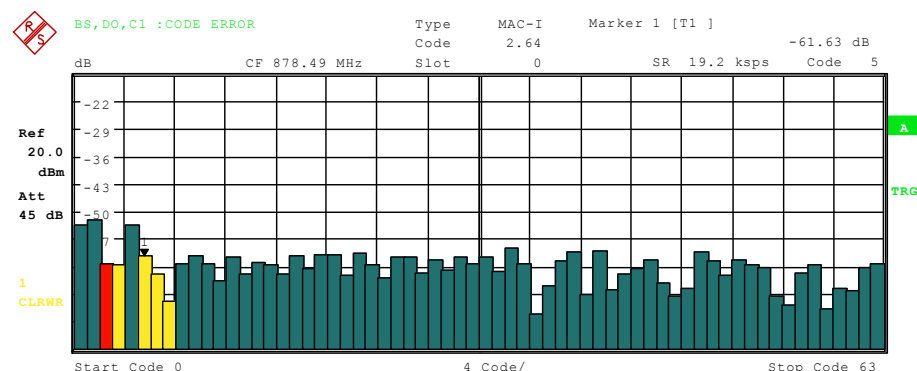
Fig, 21   CDEP-Diagramm for MAC-I

CHAN TYPE

Mapping can also be set on the *CHAN TYPE* menu. An AUTO MODE is featured; it causes complex mapping to be analyzed separately for the DATA channel type and mapping for the I or Q branch to be analyzed separately for the other channel types. In the latter case the I/Q selection can be set by means of the *SELECT I/Q* softkey. For an overview of two code domain error-power measurements for separate analysis of the I or Q branches, there is similarly the *CODE DOM OVERVIEW* softkey on the

CHAN TYPE menu, which can be used to switch to Overview mode. In Overview mode, the I branch is analyzed on screen A and the Q branch on screen B.

Another option for obtaining an overview of the CDEP is to enable *MAPPING COMPLEX*, since the code domain error power is then constantly displayed as a complex analysis on screen A for the selected channel type.

By entering a code number (refer to the *SELECT CODE* softkey), a code can be highlighted for more detailed displays. The code is displayed in red.

The selection of more detailed analyses (such as SYMBOL CONSTELLATION) for unassigned codes is possible but not meaningful, since the results are not valid.

```
Remote:    CALC<1>:FEED "XPOW:CDEP"
           CDP:OVER ON | OFF
```

COMPOSITE EVM

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

In the Composite EVM measurement, the square root is determined from the square of the error between the real and imaginary components of the test signal and of an ideally generated reference signal.

The measurement result consists of one composite EVM measurement value per slot. The number of slots can be set by means of the *CAPTURE LENGTH* softkey. Accordingly, the COMPOSITE EVM analysis takes into account the whole signal over the whole period of observation.

Only the channels detected as being active for this channel type are used to generate the ideal reference signal. In the case of a channel which is not detected as being active on account of, say, low power, the difference between the test signal and the reference signal and the composite EVM is therefore very large (refer to the figure).
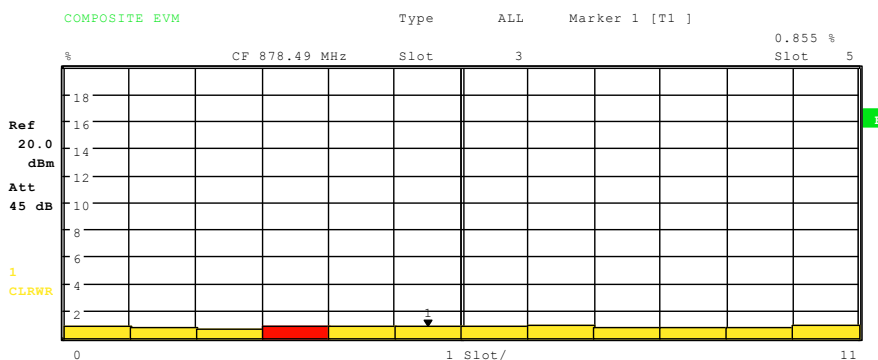
Fig, 22   Display of Composite EVM when all channels contained in the signal were detected as active
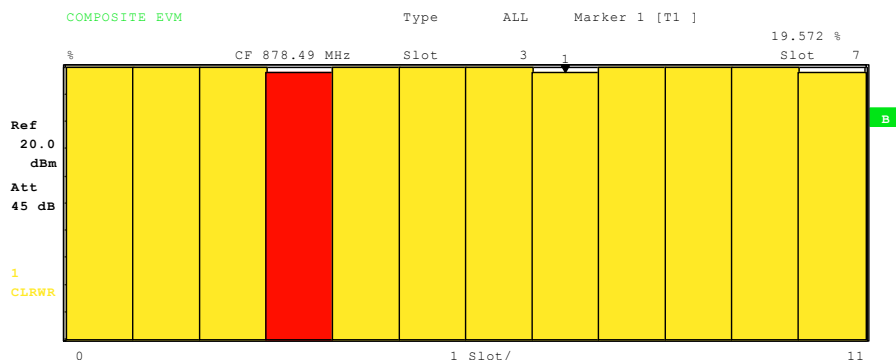
Fig, 23   Display of Composite EVM when one code channel was not detected as active

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

```
Remote: CALC2:FEED "XTIM:CDP:MACC"
```

PEAK CODE DOMAIN ERR

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

With the peak code domain-error measurement, there is a projection of the error between the test signal and the ideally generated reference signal to the spreading factor. The value of the spreading factor is automatically determined by the channel type (refer to Table 21). The unit on the y axis is dB.

The measurement result consists of a numerical value per slot for the peak code domain error. The number of slots can be set by means of the *CAPTURE LENGTH* softkey. Accordingly, the peak code domain-error analysis allows for a channel type over the whole period of observation.

Only the channels detected as being active are used to generate the ideal reference signal for the peak code domain error. If an assigned code is not detected as being active on account of low power, the difference between the test signal and the reference signal is very large. The R&S FS-K84 therefore displays a peak code domain error that is too high (refer to figure).
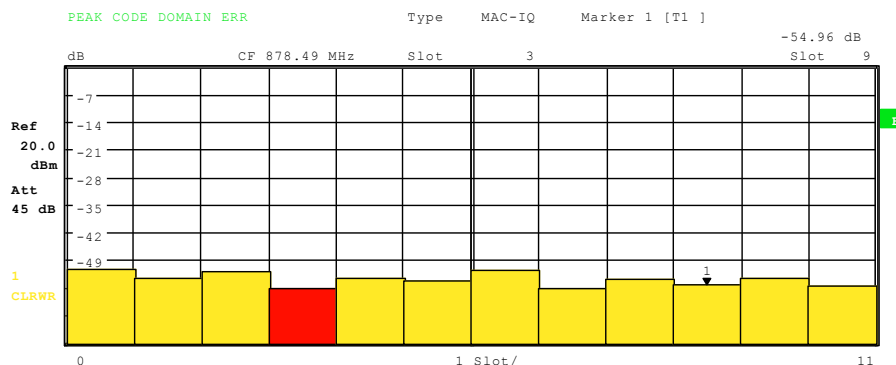

Fig, 24   Peak code domain error in the event of all channels contained in the signal being detected as active
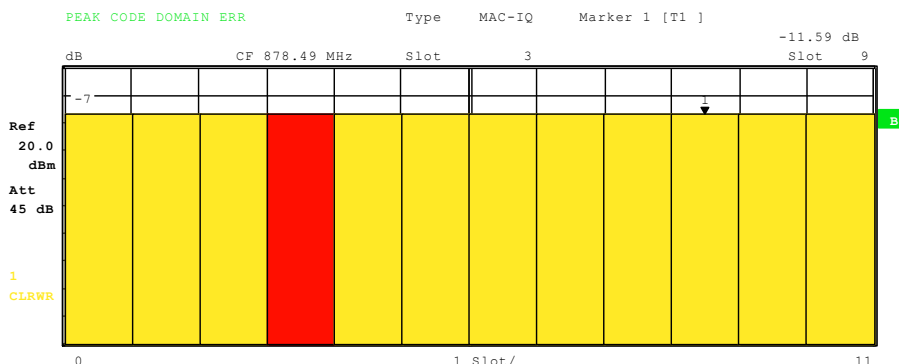
Fig, 25   Peak code domain error in the event of one channel not being detected as active

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

```
Remote: CALC2:FEED "XTIM:CDP:ERR:PCD"
```

POWER VS CHIP

The *POWER VS CHIP* softkey enables the power versus chip analysis.

The absolute power is displayed in dBm per chip time for the selected slot. There are thus 2048 power values as a trace. This analysis accordingly makes allowance for the total signal for the duration of one slot.

With the help of the Power versus Chip analysis, it is simple to identify which channel types in the slot have power on account of the symmetrical structure of the 1xEV-DO forward link signal (refer to the section "Code-Domain" on page 66).

The slot to be examined can be selected by means of the *SELECT SLOT* softkey.
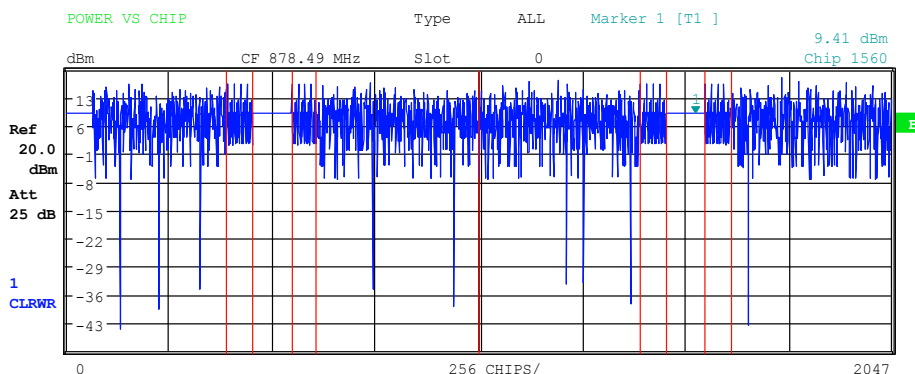
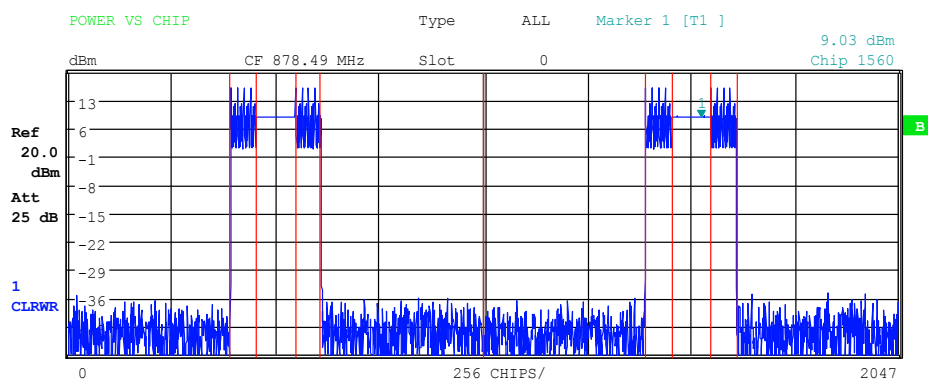***Fig, 26   Power versus Chip for all channel types active***

Fig, 27   Power versus Chip for IDLE Slot (only PILOT and MAC active)

Remote: `CALC2:FEED "XTIM:CDP:PVCH"`

GENERAL RESULTS, CHANNEL RESULTS

The *GENERAL RESULTS* and *CHANNEL RESULTS* softkeys feature the numerical analysis of the measurement results on two pages. The two pages are broken down as follows:
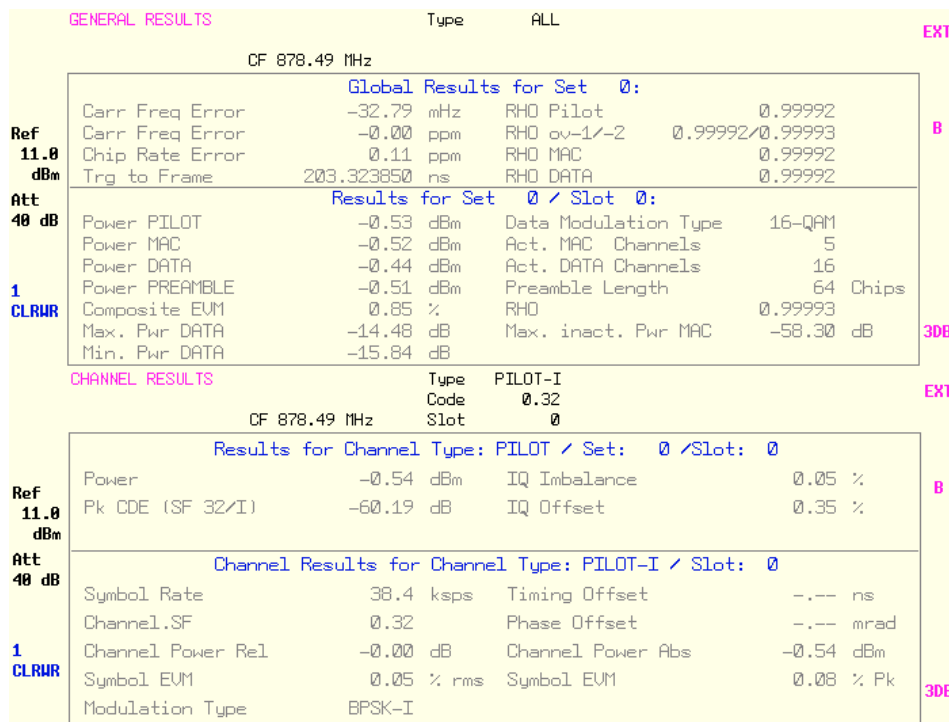

Fig, 28   General Results and channel results

The softkey *GENERAL RESULTS* shows a table of numerical results. With firmware version 4.x beside RHO Pilot also RHO MAC and RHO DATA are evaluated and shown. If all slots of the analyzed set of IQ data do only contain IDLE SLOTS the value of RHO DATA is 0.

The top part of GENERAL RESULTS presents global results that display the total signal over the whole period of observation (all slots):

Carrier Freq Error: Specifies the frequency error referred to the set center frequency of the analyzer. The absolute frequency error is the sum of the frequency error of the analyzer and that of the device under test.
Differences of more than 8.0 kHz between transmitter and receiver frequency impair the synchronization of the CDP measurement. If at all possible, the transmitter and the receiver should be synchronized (refer to the Getting Started chapter). The frequency error is available in Hz as the unit, on the one hand, and in ppm referred to the carrier frequency, on the other.

Chip Rate Error: Specifies the chip rate error (1.2288 Mcps) in ppm. A large chip rate error results in symbol errors and, consequently, possibly in the CDP measurement not being able to perform synchronization. This measurement result is also valid if the analyzer was not able to synchronize onto the 1xEV-DO signal.

Trigger to Frame: This measurement result reproduces the timing offset from the beginning of the acquired signal section until the start of the first slot. In the case of triggered data acquisition, this corresponds to the timing offset frame-trigger (+ trigger-offset) - start of the first slot. If the analyzer was not able to synchronize onto the 1xEV-DO signal, the value of Trg to Frame is not meaningful. If the *FREE RUN* trigger is selected, dashes (---) are displayed.

RHO Pilot: Specifies the RHO quality parameter for the area of the pilot channel calculated over all slots, as called for in the Standard.

RHO overall-1: Specifies the RHO quality parameter calculated for over all chips and over all slots, where the averaging limit is on the half-slot limit, as called for in the Standard.

RHO overall-2: Specifies the RHO quality parameter calculated for over all chips and over all slots, where the averaging limit is on the quarter-slot limit, as called for in the Standard.

RHOData: Read out values from IEC/IEEE bus.

RHOMac: Read out values from IEC/IEEE bus.

The bottom part of General Results shows results applicable to the selected slot (*SELECT SLOT*):

Power PILOT: Absolute power measurements in dBm in the PILOT channel type.

Power MAC: Absolute power measurements in dBm in the MAC channel type.

Power DATA: Absolute power measurements in dBm in the DATA channel type.

Power PREAMBLE:

Absolute power measurements in dBm in the PREAMBLE channel type.

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

Max./Min. Pwr DATA:

> The minimum and maximum DATA channel power, which is the smallest and highest value of the I- and Q-branch of the DATA channel type.

RHO:

> Specifies the RHO quality parameter calculated over a slot. (As in CDMA2000 BTS R&S FS-K82).

Max. inact. Pwr MAC:

> The maximum inactive MAC channel power, which is the highest inactive channel from the I- and Q-branch of the MAC channel type.

Data Modulation Type:

> Modulation type of the DATA channel type.

Act. MAC Channels:

> Number of active MAC channels.

Act. DATA Channels:

> Number of active DATA channels.

Preamble Length: Length of the preamble in chips, 0 if no preamble is present in this slot.

```
Remote: CALC1:MARK1:FUNC:CDP:BTS:RES? SLOT | PTOT | PPIC | RHO |
MACC | PCD | ACT | FERR | FERP | CERR | TFR I IQOF | IQIM | SRAT
| CHAN | SFAC | TOFF | POFF | CDP | CDPR | EVMR | EVMP | RHOP |
RHO1 | RHO2 | PPIL | PMAC | PDAT | PPR | MACT | DACT | PLEN |
MTYPe| DMTY | RHOD | RHOM | PDM | PDM | IPMM
```

The CHANNEL RESULTS analysis is subdivided into two halves. The top part displays results that depend on the selected channel type (CHAN TYPE softkey) and the selected slot:

Power:

> The total power of the channel type. This result is identical to one from the bottom half of General Results and is listed again, because the Channel Power Rel relative to this value is displayed from this point on.

Pk CDE:

> The *PEAK CODE DOMAIN ERR* measurement specifies a projection of the difference between test signal and ideal reference signal to the spreading factor that belongs to the channel type. This spreading factor is output in brackets.

IQ Imbalance: IQ imbalance of the signal in %

IQ Offset: DC offset of the signal in %

The lower part of CHANNEL RESULTS displays the results of measurements on the selected channel in the specified channel type and of the selected slot.

Symbol Rate: Symbol rate with which the channel is transmitted

Code.SF: Number of the code and its associated spreading factor

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

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

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

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

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

```
Remote: CALC2:FEED "XTIM:CDP:ERR:SUMM"

               CALC<1|2>:MARK<1>:FUNC:CDP[:BTS]:RES? RHO
               | MACC | PCD FERR | FERP | CERR | TFR I
               IQOF | IQIM | SRAT | CHAN1 | SFAC | TOFF
               | POFF | CDP | CDPR | EVMR | EVMP | RHOP
               | RHO1 | RHO2 | PPIL | PMAC | PDAT| PPR |
               MACT | DACT | PLEN | MTYP | DMT
```

CHANNEL TABLE

The *CHANNEL TABLE* softkey selects the Channel Occupancy Table analysis, in which all <u>active</u> channels are displayed.

The channel assignment table can theoretically contain 146 entries. One in the PILOT and one in the PREAMBLE channel type, 16 in the DATA channel type and theoretically 64 on the I and 64 on the Q branch of the MAC channel type. In reality, not more than 64 MAC codes should be assigned, since the Standard only provides for 64 MAC indices. The Channel Occupancy Table analysis makes allowance for the total signal over precisely one slot. The slot needing to be analyzed can be set by means of the *SELECT SLOT* softkey.

The channels are listed in the following channel type order: PILOT, MAC, PREAMBLE, DATA. Within the channel types, the channels are sorted in ascending code number order.

```
       BS,DO,C0 :CHANNEL TAB          Type    MAC-I
                                      Code    2.64  Max T    1.57 ns   @  MAC  5.64
                          CF 878.49 MHz   Slot      0  Max Ph   3.37 mrad @  MAC 37.64
```

	Type	Chan.SF	Symb Rate ksps	Modulation	Pwr Abs dBm	Pwr Rel dB	T Offs ns	Ph Offs mrad	
Ref	PILOT	0.32	38.4	BPSK-I	-0.76	-0.00	0.00	0.00	**A**
10.0	MAC	2.64	19.2	BPSK-I	-6.71	-5.91	0.00	0.00	**SGL**
dBm	MAC	3.64	19.2	BPSK-I	-7.70	-6.91	-0.84	2.21	
	MAC	5.64	19.2	BPSK-I	-9.71	-8.91	1.57	-2.20	**TRG**
Att	MAC	6.64	19.2	BPSK-I	-11.72	-10.92	0.86	-2.23	
40 dB	MAC	7.64	19.2	BPSK-I	-12.72	-11.92	-0.78	3.33	
	MAC	35.64	19.2	BPSK-Q	-8.67	-7.87	0.88	2.15	
	MAC	37.64	19.2	BPSK-Q	-10.68	-9.88	0.65	3.37	
1	PRE64	7.32	38.4	BPSK-I	-0.79	-0.00	0.00	0.00	
CLRWR	DATA	0.16	76.8	8-PSK	-12.83	-12.04	0.00	0.00	
	DATA	1.16	76.8	8-PSK	-12.83	-12.05	0.16	1.87	
	DATA	2.16	76.8	8-PSK	-12.82	-12.03	0.49	-0.19	

Fig, 29   *Channel table*

The following parameters are determined for the channels:

Type: Specifies the channel type of the active channel. Possible values are PILOT, MAC and DATA. For the PREAMBLE channel, the length in chips is similarly specified, thus resulting in the following options for the PREAMBLE channel type: PRE64, PRE128, PRE256, PRE512 or PRE1024.

Chan.SF: The number of the Walsh code of the active channel including spreading factor. The spreading factor depends on the channel type.

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

Modulation/mapping:

                        The DATA channel type can contain QPSK, 8-PSK or 16-QAM modulated channels; there is BPSK-I or BPSK-Q modulation for the other channel types.

Pwr Abs / Rel: Specification of the absolute and relative power (referred to the total power in the channel type) of the channel.

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

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

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

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

```
Remote: CALC1:FEED "XTIM:CDP:ERR:CTAB"
```

SYMBOL CONST

The *SYMBOL CONST* softkey selects the analysis of the constellation diagram at symbol level.

Analysis of the symbols is performed for the selected code (*SELECT CODE* softkey) in the set channel type (*CHAN TYPE* softkey) and the selected slot (*SELECT SLOT* softkey). This means that this analysis makes allowance for results of a code in the selected channel type for one slot. The number of symbols on the x axis is between 2 and 100 (refer to Table 21). Evaluation of the constellation diagram is possible for unassigned codes, but the results are meaningless since unassigned code channels do not contain data.
For orientation, the unit circle is added to the figure.
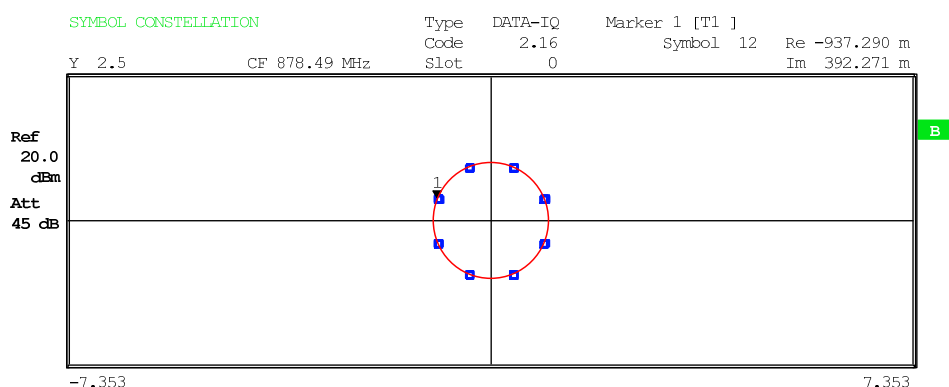
Fig, 30 Symbol constellation diagram

```
Remote: CALC2:FEED "XTIM:CDP:SYMB:CONS"
```

SYMBOL EVM

The *SYMBOL EVM* softkey selects the analysis for the symbol error vector magnitude. Analysis of the EVM is performed for the selected code (*SELECT CODE* softkey) in the set channel type (*CHAN TYPE* softkey) and the selected slot (*SELECT SLOT* softkey). This means that this analysis makes allowance for results of a code in the selected channel type for one slot. The number of symbols on the x axis is between 2 and 100 (refer to Table 21). Evaluation of the symbol error vector magnitude for unassigned codes is possible, but the results are not valid.
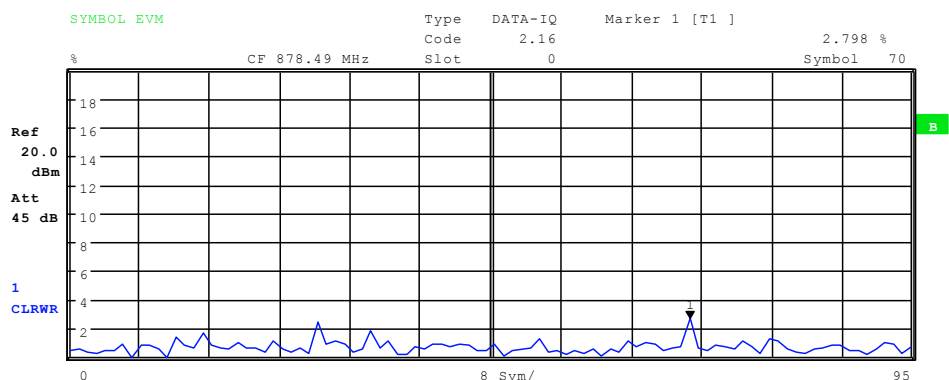

Fig, 31   Error vector magnitude for one slot of a channel

```
Remote: CALC2:FEED "XTIM:CDP:SYMB:EVM"
```

BITSTREAM

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

Analysis of the different bits is performed for the selected code (*SELECT CODE* softkey) in the set channel type (*CHAN TYPE* softkey) and the selected slot (*SELECT SLOT* softkey). This means that this analysis makes allowance for results of a code in the selected channel type for one slot .

Depending on the symbol rate of the channel type and on the number of chips of the channel type, and also on the modulation type, a minimum of 4 and a maximum of 400 bits can be contained in a slot; refer to Table 21 on page 70. With QPSK modulated channels, one symbol always consists of two bits; with 8-PSK the number is three bits 3 and with 16-QAM it is four bits. With BPSK modulated channels, a symbol consists of one bit (either the I component or the Q component is assigned; for complex analysis a 2BPSK is displayed with I and Q components).).
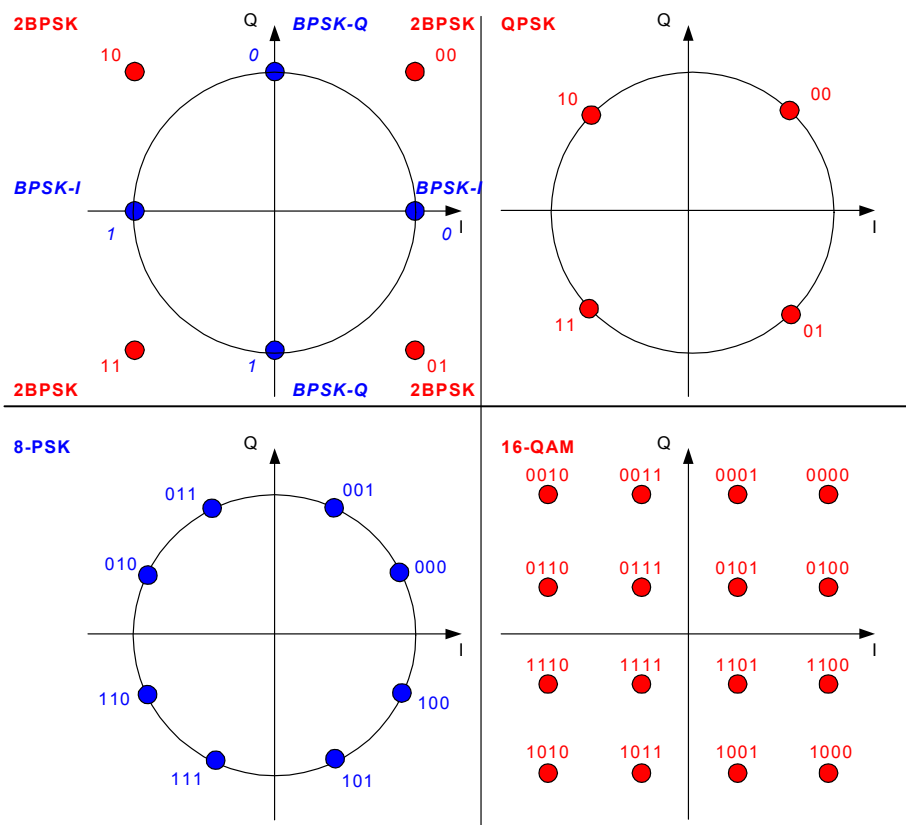
Fig, 32   Constellation diagrams for BPSK, QPSK, 8-PSK and 16-QAM including bit values

Depending on the channel type, there are the following modulated channels in the 1xEV-DO system:

Table 22 Relationship between channel type and modulation type

Channel type	Modulation
PILOT	BPSK-I
MAC	BPSK-I / BPSK-Q
PREAMBE	BPSK-I
DATA	QPSK / 8-PSK / 16-QAM

An analysis of the bit stream for unassigned codes is indeed possible, but since the results are not meaningful on account of the missing data, all bits are identified as invalid in this case by '-'.
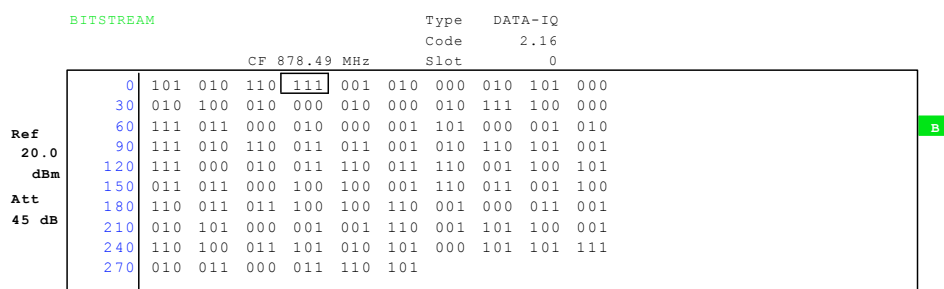The marker can be used to scroll in the bit stream.

Fig, 33 Demodulated bits for a slot of a channel in the channel type

```
Remote: CALC2:FEED "XTIM:CDP:BSTR"
```

COMPOSITE CONST

The *COMPOSITE CONST* softkey selects the analysis of the constellation diagram at chip level.
With the COMPOSITE CONST, the total signal is taken into account by means of the selected channel type over the selected slot (*SELECT SLOT* softkey).

A constellation point is plotted for each chip in the diagram. The number of chips depends on the selected channel type and, in the case of PREAMBLE and DATA, on the length of the preamble and can vary between 64 and 1600 chips.

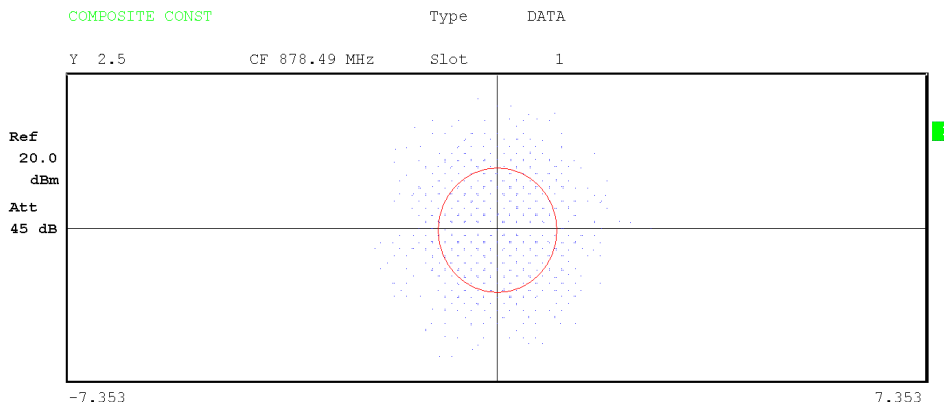For orientation, the unit circle is added to the figure.

Fig, 34   Composite constellation diagram

```
Remote: CALC2:FEED "XTIM:CDP:COMP:CONS"
```

POWER VS SYMBOL

The *POWER VS SYMBOL* softkey selects the Power versus Symbol analysis. The analysis outputs the absolute power in dBm at each symbol time for the selected code (*SELECT CODE* softkey) in the set channel type (*CHAN TYPE* softkey) and the selected slot (*SELECT SLOT* softkey). This means that this analysis makes allowance for results of a code in the selected channel type for one slot . The number of symbols on the x axis is between 2 and 100 (refer to Table 21).
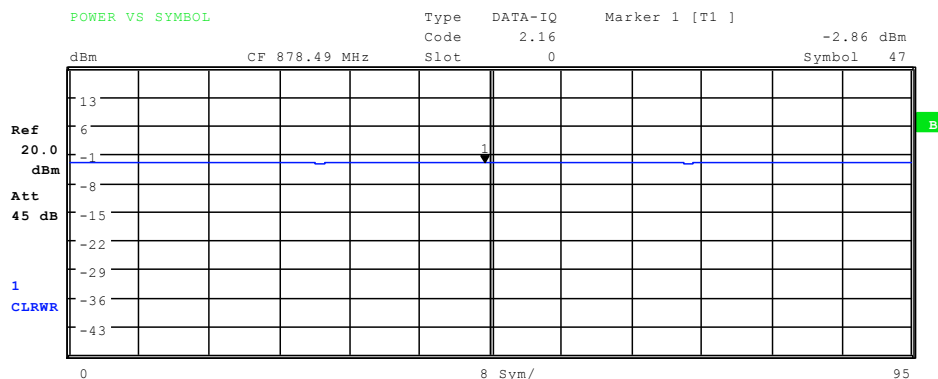
Fig, 35   Power versus Symbol for one slot of a channel in the channel type

```
Remote: CALC2:FEED "XTIM:CDP:PVSY"
```

SELECT

The *SELECT* softkey opens a submenu to define the capture configuration and the selection of the slot and channel for the evaluation.

CAPTURE LENGTH
SET TO COUNT, SET TO ANALYZE
CHAN TYPE
SELECT CODE
SELECT SLOT

CAPTURE LENGTH

The *CAPTURE LENGTH* softkey allows entry of the number of slots to be acquired. The input is always made as a multiple of the slot. The range is between 2 and 36 for the Analyzers R&S FSU/R&S FSQ and from 2 to 12 for the Analyzer R&S FSP. For all analyses that exhibit a value per slot on the x axis the maximum value on the x axis is the set CAPTURE LENGTH -1.

```
Remote: [SENS:]CDP:IQL 2..36 (2..12)
```

SET TO COUNT, SET TO ANALYZE

This function offers the possibility for the **R&S FSQ** to capture up to 1824 slots (more than 3 seconds) with a SINGLE SWEEP and then post process all the data with *SET TO ANALYZE*.

SET COUNT is set to 1 (default value), the device behaves as before and with the *CAPTURE LENGTH* the number of slots can be set.

For R&S FSQ the *SET COUNT* can be adjusted in the range of 1…57. Is the *SET COUNT* greater than 1 the *CAPTURE LENGTH* will be implicitly set to 32 slots and become unavailable. The *SET COUNT* defines then how many SETS of 32 slots shall be captured consecutively into the IQ RAM of the R&S FSQ. With the *SET TO ANALYZE* softkey the set for which the results are calculated can be defined. The range is from 0...(SET COUNT-1).

```
Remote:  SENS:CDP:SET:COUN 1..57 (R&S FSQ)
         SENS:CDP:SET:VAL <numeric_value>
```

CHAN TYPE

By operating the *CHAN TYPE* softkey*, you go to a submenu* on which you can set the following parameters:

● Channel type: PILOT, MAC, PREAMBLE or DATA
● Code Domain Overview mode can be enabled/disabled
● Mapping mode: AUTO, COMPLEX or I OR Q (whether I or Q branch is analyzed)
● SELECT I/Q: With separate I OR Q analysis, this determines which branch will be displayed.

On the second line of the *CHAN TYPE* softkey, the setting performed in the submenu is shown in its short form. Precise details of this softkey are provided on page 102.
```
Remote: SENS:CDP:CTYP PIL | MAC | PRE | DATA
```

SELECT CODE

You can use the *SELECT CODE* softkey to select a code. All analyses that take the results for a code into account specify the results for the newly selected channel: POWER VS SYMBOL, CHANNEL RESULTS, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM.

In the analyses CODE DOMAIN POWER, CODE DOMAIN ERROR POWER and CHANNEL TABLE (all on screen A), the selected code is identified in red to distinguish it.

Codes are entered in decimal format.

The rotating wheel behavior depends on the analysis on screen A and is geared to the graphic display. With CODE DOMAIN POWER and CODE DOMAIN ERROR POWER, it is always the adjacent channel that is selected. With the channel table, the rotating wheel is used to scroll through the list. In this instance, the channel type and the selection of I or Q are reset automatically if this is required by the new channel that has to be selected.

The maximum settable value depends on the spreading factor of the channel type. PILOT, PREAMBLE: 0..31, MAC: 0..63 and DATA 0.63.

```
Remote: SENS:CDP:CODE 0...31 | 63 | 15,
```
                        (depending on the channel type)

SELECT SLOT

The *SELECT SLOT* softkey is used to select a slot. Slots are entered in decimal format. In this instance the range of values is from 0 to (Capture-Length-1); refer to the *CAPTURE LENGTH* softkey. All analyses that take the results for a slot into account specify the results for the newly selected slot: (CODE DOMAIN POWER, CODE DOMAIN ERROR POWER, CHANNEL TABLE, POWER vs CHIP, POWER vs SYMBOL, COMPOSITE CONSTELLATION, GENERAL RESULTS, CHANNEL RESULTS, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM).

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

```
Remote: SENS:CDP:SLOT 0 ... (CAPTURE_LENGTH-1)
```

ADJUST REF LVL

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

```
Remote: SENS:POW:ACH:PRES:RLEV
```

6.8.2 Measurement configuration

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

CODE CHAN AUTOSEARCH
CODE CHAN PREDEFINED
EDIT CHAN CONF TABLE
HEADER/VALUES
INSERT MAC
INSERT PREAMBLE
DELETE LINE
MEAS CHAN CONF TABLE
SAVE TABLE
SORT TABLE
NEW CHAN CONF TABLE
DEL CHAN CONF TABLE
COPY CHAN CONF TABLE
RESTORE STD TABLES

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

```
Remote: CONF:CDP:BTS:CTAB:CAT?
```

CODE CHAN AUTOSEARCH

The *CODE CHAN AUTOSEARCH* softkey supports measurements of the code domain power analyzer in Autosearch mode. In this mode, all channel types are searched according to their spreading factors for active channels. A channel is active when the minimum power, referred to the total power, entered by the user is exceeded (refer to the *INACT CHAN THRESHOLD* softkey).

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

```
Remote: CONF:CDP:BTS:CTAB[:STAT] OFF
```

CODE CHAN PREDEFINED

The *CODE CHAN PREDEFINED* softkey switches the CDP analysis to the measuring mode with the help of predefined channel tables. In this mode, there is no search for active channels, but the channels of a channel table defined before the measurement are assumed to be active.

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

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

When the R&S FS-K84 leaves the factory, the following channel tables are stored on the measuring instrument:

- Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type QPSK in channel type DATA. (File name: DOQPSK).
- Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type 8-PSK in channel type DATA (File name DO8PSK).
- Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type 16-QAM in channel type DATA. (File name DO16QAM).
- Channel table with channel types PILOT/MAC - known as IDLE slot, since it does not contain any active channels in the DATA channel type. (File name DO_IDLE).

For a precise definition of the channel tables refer to Chapter

```
Remote:  CONF:CDP[:BTS]:CTAB[:STAT] ON
         CONF:CDP[:BTS]:CTAB:SEL "DOQPSK"
```

EDIT CHAN CONF TABLE

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

EDIT CHANNEL TABLE					
NAME:	DO16QAM				
COMMENT:	Base Station Main 2457.6 kbps (1 Slot) 16-QAM				
TYPE	CHAN.SF	SYMBOL RATE [ksps]	MODULATION/ MAPPING	CDP REL [dB]	STATUS
PILOT	0.32	38.4	BPSK-I	0.0	ACTIVE
MAC	2.64	19.2	BPSK-I	0.0	ACTIVE
MAC	3.64	19.2	BPSK-I	0.0	ACTIVE
MAC	4.64	19.2	BPSK-I	0.0	ACTIVE
MAC	34.64	19.2	BPSK-Q	0.0	ACTIVE
MAC	35.64	19.2	BPSK-Q	0.0	ACTIVE
PRE64	2.32	38.4	BPSK-I	0.0	ACTIVE
DATA	0.16	76.8	16-QAM	0.0	ACTIVE
DATA	1.16	76.8	16-QAM	0.0	ACTIVE
DATA	2.16	76.8	16-QAM	0.0	ACTIVE
DATA	3.16	76.8	16-QAM	0.0	ACTIVE
DATA	4.16	76.8	16-QAM	0.0	ACTIVE
DATA	5.16	76.8	16-QAM	0.0	ACTIVE
DATA	6.16	76.8	16-QAM	0.0	ACTIVE
DATA	7.16	76.8	16-QAM	0.0	ACTIVE
DATA	8.16	76.8	16-QAM	0.0	ACTIVE
DATA	9.16	76.8	16-QAM	0.0	ACTIVE
DATA	10.16	76.8	16-QAM	0.0	ACTIVE
DATA	11.16	76.8	16-QAM	0.0	ACTIVE
DATA	12.16	76.8	16-QAM	0.0	ACTIVE
DATA	13.16	76.8	16-QAM	0.0	ACTIVE
DATA	14.16	76.8	16-QAM	0.0	ACTIVE
DATA	15.16	76.8	16-QAM	0.0	ACTIVE

Fig, 36　Table for editing a channel configuration

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

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

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

If the CHAN parameter of a channel is modified, a check of the code domain conflicts is performed after pressing the input (units keys). If a code domain conflict is detected, the associated channels are identified by an asterisk. You are given the opportunity of eliminating the code domain conflicts. When a table with code domain conflicts is used for a CDP analysis, the results are invalid.

HEADER/VALUES

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

Editing the table header (*HEADER*):

Overwriting of saved tables can be avoided by changing the name of a table. A table name must not consist of more than 8 characters.

```
Remote: CONF:CDP:BTS:CTAB:NAME "NEW_TAB"
```

Editing table entries (VALUES):

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

TYPE:	Defines the channel type, either PILOT, MAC, PRE64, PRE128, PRE256, PRE512, PRE1024 or DATA. With the PREAMBLE channel type, the length of the preamble is entered simultaneously in chips. The entry cannot be edited, because the PILOT channel and the 16 DATA channels are always available, and MAC and PREAMBLE can be inserted by means of the *INSERT* softkeys.
CHAN.SF:	The channel number is entered for the channel in this column. The spreading factor is inserted automatically depending on the channel type (refer to Table 21). Invalid entries are rejected.
SYMBOL RATE:	Symbol rate with which the channel is transmitted. It depends directly on the spreading factor of the channel type (refer to Table 21) and cannot therefore be edited.
MODULATION:	The modulation type is entered here. With channel types PILOT, MAC and PREAMBLE, mapping is specified too - that is, whether a channel will transmit on the I or Q branch. The following settings are possible:

PILOT:	BPSK-I (permanent, edit not possible)
MAC:	BPSK-I / BPSK-Q
PREAMBLE:	BPSK-I / BPSK-Q
DATA:	QPSK / 8-PSK / 16-QAM

CDP REL.:	Informative entry of the relative channel power (referred to the total power in the channel type). The entry cannot be edited and only exists for the *RECENT* table; it is used to detect channels with low power.
STATUS:	Status of the channel (active/inactive). When a change of channel status occurs, a channel that has been entered in the table can be hidden in the Code Domain Power analysis without having to remove the corresponding entry from the table. Only channels having an "active" channel status are used for the CDP analysis.

```
Remote:
CONF:CDP:CTAB:DATA 0,5,0,0,0,0,1,0.0,1,6,35,1,0,0,1,0.0"
'Selects PILOT 0.32 BPSK-I and MAC 35.64 BPSK-Q.
CONF:CDP [:BTS]:CTAB:COMM "Comment for new table"
```

INSERT MAC

The *INSERT MAC* softkey adds a new entry to the table. Entries can be made in any order.

Remote: -- ((integrated in the :CONF:CDP[:BTS]:CTAB:DATA command

INSERT PREAMBLE

The *INSERT PREAMBLE* softkey makes it possible to add the Preamble channel to the channel table.

Fig, 37   Table of Preamble selection

Remote: -- ((integrated in the :CONF:CDP[:BTS]:CTAB:DATA command)

DELETE LINE

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

Remote: --

MEAS CHAN CONF TABLE

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

Remote: --

SAVE TABLE

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

> **Note:**
>
> Editing of the channel models and saving with the original name results in the models being overwritten.

Remote: -- (automatic with remote control)

SORT TABLE

The *SORT TABLE* softkey sorts the table according to channel types (PILOT, MAC, PREAMBLE, and DATA) and in channel number order within the channel types.

Remote: --

NEW CHAN CONF TABLE

The *NEW CHAN CONF TABLE* softkey opens a submenu that is identical with that described for the *EDIT CHAN CONF TABLE* softkey. Unlike *EDIT CHAN CONF TABLE*, a new channel table with the PILOT channel type and channel 0.32 and the 16 DATA channel types for *NEW CHAN CONF TABLE*. The name of the table has still not been fixed at present:

TYPE	CHAN.SF	SYMBOL RATE [ksps]	MODULATION/ MAPPING	CDP REL [dB]	STATUS
			EDIT CHANNEL TABLE		
NAME:					
COMMENT:					
PILOT	0.32	38.4	BPSK-I	0.0	ACTIVE
DATA	0.16	76.8	16-QAM	0.0	ACTIVE
DATA	1.16	76.8	16-QAM	0.0	ACTIVE
DATA	2.16	76.8	16-QAM	0.0	ACTIVE
DATA	3.16	76.8	16-QAM	0.0	ACTIVE
DATA	4.16	76.8	16-QAM	0.0	ACTIVE
DATA	5.16	76.8	16-QAM	0.0	ACTIVE
DATA	6.16	76.8	16-QAM	0.0	ACTIVE
DATA	7.16	76.8	16-QAM	0.0	ACTIVE
DATA	8.16	76.8	16-QAM	0.0	ACTIVE
DATA	9.16	76.8	16-QAM	0.0	ACTIVE
DATA	10.16	76.8	16-QAM	0.0	ACTIVE
DATA	11.16	76.8	16-QAM	0.0	ACTIVE
DATA	12.16	76.8	16-QAM	0.0	ACTIVE
DATA	13.16	76.8	16-QAM	0.0	ACTIVE
DATA	14.16	76.8	16-QAM	0.0	ACTIVE
DATA	15.16	76.8	16-QAM	0.0	ACTIVE

Fig, 38 Creating a new channel configuration

DEL CHAN CONF TABLE

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

```
Remote:  CONF:CDP:BTS:CTAB:DEL
```

COPY CHAN CONF TABLE

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

```
Remote:  CONF:CDP:BTS:CTAB:COPY "CTAB2"
```

RESTORE STD TABLES

The *RESTORE STD TABLES* softkey restores the channel tables defined in Chapter 4, "Predefined Channel Tables", to the state in which they were in when the device left the factory. In this way unintentional overwriting of the channel table can be undone.

```
Remote:  CONF:CDP:BTS:CTAB:REST
```

6.8.3 Configuring the firmware application - SETTINGS

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

BAND CLASS
REVISION 0/A
PN OFFSET
CAPTURE SETTINGS
INACT CHAN THRESHOLD
CHAN TYPE MAC-I
CODE PWR ABS/REL
CDP AVG ON/OFF
TIME/PHASE ON/OFF
MULTI CARRIER
INVERT Q
SIDEBAND NORM / INV
NORMALIZE ON / OFF

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

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

The softkeys *CAPTURE SETTINGS* and *MULT CARRIER* are leading in the submenus as shown in the drawing on the right.

BAND CLASS

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

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


```
            BAND CLASS SELECTION
     Band Class  0 (800 MHz Band)
   √ Band Class  1 (1900 MHz Band)
     Band Class  2 (TACS Band)
     Band Class  3 (JTACS Band)
     Band Class  4 (Korean PCS Band)
     Band Class  5 (450 MHz Band)
     Band Class  6 (2 GHz Band)
     Band Class  7 (700 MHz Band)
     Band Class  8 (1800 MHz Band)
     Band Class  9 (900 MHz Band)
     Band Class 10 (Secondary 800 MHz Band)
     Band Class 11 (400 MHz European PAMR Band)
     Band Class 12 (800 MHz PAMR Band)
     Band Class 14 (US PCS 1.9GHz Band)
     Band Class 15 (AWS Band)
```

Fig, 39   Band class selection

You can scroll in the table, and the entry currently being used is checked, while a bar displays the selected entry; click ENTER to apply the value.

The numerical value is specified over the IEC/IEEE bus.

```
Remote: CONF:CCDP:BCL <band_class>
```

REVISION 0/A

The softkey *REVISION 0/A* allows to define whether a revision 0 (subtype 0/1) signal or a revision A (subtype 2) signal is analyzed.

In the default mode (revision 0) the analysis software behaves unchanged. With firmware version 3.90 the revision A mode can be selected.

In revision A the number of active users is increased. Therefore the spreading factor (number of orthogonal codes) is doubled within the channel type MAC and the channel type PREAMBLE. See table below:

Table 23Relationship between symbol rate, spreading factor, number of symbols, number of bits, number of chips and channel type

Channel type	Spreading factor	Symbol rate	Modulation type	Chips per slot	Symbols per slot and code	Bits per slot and code		
PILOT	32	38.4 ksps	BPSK-I or BPSK-Q	96*2 = 192	6	Mapping I or Q 6	Mapping complex 12	
MAC	Rev. 0 64 Rev. A 12 8	19.2 ksps 9.6 ksps	BPSK-I or BPSK-Q	64*4 = 256	4 2	4 2	8 4	
PRE-AMBLE	Rev. 0 32	38.4 ksps	BPSK-I or BPSK-Q	Preamble length 64: 128: 256: 512: 1024:	2 4 8 16 32	2 4 8 16 32	4 8 16 32 64	
	Rev. A 64	19.2 ksps	BPSK-I or BPSK-Q	64: 128: 256: 512: 1024:	1 2 4 8 16	1 2 4 8 16	2 4 8 16 32	
DATA	16	76.8 ksps	QPSK, 8-PSK, 16-QAM	400*4-PreambleChips= DataNettoChips		Mapping always complex Modulation type:		
						QPSK	8-PSK	16-QAM
				1600-0 = 1600	100	200	300	400
				1600-64 = 1536	96	192	288	384
				1600-128 = 1472	92	184	276	368
				1600-256 = 1344	84	168	252	336
				1600-512 = 1088	68	136	204	272
				1600-1024 = 576	36	72	104	144

Depending on the channel type and selected evaluation the amount of returned trace data (TRAC:DATA? TRACe1 | TRACe2) in the MAC and PREAMBLE channel differs between revision 0 and A. This is also listed in the table above.

The analysis detects all the channels on a per slot basis. Therefore changing channel configuration or modulation over the recorded slots is recognized.

The new modulation types of revision A within some of the MAC channels is detected. The new modulation types are:

- ON/OFF keying ACK on the I branch (OOKA-I),
- ON/OFF keying ACK on the Q branch (OOKA-Q),
- ON/OFF keying NACK on the I branch (OOKN-I) and the
- ON/OFF keying NACK on the Q branch (OOKN-Q).

Via remote the commands for querying the trace data or result summary data are extended for the modulation type in the following numbering scheme:

- 6 = OOKA-I
- 7 = OOKA-Q
- 8 = OOKN-I
- 9 = OOKN-Q

If the 2 bits within an ON/OFF keying modulation are identical, the modulation is not possible to be recognized as an ON/OFF keying modulation. If both bits are containing '1' information (ON) the modulation is identical to a BPSK and will be recognized as BPSK. If both bits are containing '0' information (OFF) there is no power within that code and slot and therefore no modulation is detected.

Is the evaluation set to MAPPING COMPLEX the separate I and Q branch detection within the result summary is not any longer selected and the modulation type will be a 2BPSK with the coding number 5 via remote.

```
Remote: CONF:CDP:BTS:REV 0 | A
```

PN OFFSET

The *PN OFFSET* softkey allows entry of the base station PN offset, which is used to distinguish between the base stations with 1xEV-DO.

The PN offset determines the offset in the circulating PN sequence in multiples of 64 chips with reference to the event second clock trigger.

```
Remote: SENS:CDP:PNOF 0...511
```

CAPTURE SETTINGS

The *SELECT* softkey opens a submenu to define the capture configuration and the selection of the slot and channel for the evaluation.

CAPTURE LENGTH
SET COUNT, SET TO ANALYZE
SELECT CODE
SELECT SLOT

CAPTURE LENGTH

The *CAPTURE LENGTH* softkey allows entry of the number of slots to be acquired. The input is always made as a multiple of the slot. The range is between 2 and 36 for the Analyzers R&S FSU/R&S FSQ and from 2 to 12 for the Analyzer R&S FSP. For all analyses that exhibit a value per slot on the x axis the maximum value on the x axis is the set CAPTURE LENGTH -1.

```
Remote: SENS:CDP:IQL 2..36 (2..12)
```

SET COUNT, SET TO ANALYZE

This function offers the possibility for the R&S FSQ to capture up to 1824 slots (more than 3 seconds) with a SINGLE SWEEP and then post process all the data with *SET TO ANALYZE*.

If the *SET COUNT* is set to 1 (default value), the device behaves as before and with the *CAPTURE LENGTH* the number of slots can be set.

For R&S FSQ the *SET COUNT* can be adjusted in the range of 1…57. Is the *SET COUNT* greater than 1 the *CAPTURE LENGTH* will be implicitly set to 36 slots and become unavailable. The *SET COUNT* defines then how many SETS of 36 slots shall be captured consecutively into the IQ RAM of the R&S FSQ. With the *SET TO ANALYZE* softkey the set for which the results are calculated can be defined. The range is from 0... (SET COUNT-1).

```
Remote:   SENS:CDP:SET:COUN 1..57 (FSQ)
          SENS:CDP:SET:[VAL] <numeric_value>
```

SELECT CODE

You can use the SELECT CODE softkey to select a code. All analyses that take the results for a code into account specify the results for the newly selected channel: POWER VS SYMBOL, CHANNEL RESULTS, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM.

In the analyses CODE DOMAIN POWER, CODE DOMAIN ERROR POWER and CHANNEL TABLE (all on screen A), the selected code is identified in red to distinguish it. Codes are entered in decimal format.

The rotating wheel behavior depends on the analysis on screen A and is geared to the graphic display. With CODE DOMAIN POWER and CODE DOMAIN ERROR POWER, it is always the adjacent channel that is selected. With the channel table, the rotating wheel is used to scroll through the list. In this instance, the channel type and the selection of I or Q are reset automatically if this is required by the new channel that has to be selected.

The maximum settable value depends on the spreading factor of the channel type. PILOT, PREAMBLE: 0..31, MAC: 0..63 and DATA 0.63.

```
Remote: SENS:CDP:CODE 0...31 | 63 | 15 (depending on the channel type)
```

SELECT SLOT

The *SELECT SLOT* softkey is used to select a slot. Slots are entered in decimal format. In this instance the range of values is from 0 to (Capture-Length-1); refer to the *CAPTURE LENGTH* softkey. All analyses that take the results for a slot into account specify the results for the newly selected slot: (CODE DOMAIN POWER, CODE DOMAIN ERROR POWER, CHANNEL TABLE, POWER vs CHIP, POWER vs SYMBOL, COMPOSITE CONSTELLATION, GENERAL RESULTS, CHANNEL RESULTS, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM).

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

```
Remote: SENS:CDP:SLOT 0 ...(CAPTURE_LENGTH-1)
```

INACT CHAN THRESHOLD

The INACT CHAN THRESHOLD softkey allows entry of the minimum power that an individual channel must have in the MAC or DATA channel type, compared with the total signal of the channel type, to be regarded as the active channel.

Channels below the specified threshold are regarded as "inactive".

With the PILOT channel type, the code 0.32 is normally expected on the I branch, synchronization will not otherwise take place and the 'SYNC FAILED' message failed appears. In the PREAMBLE channel type, only one code is normally assigned and thus the optimum detection threshold is permanently
-4.5 dB below the total power of the PREAMBLE channel type.
The two measurements COMPOSITE EVM and PEAK CODE DOMAIN ERR, which are specified as measurements on the total signal, are performed using the list of active channels. Distortions of these two measurements always occur when active channels are not detected as being active and unassigned codes are wrongly given the status of "occupied channel". INACT CHAN THRESHOLD can therefore be used to influence the results of the two measurements.

The default value is -40 dB. If not all channels contained in the signal are detected automatically, INACT CHAN THRESHOLD must be decremented.

```
Remote: SENS:CDP:ICTR -100 dB ... 0 dB
```

CHAN TYPE MAC-I

The *CHAN TYPE* softkey branches to a separate submenu. This will be explained after the Settings menu (s. CHAN TYPE MAC-I).

```
Remote: SENS:CDP:CTYP PIL | MAC | PRE | DATA
```

CODE PWR ABS/REL

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

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

CDP AVG ON/OFF

The CDP AVG softkey is available for the code domain analysis. If it is ON, the code domain analysis is averaged over all slots. This analysis is required by the 1xEV-DO Standard. It presumes, however, with the DATA and PREAMBLE channel types that preambles of different length do not occur in the slots. This averaging is not permitted otherwise. If averaging is active, then it will be necessary, in the function field above the CDP display *SLOT:,* to read *ALL*. To be able to measure signals of any configuration, the default value is OFF.

```
Remote: SENS:CDP:AVER ON | OFF
```

TIME/PHASE ON/OFF

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

```
Remote: SENS:CDP:TPM ON | OFF
```

MULTI CARRIER

The softkey *MULTI CARRIER* activates an additional mode in the signal processing to improve the processing of multi carrier signals. This allows the measurement on one carrier out of a multi carrier signal with 1.23 MHz carrier spacing even with identical PN offset values on all carriers.

This multi carrier mode has by default two features switched on:

● improved algorithm for signal detection on multi carrier signals
● additional low pass filter

From this base setting the enhanced multi carrier algorithm can be switched on or off with the *ENHANCED ALGORITHM* softkey.

With respect to the *MC FILTER* there are also different configurations possible:

The *MC FILTER ON/OFF* softkey allows to switch the additional filter on or off.

If the *ENHANCED ALGORITHM* and the *MC FILTER* are switched off the multi carrier mode is deactivated and the *MULTI CARRIER* softkey becomes grey. To restart the multi carrier mode it is necessary to repress the *MULTI CARRIER* softkey.

The softkey *FILT TYPE LOWPA/RRC* allows the selection between the automatically activated low pass filter and a configurable RRC filter with integrated hamming window. If the RRC filter is selected further two softkeys become available. These are the softkeys *ROLL OFF* and *CUT OFF FREQUENCY*. The first defines the roll off factor, meaning the type of decay of the filter curve, between 0.01 and 0.99 in 0.01 steps - default value is 0.02. The second softkey defines the cut off frequency. This is the frequency where the cut off of the filter begins - here the default value is 1.25 MHz and the value is adjustable between 0.1 MHz and 2.4 MHz in Hz-steps.

If the M*ULTI CARRIER* softkey is switched off also the further settings became unavailable.

Please be aware that the low pass filter is influencing the measured signal quality (like RHO or EVM) in comparison without an additional filter and the improved algorithm will slightly increase the calculation time.

```
Remote:   CONF:CDP:MCAR ON | OFF
          CONF:CDP:MCAR:MALG ON | OFF
          CONF:CDP:MCAR:FILT:STAT ON | OFF
          CONF:CDP:MCAR:FILT:TYPE LPAS | RRC
          CONF:CDP:MCAR:FILT:ROFF <numeric_value>
          CONF:CDP:MCAR:FILT:COFR <numeric_value>
```

INVERT Q

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

```
Remote: SENS:CDP:QINV OFF
```

SIDEBAND NORM / INV

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

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

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

The default setting is NORM.

```
Remote: SENS:CDP:SBAN NORM|INV
```

NORMALIZE ON / OFF

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

```
Remote: SENS:CDP:NORM ON|OFF
```

CHAN TYPE MAC-I

The menu shown on the left is opened with the *CHAN TYPE* softkey. This softkey is present on both the SETTINGS and the RESULTS menus.

PILOT, MAC, PREAMBLE , DATA
CODE DOM OVERVIEW
MAPPING AUTO, MAPPING COMPLEX, MAPPING I OR Q
SELECT I/Q

On the *CHAN TYPE* menu, the channel type and mapping mode can be set. Furthermore, it is possible to select I/Q on it, and the Code Domain Overview mode can be enabled and disabled.

Depending on the menu settings, the second line of the *CHAN TYPE* softkey is labeled in the following examples:
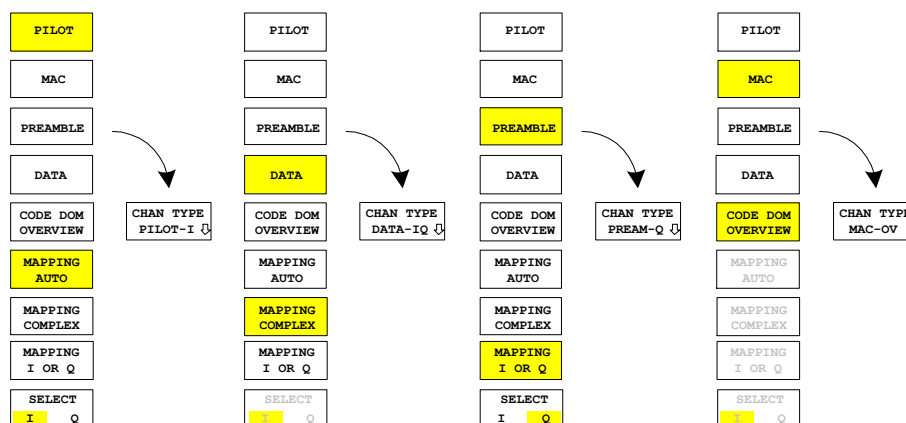
PILOT, MAC, PREAMBLE, DATA

The *PILOT*, *MAC*, *PREAMBLE* and *DATA* softkeys are a 1-out-of-4 selection and define the corresponding channel type. Since the four channel types subdivide 1xEV-DO slot with regard to time, the majority of the analyses of the code domain analyzers are available for each channel type. Refer to Table 20. The default value is PILOT.

```
Remote: SENS:CDP:CTYP PIL | MAC | PRE | DATA
```

CODE DOM OVERVIEW

The *CODE DOM OVERVIEW* softkey is available for the code domain power and code domain error-power and can be enabled. If Overview mode is activated, screen A will display the I branch and screen B the Q branch of the CDP and CDEP analysis as a general rule. The *MAPPING AUTO*, *MAPPING COMPLEX*, *MAPPING I OR Q* and *SELECT I/Q* softkeys are not available when Code Domain Overview mode is active. The default setting is OFF.

```
Remote: SENS:CDP:OVER ON | OFF
```

MAPPING AUTO, MAPPING COMPLEX, MAPPING I OR Q

The *MAPPING AUTO*, *MAPPING COMPLEX* and *MAPPING I OR Q* softkeys are a 1-out-of-3 selection. Mapping mode determines whether the I or Q branch or the complex signal is analyzed. Mapping is selected automatically with the *MAPPING AUTO* softkey, depending on the channel type:

Channel type	Mapping
PILOT	I OR Q
MAC	I OR Q
PREAMBLE	I OR Q
DATA	COMPLEX

In order to obtain the option of examining every channel type individually as either complex, or the I and Q branch on their own, mapping can be permanently set by means of the *MAPPING COMPLEX* and *MAPPING I OR Q* softkeys. It is then valid for all channel types. The default value is *MAPPING AUTO*.

```
Remote: SENS:CDP:MMOD AUTO | IOQ | COMPL
```

SELECT I/Q

The I or Q branch to be analyzed is selected with the *SELECT I/Q* softkey. The softkey is not available for *MAPPING COMPLEX*. The I branch is selected after a Preset.

```
Remote: SENS:CDP:MAPP I | Q
```

6.8.4 Frequency settings - *FREQ* key

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

CENTER
CF-STEPSIZE
FREQUENCY OFFSET

CENTER

The *CENTER* softkey opens the input window for manually entering the center frequency.

The permissible input range of the center frequency is:

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

f_{center} center frequency

Minspan   smallest selectable span >0 Hz (10 Hz)

f_{max} maximum frequency

```
Remote: FREQ:CENT 100MHz
```

CF-STEPSIZE

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

```
Remote: FREQ:CENT:STEP <numeric_value>
```

FREQUENCY OFFSET

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

```
Remote: FREQ:OFFS 10 MHz
```

6.8.5 Span settings - *SPAN* key

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

6.8.6 Level settings - *AMPT* key

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

REF LEVEL
ADJUST REF LEVEL
REF LEVEL OFFSET
Y PER DIV
REF VALUE POSITION
RF ATTEN MANUAL
RF ATTEN AUTO
EL ATTEN MANUAL
EL ATTEN AUTO
EL ATTEN OFF

REF LEVEL

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

Remote: `DISP:WIND:TRAC:Y:RLEV -60dBm`

ADJUST REF LEVEL

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

Remote: `SENS<1|2>:CDP:LEV:ADJ`

REF LEVEL OFFSET

The *REF LEVEL OFFSET* softkey enables entry of an arithmetic level offset. This is added to the measured level irrespective of the selected unit. The Y axis scaling is changed accordingly.

The setting range is ±200 dB in steps of 0.1 dB.

Remote: `DISP:WIND1:TRAC:Y:RLEV:OFFS -10dB`

Y PER DIV

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

Remote: `DISP:WIND<1|2>:TRAC<1..3>:Y:SCAL:PDIV`

REF VALUE POSITION

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

```
Remote: DISP:WIND<1|2>:TRAC<1..3>:Y:SCAL:RPOS
```

RF ATTEN MANUAL

The *RF ATTEN MANUAL* softkey enables entry of the attenuation, irrespective of the reference level.

If the required reference level can no longer be set for the given RF attenuation, it will be adjusted and the message "Limit reached" will be issued.

```
Remote: INP:ATT 40 DB
```

RF ATTEN AUTO

The *RF ATTEN AUTO* softkey sets the RF attenuation automatically irrespective of the set reference level.

This ensures that the optimum attenuation desired by the user is always used.

RF ATTEN AUTO is the default setting.

```
Remote: INP:ATT:AUTO ON
```

EL ATTEN MANUAL

The *EL ATTEN MANUAL* softkey enables the electronic step attenuator enables entry of the attenuation, which is set on the electronic step attenuator.

The attenuation can be modified in steps of 5 dB between 0 and 30 dB. Other entries will be rounded down to the next lower integer value.

```
Remote:   INP:EATT:AUTO OFF;
          INP:EATT 10 DB
```

The softkey is only available with the *ELECTRONIC ATTENUATOR* R&S FSP-B25, R&S FSU-B25 and R&S FSQ-B25 option.

EL ATTEN AUTO

The *EL ATTEN AUTO* softkey enables the electronic step attenuator and sets its attenuation to 0 dB.

The permissible range of the reference level extends from the current reference level on enabling the electronic step attenuator to 30 dB beyond that value. If a reference level outside the permissible 30 dB range is set, the setting is performed with the mechanical step attenuator. Starting from this new reference level up to 30 dB above it, the setting is again performed with this electronic step attenuator.

```
Remote: INP:EATT:AUTO ON
```

The softkey is only available with the *ELECTRONIC ATTENUATOR* R&S FSP-B25, R&S FSU-B25 and R&S FSQ-B25 option.

EL ATTEN OFF

The softkey is only available with the *ELECTRONIC ATTENUATOR* R&S FSP-B25, R&S FSU-B25 and R&S FSQ-B25 option.

```
Remote: INP:EATT:STAT OFF
```

6.8.7 Marker settings - *MKR* key

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

Markers are not available for the *GENERAL RESULTS, CHANNEL RESULTS* and *CHANNEL TABLE* analyses. Up to four markers can be enabled in all other analyses and defined as marker or delta marker with the help of the *MARKER NORM/DELTA* softkey.

The *MARKER 1/2/3/4* softkey*s* select the marker concerned and enable it simultaneously.

Marker 1 is always the normal marker after it has been enabled, while markers 2 to 4 are delta referring to marker 1 after they have been enabled. The *MARKER NORM DELTA* softkey can be used to transform these markers into markers with absolute measure value display. If marker 1 is the active marker, *MARKER NORM DELTA* is enabled as an additional delta marker.

Pressing the *MARKER 1* to *MARKER 4* softkeys disables the selected marker.

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

ALL MARKER OFF

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

```
Remote: CALC:MARK:AOFF
```

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

```
Marker 1 [T1]
                      -5.00 dB
   SR  76.8 ksps     Code 11
```

Fig, 40   Diagram marker field

Apart from the channel power, which is displayed relative to the total power in the channel type, the parameters of the channel are specified. The meanings are as follows (for the channel assigned to the marker):

SR 76.8 ksps: Symbol rate of the channel
Code 11:   Walsh code number of the channel

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

6.8.8 Changing instrument settings - *MKR→* key

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

SELECT MARKER
PEAK
NEXT PEAK
PEAK MODE MIN/MAX

SELECT MARKER

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

```
Remote:   CALC:MARK1 ON;
          CALC:MARK1:X <value>;
          CALC:MARK1:Y?
```

PEAK

The *PEAK* softkey sets the active marker or delta marker to the maximum/minimum of the associated trace.

If no marker had been active before the *MKR->* menu was opened, marker 1 is automatically enabled and the Peak function is executed.

```
Remote:   CALC:MARK:MAX
          CALC:DELT:MAX
          CALC:MARK:MIN
          CALC:DELT:MAX
```

NEXT PEAK

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

```
Remote:   CALC:MARK:MAX:NEXT
          CALC:DELT:MAX:NEXT
          CALC:MARK:MIN:NEXT
          CALC:DELT:MIN:NEXT
```

PEAK MODE MIN/MAX

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

```
Remote: --
```

6.8.9 Marker functions - MKR *FCTN* key

The MKR *FCTN* key is disabled for all measurements of the code domain analyzer. For all other measurements of the R&S FS-K84, the softkeys are described in the manual for the basic device.

6.8.10 Bandwidth setting - *BW* key

The *BW* key is disabled for all measurements of the code domain analyzer. For all other measurements of the R&S FS-K84, the softkeys associated with the menu are described in the manual for the basic device.

6.8.11 Measurement control - *SWEEP* key

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

6.8.12 Measurement selection - *MEAS* key

The menu of the *MEAS* key contains all the measurements that can be selected on the R&S FS-K84 by pressing a key. The menu and its submenus are described in Chapter 6.

6.8.13 Trigger settings - *TRIG* key

The selectable trigger options depend on the measurement selected. For the code domain power analyzer, a free-run mode and a mode with the external even second clock trigger called for by the 1xEV-DO Standard are possible. The trigger options for all other measurements are identical to those of the corresponding measurement in the basic device. The associated softkeys are described in the manual for the basic device.

The GATED TRIGGER can be used with POWER, ADJACENT CHANNEL LEAKAGE RATION, SPECTRUM EMISSION MASK and OCCUPIED BANDWIDTH measurements to measure idle slots as well (only PILOT and MAC channel types active). To do this, set the power range with *GATE DELAY and GATE LENGTH* after selecting a trigger source in the *GATED TRIGGER SETTINGS* and then connect the *GATED TRIGGER* on the Trigger menu.

EXTERN

With the softkey *EXTERN* the external trigger source can be selected. From firmware V2.60/3.60 on also the external trigger level can be adjusted in the range from 0.5V to 3.5V. The default value is 1.4V.

```
Remote: TRIG:SEQ:LEV:EXT <numeric_value>
```

6.8.14 Trace settings - *TRACE* key

The *TRACE* key opens the following submenu:

CLEAR/WRITE
MAX HOLD
MIN HOLD
AVERAGE
SWEEP COUNT

CLEAR/WRITE

The CLEAR/WRITE softkey enables Overwrite mode for the acquired measured values, i.e. the trace is rewritten for each sweep.

After the CLEAR/WRITE softkey has been operated, the device deletes the selected trace memory and restarts the measurement.

```
Remote: DISP:WIND:TRAC:MODE WRIT
```

MAX HOLD

The MAX HOLD softkey activates the peak value detector.

The analyzer only accepts the new measured value into the saved trace data if it is larger than the previous one.

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

```
Remote: DISP:WIND:TRAC:MODE MAXH
```

MIN HOLD

The MIN HOLD softkey activates the minimum value detector

The analyzer only accepts the new measured value into the saved trace data if it is smaller than the previous one.

Pressing the MIN HOLD softkey a second time deletes the trace memory and starts minimum peak detection from the beginning again.

```
Remote: DISP:WIND:TRAC:MODE MINH
```

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

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

```
Remote: DISP:WIND:TRAC:MODE AVER
```

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

With the Channel Occupancy Table analysis, the channel configuration measured on the first sweep is retained for the trace statistics.

If the signal is reconfigured, the SINGLE SWEEP softkey (and CONTINOUS SWEEP if necessary) must be pressed.

The GENERAL RESULT, CHANNEL RESULT, BITSTREAM analyses and the CONSTELLATION diagrams support only CLEAR WRITE mode as a general rule.

SWEEP COUNT

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

Sweep Count = 0   means running averaging with averaging length of 10
Sweep Count = 1   means no averaging
Sweep Count > 1   averaging over the specified number of sweeps; in continuous sweep mode averaging changes over to running averaging once this number has been reached.

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

```
Remote: SWE:COUN 64
```

6.8.15 Display lines - LINES key

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

6.8.16 Measurement screen settings - *DISP* key

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

6.8.17 Storing and loading of device data - *FILE* key

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

6.8.18   Preset of device - *PRESET* key

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

6.8.19   Calibration of device - *CAL* key

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

6.8.20   Setup of device - *SETUP* key

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

Using the FS-K9 "Measurements with Power Sensor" is also possible within that application. Therefore the FS-K9 must be installed and the option key must be entered, then in the sidemenu the softkey *POWERMETER i*s available. For further details of the FS-K9 please refer to the FS-K9 software manual.

6.8.21   Printing - *HCOPY* key

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

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

7 Remote Control Commands

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

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

7.1 CALCulate:FEED subsystem

The type of analysis can be selected with the CALCulate:FEED subsystem. This corresponds to the result display selection in manual operation.

CALCulate<1|2>:FEED <string>

This command selects the measured data that will be displayed.

   Parameter

<string>::= 'XPOW:CDP' |
           'XPOW:CDP:RAT' |
           'XPOW:CDEP' |
           'XTIM:CDP:MACCuracy' |
           'XTIM:CDP:PVCHip' |
           'XTIM:CDP:PVSYmbol' |
           'XTIM:CDP:BSTRream' |
           'XTIM:CDP:ERR:SUMM' |
           'XTIM:CDP:ERR:CTABle' |
           'XTIM:CDP:ERR:PCDomain' |
           'XTIM:CDP:SYMB:CONSt' |
           'XTIM:CDP:SYMB:EVM' |
           'XTIM:CDP:COMP:CONSt'

The meanings of the string parameters are as follows:

'XPOW:CDP'	Result display of the code domain power absolute in the bar chart (`CALCulate<1>`)
'XPOW:CDP:RAT'	Result display of the code domain power ratio (relative) in the bar chart (`CALCulate<1>`)
'XPOW:CDEP'	Result display of the code domain error power in the bar chart (`CALCulate<1>`)
'XTIM:CDP:ERR:SUMM'	Tabular analysis of results (`CALCulate2`)
'XTIM:CDP:ERR:CTABle'	Display of the channel occupancy table (`CALCulate<1>`)
'XTIM:CDP:ERR:PCDomain'	Result display of the peak code domain error (`CALCulate2`)

'XTIM:CDP:MACCuracy'	Result display of the COMPOSITE EVM (`CALCulate2`)
'XTIM:CDP:PVCHip'	Result display of power versus chip (`CALCulate2`)
'XTIM:CDP:PVSYmbol'	Result display of power versus symbol (`CALCulate2`)
'XTIM:CDP:BSTReam'	Result display of bit stream (`CALCulate2`)
'XTIM:CDP:SYMB:CONSt'	Result display of symbol constellation (`CALCulate2`)
'XTIM:CDP:SYMB:EVM'	Result display of error vector magnitude (`CALCulate2`)
'XTIM:CDP:COMP:CONSt'	Result display of composite constellation (`CALCulate2`)

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CALC2:FEED 'XTIM:CDP:MACC'
'Select COMP EVM analysis

INIT;*WAI
'Start measurement with sync

TRAC? TRACE2
'Query COMP EVM data
```

Characteristics

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

Note:

The code domain power measurements are always shown in split screen mode and the allocation of the analysis to the measurement window is fixed. Therefore, specify for every analysis in brackets the numerical suffix that is necessary or allowed at `CALCulate`.
To activate the Overview mode for Code Domain Power and Code Domain Error-Power, you must use the `CDP:OVER ON` command. If you then switch to an analysis different from these two, (such as the Channel Occupancy table), you leave Overview mode and the analysis you used last on the other screen is restored.

7.2 CALCulate:LIMit:SPECtrum subsystem

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

CALCulate:LIMit:ESPectrum:CHECk:X?;Y?

These commands query the worst fail position.

Example

```
INST BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep
CONF:CDP:BCL 1
'Select band class 1, 1900 MHz

CONF:CDP:MEAS ESP
'Measure spectrum emission mask

CALC:LIM:ESP:VAL 33
'Activates manual selection of the limit line and selects the
one for  P≥33

INIT;*WAI
'Start measurement with synchronization

CALC:LIM:ESP:CHEC:X?;Y?
'Query result of worst fail position
```

Characteristics

*RST value: --
SCPI:　　　device-specific

CALCulate:LIMit:ESPectrum:MODE AUTO | MANual | USER

This command automatically enables and disables automatic selection of the limit line in the spectrum emission mask measurement.
The limit lines normally depend on the selected band class.
(Command `CONF:CDP:BCL`)

Parameter

AUTO　　　The limit line depends on the measured channel power
MANUAL　One of the three default limit lines is set. The selection is made with the command `CALC:LIM:ESP:VAL`
USER　　　Query only, user-defined limit lines are enabled (refer to the description of limit lines in the manual for the device

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS
```

```
INIT:CONT OFF
'Select single sweep

CONF:CDP:BCL 1
'Select band class 1, 1900 MHz

CONF:CDP:MEAS ESP
'Measure spectrum emission mask

CALC:LIM:ESP:MODE AUTO
'Activates automatic selection of limit line

INIT;*WAI
'Start measurement with synchronization

CALC:LIM:FAIL?
'Query result of worst fail position
```

Characteristics

*RST value: AUTO
SCPI: device-specific

CALCulate:LIMit:ESPectrum:RESTore

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

Example

```
INST BDO
'Activate 1xEV-DO BTS

CALC:LIM:ESP:REST
'Resets the spectrum emission mask limit lines to their
default setting
```

Characteristics

*RST value: --
SCPI: device-specific

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

CALCulate:LIMit:ESPectrum:TRANsition 0 .. 1 GHz

This command specifies the offset frequency at which the resolution bandwidth is changed between 30k and 1MHz.

Example

```
INST BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep
```

```
CONF:CDP:BCL 1
'Select band class 1, 1900 MHz

CONF:CDP:MEAS ES
'Measure spectrum emission mask

CALC:LIM:ESP:TRAN 10MHz
'Defines the transition frequency to 10 MHz
```

Characteristics

*RST value: 4.0 MHz (depending on bandclass)
SCPI: device-specific

CALCulate:LIMit:ESPectrum:VALue <numeric_value>

This command switches to manual limit line selection. The limit line is selected by specifying the expected power as a value. One of the four possible limit lines is selected depending on the value entered:

Specified value in dBm	Selected limit line	Value when queried
Value $\geq$ 33	"P $\geq$ 33"	33
28 $\leq$ value < 33	"28 $\leq$ P < 33"	28
Value< 28	"P < 28"	0

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:BCL 1
'Select band class 1, 1900 MHz

CONF:CDP:MEAS ESP
'Measure spectrum emission mask

CALC:LIM:ESP:VAL 33
'Activates manual selection of the limit line and selects the
'one for P≥33

INIT;*WAI
'Start measurement with synchronization

CALC:LIM:FAIL?
'Query result of the limit check
```

Characteristics

*RST value: 0
SCPI: device-specific

7.3 CALCulate:LIMit:PVTime subsystem

The CALCulate:LIMit:PVTime subsystem defines the limit check for Power vs. Measurement.

CALCulate:LIMit:PVTime:REFerence AUTO | MANual | ONCE

The standard asks for the sequence to first measure the FULL slot with the limit line relative to the mean power of the averaged time response. Therefore the parameter AUTO in a FULL slot measurement should be selected. In this mode the mean power is calculated and the limit lines are relative to that mean power value. This value should be used also as the reference for the IDLE slot measurement. With the parameter ONCE the current mean power value of the averaged time response is used to set as the fixed reference value for the limit lines. The mode is switched from AUTO to MANUAL. Now the IDLE slot can be selected and the measurement sequence can be finished.

The manual mode can also be selected via the parameter MANUAL. Then a user defined value can be entered via the command :CALC:LIM:PVT:RVAL <value> in dBm as the reference value for the limits.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:MEAS PVT
'Measure Power vs Time

SENS:SWE:COUN 50
'Only 50 halfslots averaging

CONF:CDP:RFSL FULL
'Limit lines for FULL Slot, use FULL slot signal at input

CALC:LIM:PVT:REF AUTO
'Automatic reference value for limit lines

INIT:IMM;*WAI
'Start measurement with synchronization

CALC:MARK:FUNC:SUMM:MEAN:RES?
'Read out mean power

CALCulate1:LIMit1:FAIL?
'Upper line failed?

CALCulate1:LIMit2:FAIL?
'Lower line failed?

CALC:LIM:PVT:REF ONCE
'Use the FULL slot results as manual reference value for IDLE
slot measurement
```

```
CONF:CDP:RFSL IDLE
''Limit lines for FULL Slot, use FULL slot signal at input

INIT:IMM;*WAI
'Start measurement with synchronization

TRACe1? TRACe1
'Read out 512 points

CALCulate1:LIMit1:FAIL?
'Upper line failed?

CALCulate1:LIMit2:FAIL?
'Lower line failed?

TRACe1? TRACe1
'Read out 512 points

CALC:LIM:PVT:RVAL?
'Read out reference value (in this example identical to the
mean power)

CALC:LIM:PVT:RVAL -33.5
'Define a new reference value
```

Characteristics

*RST value: AUTO
SCPI: device-specific

CALCulate:LIMit:PVTime:RESTore

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

Example

```
INST BDO
'Activate 1xEV-DO BTS

CALC:LIM:PVT:REST
'Resets the PVT limit lines to their default setting
```

Characteristics

*RST value: --
SCPI: device-specific

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

CALCulate:LIMit:PVTime:RVALue <numeric_value>

With this command the reference level in dBm for calculating the limit lines can be set. Precondition is that the automatic mode of power calculation is switched off via the commands `CALC:LIM:PVT:REF ONCE or CALC:LIM:PVT:REF:MAN`.

Example

See example of command `CALC:LIM:PVT:REF`

Characteristics

*RST value: -20 dBm
SCPI: device-specific

7.4 CALCulate:MARKer subsystem

**CALCulate<1|2>:MARKer<1>:FUNCtion:CDPower[:BTS]:RESult?
RHO | MACCuracy | PCDerror | FERROr | FERPpm | CERRor | TFRame I IQOFfset
| IQIMbalance | SRATe | CHANnel | SFACtor | TOFFset | POFFset | CDPabsolutee
| CDPRelative | EVMRms | EVMPeak | RHOPilot | RHO1 | RHO2 | PPILot | PMAC |
PDATa | PPReamble | MACTive | DACTive | PLENgth | MTYPe | DMTYpe**

This command queries the measured and calculated values of the Code Domain Power analysis. The channel type can be set by means of the `CDPower:CTYPe` command, the slot number by means of the `CDPower:SLOT` command and the code number by means of the `CDPower:CODe` command.

Parameter:

Global results for all slots:

FERRor	Frequency error in Hz
FERPpm	Frequency error in ppm
CERRor	Chip rate error in ppm
TFRame	Trigger to Frame
RHOPilot	RHO over all slots for the pilot area
RHO1	$RHO_{overall-1}$ over all slots over all chips with start of averaging at the half-slot limit
RHO2	$RHO_{overall-2}$ over all slots over all chips with start of averaging at the quarter-slot limit
RHOData	Read out values from IEC/IEEE bus
RHOMac	Read out values from IEC/IEEE bus

Results for the selected slot:

PPILot	Absolute power in the PILOT channel type
PMAC	Absolute power in the MAC channel type
PDATa	Absolute power in the DATA channel type
PPReamble	Absolute power in the PREAMBLE channel type
RHO	RHO value for the selected channel type/slot
DMTYpe	Modulation type of the DATA channel type
	2 = QPSK
	3 = 8-PSK

4 = 16-QAM

MACTive   Number of active MAC channels

DACTive   Number of active DATA channels

PLENGth   Length of preamble in chips

MACCuracy   Composite EVM in %

Results for the selected channel type in the selected slot:

PCDerror   Peak code domain error in dB

IQIMbalance   IQ imbalance in %

IQOFfset   IQ offset in %

Channel results:

SRATe   Symbol rate in ksps

CHANnel   Channel number

SFACtor   Spreading factor of the channel

TOFFset   Timing offset in s

POFFset   Phase offset in rad

CDPRelative   Channel power relative in dB

CDPabsolute   Channel Power absolute in dBm

EVMRms   Error vector magnitude RMS in %

EVMPeak   Error Vector mag. peak in %

MTYPe   Modulation type:

> 0 = BPSK-I
> 1 = BPSK-Q
> 2 = QPSK
> 3 = 8-PSK
> 4 = 16-QAM
> 5 = 2BPSK (if complex analysis selected for PILOT, PREAMBLE or MAC)

Note:

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

INIT;*WAI
'Start measurement with synchronization
```

```
CALC:MARK:FUNC:CDP:RES? PPIL
'Read out pilot power

CDP:SLOT 2
'Selects slot 2

CDP:CODE 11
'Select code number 11

CALC:MARK:FUNC:CDP:RES? EVMR
'Read out EVM RMS of the code with number 11 in slot 2
```

Characteristics

*RST value: -
SCPI: device-specific

7.5 CALCulate:STATistics subsystem

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

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

This command enables and disables measurement of the amplitude probability distribution (APD) The OFF state is reachable by selecting another measurement with the CONF:CDP:MEAS command.

Example

```
CALC:STAT:APD ON
```

Characteristics

*RST value: OFF
SCPI: device-specific

CALCulate:STATistics:CCDF[:STATe] ON

This command enables and disables measurement of the complementary cumulated distribution function (CCDF). The OFF state is reachable by selecting another measurement with the CONF:CDP:MEAS command..

Example

```
CALC:STAT:CCDF ON
```

Characteristics

*RST value: OFF
SCPI: device-specific

CALCulate:STATistics:NSAMples   100 ... 1E9

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

Example

CALC:STAT:NSAM 5000

Characteristics

*RST value: 100000
SCPI: device-specific

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

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

Parameter

The desired result is selected by means of the following parameters:

MEAN   Mean (RMS) power measured in the period of analysis in dBm
PEAK   Peak power in dBm measured in the period of analysis
CFACtor   Determined CREST factor (i.e. ratio of peak power to mean power) in dB
ALL   Results of all three named measurements, separated by a comma::
          <mean power>,<peak power>,<crest factor>

Example

CALC:STAT:RES? ALL
'Reads out all three measurement results. Example of reply
'string: 5.56,19.25,13.69 ie. Mean power: 5.56 dBm, Peak
'power 19.25 dBm, CREST factor 13.69 dB

Characteristics

*RST value: --
SCPI: device-specific

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

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

Example

CALC:STAT:SCAL:Y:LOW 0.001

Characteristics

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

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

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

Example

CALC:STAT:SCAL:Y:UPP 0.01

Characteristics

*RST value: 1.0
SCPI: device-specific

7.6   CALCulate:PEAKsearch subsystem

This command, activates a single evaluation of spectrum emission mask. The limit mask is checked against the trace. It is recommended to use single sweep.

CALCulate:PEAKsearch :MARGin

This command defines an overall margin which is subtracted from the limit line to make the peak search more stronger.

Example

CALC:PEAK:MARG 100dB

Characteristics

*RST value: 6dB
SCPI: device-specific

CALCulate:PEAKsearch :SUBRanges 1 .. 50

This command defines how many peaks are searched for within one range.

Example

CALC:PEAK:SUBR 25

Characteristics:

*RST value: 25
SCPI: device-specific

7.7 CONFigure:CDPower Subsystem

This subsystem contains the commands for the selection and configuration of measurement in the 1xEV-DO BTS application firmware. The numerical suffix 1 is allowed with `CONFigure`.
You will find more examples of the Code Domain Power analysis under the:[SENSe]:CDPower command.
Further settings for the spectrum emission mask measurement can be found under the CALCulate:LIMit:ESPectrum command.

CONFigure:CDPower[:BTS]:BCLass 0...15

This command selects the band class.

Band class	Name
0	800 MHz band
1	1900 MHz band
2	TACS band
3	JTACS band
4	Korean PCS band
5	450 MHz band
6	2 GHz band
7	700 MHz band
8	1800 MHz band
9	900 MHz band
10	Secondary 800 MHz band
11	400 MHz European PAMR band
12	800 MHz PAMR band
14	US PCS 1.9GHz band
15	AWS band

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:BCL 1
'Select band class 1, 1900 MHz
```

Characteristics

*RST value: 0
SCPI: device-specific

CONFigure:CDPower[:BTS]:CTABle:CATalog?

This command retrieves the names of all the channel tables for 1xEV-DO BTS stored on the hard disk.
The syntax of this output format is as follows:

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

CONF:CDP:CTAB:CAT?
'Query catalog
```

Characteristics

*RST value: --
SCPI: device-specific

CONFigure:CDPower[:BTS]:CTABle:COMMent　<string>

This command defines a comment on the selected channel table.

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

CONF:CDP:CTAB:NAME 'NEW_TAB'
'Select table for processing

CONF:CDP:CTAB:COMM
'Comment for 'NEW_TAB'"
```

Characteristics

*RST value: ""
SCPI: device-specific

CONFigure:CDPower[:BTS]:CTABle:COPY　<file_name>

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

Parameter

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS
```

```
CONF:CDP:CTAB:NAME 'CTAB_1'
'Select table for processing

CONF:CDP:CTAB:COPY 'CTAB_2'
'Copies CTAB_1 to C_TAB2
```

Characteristics

*RST value: --
SCPI: device-specific

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

CONFigure:CDPower[:BTS]:CTABle:DATA   0..7, 4..6, 0..63, 0..4, 0, 0, 0 | 1, <numeric_value>...

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

<Channel type>, <Code class>, <Code number>, <Modulation>, <Reserved1>, <Reserved2>, <Status>, <CDP Relative [dB]>, etc.

Channel type:	The channel type is numerically coded as follows: 0 = PILOT 1 = MAC 2 = PREAMBLE with 64 chip length 3 = PREAMBLE with128 chip length 4 = PREAMBLE with256 chip length 5 = PREAMBLE with 512 chip length 6 = PREAMBLE with1024 chip length 7 = DATA
Code class:	Depending on channel type, fixed: PILOT: 5, MAC: 6, PREAMBLE: 5 and DATA: 4 (spreading factor = 2^code class))
Code number:	0...spreading-factor-1
Modulation:	Modulation type including mapping: 0 = BPSK-I 1 = BPSK-Q 2 = QPSK 3 = 8-PSK 4 = 16-QAM Modulation types QPSK/8-PSK/16-QAM have complex values.
Reserved1:	Always 0 (reserved)
Reserved2:	Always 0 (reserved)
Status:	0: inactive, 1:active Can be used in a setting command to disable a channel temporarily
CDP relative:	Any with setting command, relative with CDP query

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

CONF:CDP:CTAB:NAME 'NEW_TAB'
'Select table for processing

CONF:CDP:CTAB:DATA 0,5,0,0,0,0,1,0.0,1,6,35,1,0,0,1,0.0
'elects PILOT 0.32 BPSK-I and  MAC 35.64 BPSK-Q.
```

Characteristics

*RST value: -
SCPI: device-specific

CONFigure:CDPower[:BTS]:CTABle:DELete

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

CONF:CDP:CTAB:NAME 'CTAB_2'
'Select table for processing

CONF:CDP:CTAB:DEL
'Deletes CTAB_2
```

Characteristics

*RST value: --
SCPI: device-specific

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

CONFigure:CDPower[:BTS]:CTABle:NAME   <file_name>

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

CONF:CDP:CTAB:NAME 'NEW_TAB'
'Select table for processing
```

Characteristics

*RST value: ""
SCPI: device-specific

CONFigure:CDPower[:BTS]:CTABle:RESTore

This command restores the supplied channel table. Any channel tables delivered with the instrument modified by the customer are thus returned to their initial state.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

CONF:CDP:CTAB:REST
'Restore table
```

Characteristics

*RST value: --
SCPI: device-specific

CONFigure<1>:CDPower[:BTS]:CTABle:SELect   <string>

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP Relative on Screen A
'and General Results active on Screen B

INIT:CONT OFF
'Select single sweep

INIT;*WAI
'Start measurement with sync so that channel table can be
'enabled

CONF:CDP:CTAB ON
'Use predefined channel table

CONF:CDP:CTAB:SEL 'CTAB_1'
'Select channel table

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

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

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

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

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

INIT;*WAI
'Start measurement with sync so that channel table can be
enabled

CONF:CDP:CTAB ON
'Use predefined channel table

CONF:CDP:CTAB:SEL 'CTAB_1'
'Select channel table

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: OFF
SCPI: device-specific

CONFigure:CDPower[:BTS]:MCARier:FILTer:COFRequency <numeric_value>

This command defines in multi carrier mode with the multi carrier filter on the value of the cut off frequency of the RRC filter.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:MCAR ON
'Switch on the multi carrier mode

CONF:CDP:MCAR:FILT ON
'Switch on the MC filter

CONF:CDP:MCAR:FILT:TYPE RRC"
'Select RRC MC filter
```

```
CONF:CDP:MCAR:FILT:COFR 1.2MHz
'Select 1.2 MHz cut off frequency
```

Characteristics

*RST value: 1.25 MHz
SCPI: device-specific

CONFigure:CDPower[:BTS]:MCARier:FILTer:ROFF <numeric_value>

This command defines in multi carrier mode with the RRC multi carrier filter as roll off.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:MCAR ON
'Switch on the multi carrier mode

CONF:CDP:MCAR:FILT ON
'Switch on the MC filter

CONF:CDP:MCAR:FILT:TYPE RRC
'Select RRC MC filter

CONF:CDP:MCAR:FILT:ROFF 0.03
'Defines 0.03 as roll off
```

Characteristics

*RST value: 0.02
SCPI: device-specific

CONFigure:CDPower[:BTS]:MCARier:FILTer[:STATe] ON | OFF

This command defines in multi carrier mode whether the additional multi carrier filter is used (ON) or not (OFF). If the multi carrier mode is activated the additional multi carrier filter is switched on.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:MCAR ON
'Switch on the multi carrier mode

CONF:CDP:MCAR:FILT OFF
'Switch off the MC filter
```

Characteristics

*RST value: OFF
SCPI: device-specific

CONFigure:CDPower[:BTS]:MCARier:FILTer:TYPE LPASs | RRC

This command defines in multi carrier mode with the multi carrier filter on the type of the filter. By default a fix low pass filter is used. It is also possible to choose a definable RRC filter.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:MCAR ON
'Switch on the multi carrier mode

CONF:CDP:MCAR:FILT ON
'Switch on the MC filter

CONF:CDP:MCAR:FILT:TYPE RRC
'Select RRC MC filter

CONF:CDP:MCAR:FILT:ROFF 0.03
'Defines 0.03 as roll off
```

Characteristics

*RST value: LPASs
SCPI: device-specific

CONFigure:CDPower[:BTS]:MCARier:MALGo ON | OFF

This command defines in multi carrier mode whether the enhanced multi carrier algorithm is used (ON) or not (OFF). If the multi carrier mode is activated the enhanced algorithm is switched on.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:MCAR ON
Switch on the multi carrier mode

CONF:CDP:MCAR:MAL OFF
'witch off the enhanced multi carrier algorithm
```

Characteristics

*RST value: OFF
SCPI: device-specific

CCONFigure:CDPower[:BTS]:MCARier[:STATe] ON | OFF

This command defines whether the multi carrier mode is ON or OFF.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:MCAR ON
'Switch on the multi carrier mode
```

Characteristics

*RST value: OFF
SCPI: device-specific

CONFigure<1>:CDPower[:BTS]:MEASurement POWer | ACLR | MCAClr | ESPectrum | OBANdwidth | OBWidth | CDPower | CCDF | PVTime

This command selects the measurement of Application FS-K84, 1xEV-DO base station tests. The predefined settings of the different measurements are described at length in Chapter 6.

Parameter:

POWer	Power channel measurement (Standard 1xEV-DO Forward) with predefined settings
ACLR	Adjacent channel power measurements (Standard 1xEV-DO forward) with predefined settings
MCAClr	Multi carrier adjacent channel power measurement (Standard 1xEV-DO Forward) with predefined settings
ESPectrum	Check on signal power (Spectrum Emission Mask)
OBANdwith | OBWidth	Measurement of occupied bandwidth
CDPower	Code domain analyzer measurement
CCDF	Measurement of the Complementary Cumulative Distribution function (signal statistics measurement)
PVTime	Measurement or power versus time, here trace readout delivers 512 points

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS

INIT:CONT OFF
'Select single sweep

CONF:CDP:MEAS POW
'Select Channel Power measurement

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: CDPower
SCPI: device-specific

CONFigure:CDPower[:BTS]:PVTimer:BURSt ON | OFF

This command activates an automatic burst alignment to the center of the diagram.

Example

CONF:CDP:PVT:BURS ON
'Activates the automatic alignment

Characteristics

*RST value: OFF
SCPI: device-specific

CONFigure:CDPower[:BTS]:PVTimer:FREStart ON | OFF

If switched on, this command evaluates the limit line over all results at the end of a single sweep. The sweep is restarted if this result is FAILED.

Example

CONF:CDP:PVT:FRES ON
'Restarts a single sweep if the result evaluation is failed.

Characteristics

*RST value: OFF
SCPI: device-specific

CONFigure:CDPower[:BTS]:PVTimer:LIST:RESult

With this command the list evaluation results are queried in a defined order.

Example

CONF:CDP:PVT:LIST:RES

Characteristics

*RST value: OFF
SCPI: device-specific

CONFigure:CDPower[:BTS]:RFSLot FULL | IDLE

This command defines the expected signal: FULL slot or IDLE slot. Accordingly the limit lines and the borders for calculating the mean power are set. The lower and upper limit line are called DOPVTFL/DOPVTFU for FULL and DOPVTIL/DOPVTIU for IDLE mode. It is possible to change these lines with the standard limit line editor.

Example

INST:SEL BDO
'Activate 1xEV-DO BTS

```
INIT:CONT OFF
'Select single sweep

CONF:CDP:MEAS PVT
'Select power vs time

SENS:SWE:COUN 50
'50 half slots averaging

CONF:CDP:RFSL FULL
'Use limit line for FULL slot Connect FULL slot signal

CALC:LIM:PVT:REF AUTO
'Automatic reference value for limit lines

INIT:IMM;*WAI
'Start measurement with synchronization

CALC:MARK:FUNC:SUMM:MEAN:RES?
'Read out mean level

CALC:LIM1:FAIL?
'Upper line failed?

CALC:LIM2:FAIL?
'Lower line failed?

CALC:LIM:PVT:REF ONCE
'Take over FULL slot result as manual value for IDLE
measurement

CONF:CDP:RFSL IDLE
'Use limit line for IDLE slot Connect IDLE slot signal

INIT:IMM;*WAI
'Start measurement with synchronization

CALC:LIM1:FAIL?
'Upper line failed?

CALC:LIM2:FAIL?
'Lower line failed?
```

Characteristics

*RST value: FULL
SCPI: device-specific

CONFigure:CDPower[:BTS]:REVision 0 | A

With this command whether a revision 0 (subtype 0/1) signal or a revision A
(subtype 2) signal is analyzed.

Example

```
CONF:CDP:REV 0
'revision 0 signal is analyzed
```

Characteristics

*RST value: revision 0
SCPI: device-specific

7.8 INSTrument Subsystem

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

INSTrument:NSELect 1 | 10 | 14

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

Parameter

1:      Spectral analysis mode

10:    CDMA2000 FWD (BTS) mode

14:    1xEV-DO FWD (BTS) mode

Example

```
INST:NSEL 14
'Activate 1xEV-DO BTS.
```

Characteristics

*RST value: 1
SCPI: conforming

Switching to 10 presupposes the option cdma2000 FWD (BTS) R&S FS-K82.
Switching to 14 presupposes the option 1xEV-DO FWD (BTS) R&S FS-K84.

INSTrument[:SELect] SANalyzer | BC2K | BDO

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

Selecting 1xEV-DO BTS (BDO = base station 1xEV-DO) sets the device to a defined state. The preset values are described in Chapter 2, in the section entitled "Default settings in ".

Example

```
INST BDO
'Activate 1xEV-DO BTS
```

Characteristics

*RST value: SANalyzer
SCPI: conforming

Switching to BC2K presupposes the option CDMA2000 FWD (BTS) R&S FS-K82.
Switching to BDO presupposes the option 1xEV-DO FWD (BTS) R&S FS-K84.

7.9 MMEMory subsystem

The MMEMory (mass memory) subsystem provides commands which allow for access to the storage media of the instrument and for storing and loading various instrument settings. The various drives can be addressed via the "mass storage unit specifier" <msus> using the conventional DOS syntax. The internal hard disk is addressed by "D:", the floppy disk drive by "A:".

MMEM:STOR:FIN 'A:\final.dat'

With this command the peak list is exported to a file in ASCII format.

Example

```
MMEM:STOR:FIN 'A:\final.dat'
```

Characteristics

*RST value:
SCPI: device-specific

7.10 SENSe:CDPower Subsystem

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

SENSe:CDPower:AVERage ON | OFF

This command can be precisely enabled by means of ON when the Code Domain Power analysis is active. (Refer to the command CALC1:FEED). If averaging is active, the CDP is calculated over all slots and displayed as called for by the 1xEV-DO Standard.

Example

```
INST:SEL BDO"
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

INIT;*WAI
'Start measurement with synchronization

CDP:AVER ON
'Activate averaging CDP Relative over all slots active on
screen A
```

Characteristics

*RST value: OFF
SCPI: device-specific

[SENSe:]CDPower:CODE   <numeric value>

This command selects the code number. The maximum value depends on the spreading factor of the channel type. PILOT/PREAMBLE: 0..31, DATA: 0..15, MAC: 0..63.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A and General Results
active on screen B

INIT:CONT OFF
'Select single sweep

CDP:CODE 11
'Select code number 11

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: 0
SCPI: device-specific

[SENSe:]CDPower:CTYPe PILot | MAC | PREamble | DATA

This command is used to select the channel type. The number of results then changes in most analyses, such as code domain power, symbol EVM, and bit stream, because either a different spreading factor or a different number of symbols is available for the analysis.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are the PILOT channel type is
selected

INIT:CONT OFF
'Select single sweep

CDP:CTYP MAC
'MAC channel type is selected

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: PILOT
SCPI: device-specific

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

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CDP:ICTR -10DB
'Threshold value to -10dB

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

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

[SENSe:]CDPower:IQLength R&S FSU/R&S FSQ: 2..36, R&S FSP: 2..12

This command sets the capture length (IQ Capture Length) in multiples of the slot. The range is between 2 and 36 for the Analyzer R&S FSU/R&S FSQ and from 2 to 12 for the Analyzer R&S FSP.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP Relative  active on
screen A and General Results on screen B

INIT:CONT OFF
'Select single sweep

CDP:IQL 8
'8 slots capture length

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: 3
SCPI: device-specific

[SENSe:]CDPower:LEVel:ADJust

This command initiates automatic setting of the RF attenuation and IF gain to the level of the applied signal. The device is placed in the *ATTEN MANUAL* mode to set RF attenuation and IF gain independently of each other to optimum values. This mode is retained even after the mode has changed from 1xEV-DO BTS to SPECTRUM.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CDP:LEV:ADJ
'Start automatic level setting

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: -
SCPI: device-specific

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

[SENSe:]CDPower:MAPPing I | Q

This command selects, when the mapping mode is not Complex, whether the I or Q branch should be analyzed.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are the PILOT channel type,
mapping mode IORQ and the I branch are selected

INIT:CONT OFF
'Select single sweep

CDP:MAPP Q
'Selects the Q branch

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: I
SCPI: device-specific

[SENSe:]CDPower:MMODe AUTO | IOQ | COMPlex

This command defines the mapping mode. With AUTO, internal working takes place in "Complex" mapping mode for the DATA channel type and "I or Q" for the PILOT, MAC and PREAMBLE channel types. With this command, each mapping mode can be determined personally for all channel types, or it is possible to return to AUTO.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are the PILOT channel type
and the I branch are selected

INIT:CONT OFF
'Select single sweep

CDP:MMOD COMP
'The pilot channel type is analyzed complex

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: AUTO
SCPI: device-specific

[SENSe:]CDPower:NORMalize   ON | OFF

This command enables and disables elimination of the IQ offset.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CDP:NORM OFF
'Elimination of IQ Offset off

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: OFF
SCPI: device-specific

[SENSe:]CDPower:OVERview ON | OFF

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

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

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

INIT;*WAI
'Start measurement with synchronization

CDP:OVER ON
'Activate Overview mode
CDP Relative on screen A I branch
CDP Relative on screen B Q branch

TRAC? TRACE1
'Read out CDP Relative of I branch

TRAC? TRACE2
'Read out CDP Relative of I branch

CDP:OVER OFF
'Disable Overview mode: CDP Relative active on screen A and
General Results on screen B
```

Characteristics

*RST value: OFF
SCPI: device-specific

[SENSe:]CDPower:PNOFfset   0...511

This command sets the PN offset of the base station in multiples of 64 chips.

Example

```
INST:SEL BD
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CDP:PNOF 4
'Set PN Offset

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: 0
SCPI: device-specific

[SENSe:]CDPower:QINVert   ON | OFF

This command inserts the sign of the signal Q component.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CDP:QINV ON
'Enable Invert Q component

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: OFF
SCPI: device-specific

[SENSe:]CDPower:SBANd   NORMal | INVers

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CDP:SBAN INV
'Swap sidebands

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: NORM
SCPI: device-specific

[SENSe:]CDPower:SET:COUNt   1 ... 57

If the SET COUNT is set to 1 (default value), the device behaves as normal and with the command CDPower:IQLength (IQ-Capture-Length) the number of slots can be set.

For R&S FSQ the SET COUNT can be adjusted in the range of 1…57. Is the SET COUNT greater than 1 the IQ-Capture-Length will be implicitly set to 32 Slots and become unavailable. The SET COUNT defines then how many SETS of 32 Slots shall be captured consecutively into the IQ RAM of the R&S FSQ.
This command is only available on R&S FSQ.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and 'result summary active on screen B

INIT:CONT OFF
'Select single sweep

CDP:SET:COUN 12
'Select 12 Sets of 32 slots on R&S FSQ

INIT;*WAI
'Start measurement with synchronization

CDP:SET 2
'Select results from SET 2

TRAC? TRACE1
'Read out CDP
```

Characteristics

*RST value: 1
SCPI: device-specific

[SENSe:]CDPower:SET[:VALue]   0 ... (SET COUNT-1)

With this command the SET is selected for which the results are evaluated.
Beforehand with `CDP:SET:COUN` a *SET COUNT* value greater than 1 must be set.

This command is only available on R&S FSQ..

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and result summary active on screen B

INIT:CONT OFF
'Select single sweep

CDP:SET:COUN 12
'Select 12 Sets of 32 Slots on R&S FSQ

INIT;*WAI
'Start measurement with synchronization

CDP:SET 2
'Select results from SET 2

TRAC? TRACE1
'Read out CDP
```

Characteristics

*RST value: 0
SCPI: device-specific

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

This command selects the slot.

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CDP:SLOT 2
'Selects slot 2

INIT;*WAI
'Start measurement with synchronization
```

Characteristics

*RST value: 0
SCPI: device-specific

[SENSe:]CDPower:TPMeas   ON | OFF

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

Example

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CDP:TPM ON
'Enable Analyze Timing and Phase Offset

INIT;*WAI
'Start measurement with synchronization

CDP:SLOT 2
'Selects slot 2

CDP:CODE 11
'Select code number 11

CALC:MARK:FUNC:CDP:RES? TOFF
'Read out timing offset of the code with number 11 in slot 2

CALC:MARK:FUNC:CDP:RES? POFF
'Read out phase offset of code with number 11 in slot 2
```

Characteristics

*RST value: OFF
SCPI: device-specific

7.11 TRACe Subsystem

TRACe[:DATA]　TRACE1 | TRACE2

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

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

The trace data (TRACE1 | TRACE2) are formatted for the different displays as shown in the following. The number of values refers to the table below:

Channel type	Spreading factor	Symbol rate	Modulation type	Chips per slot	Symbols per slot and code	Bits per slot and code		
PILOT							Mapping I or Q	Mapping complex
	32	38.4 ksps	BPSK-I or BPSK-Q	96*2　　= **192**	6		6	12
MAC	Rev. 0　64	19.2 ksps	BPSK-I or BPSK-Q	64*4　　= **256**	4		4	8
	Rev. A　128	9.6 ksps			2		2	4
PRE-AMBLE	Rev. 0　32	38.4 ksps	BPSK-I or BPSK-Q	Preamble length 64:	2		2	4
				128:	4		4	8
				256:	8		8	16
				512:	16		16	32
				1024:	32		32	64
	Rev. A　64	19.2 ksps	BPSK-I or BPSK-Q	64:	1		1	2
				128:	2		2	4
				256:	4		4	8
				512:	8		8	16
				1024:	16		16	32
DATA	16	76.8 ksps	QPSK, 8-PSK, 16-QAM	400*4-PreambleChips= **DataNettoChips**		Mapping always complex Modulation type:		
						QPSK	8-PSK	16-QAM
				1600-0　　　= **1600**	100	200	300	400
				1600-64　　= **1536**	96	192	288	384
				1600-128　= **1472**	92	184	276	368
				1600-256　= **1344**	84	168	252	336
				1600-512　= **1088**	68	136	204	272
				1600-1024 = **576**	36	72	104	144

<u>CODE DOMAIN POWER ABSOLUTE/CODE DOMAIN POWER RELATIV (TRACE1/TRACE2):</u>

The following is output for each channel of the selected channel type:

Code number　　Code number of the channel, values between 0 to 31/15/63 depending on the channel type

Level	- For CODE DOMAIN POWER ABSOLUTE in unit dBm
	- For CODE DOMAIN POWER RELATIVE in unit dB

Power ID	0 - inactive channel	
	1 - active channel	

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

The number of output codes corresponds to the spreading factor, which depends on the channel type: PILOT/PREAMBLE: 32, DATA: 16, MAC: 64. (See table above.)
Depending on the mapping settings, the I or Q branch or the complex signal is returned. With Code Domain Overview, the I branch in TRACE1 and the Q branch in TRACE2 are always returned.

Example

The example shows the results of the query for the PILOT channel type, in which only code 0.32 at BPSK-I with 0 dB power is active:

`INST:SEL BDO"`		'Activate 1xEV-DO BTS, implicit are CDP Relative active on screen A and General Results on screen B and PILOT channel type, mapping mode IORQ and I branch selected
`INIT:CONT OFF"`		'Select single sweep
`INIT;*WAI"`		'Start measurement with synchronization
`TRAC? TRACE1"`		'Read out CDP Relative of the I branch
`0,  0.0,1,`	`1,-57.3,0,`	
`2,-54.6,0,`	`3,-55.3,0,`	
`....`	`31,-54.7,0`	
`CDP:OVER ON"`		'Activate Overview mode
`TRAC? TRACE1"`		'Read out CDP Relative of the I branch
`0,  0.0,1,`	`1,-57.3,0,`'	Same values as above
`2,-54.6,0,`	`3,-55.3,0,`	
`....`	`31,-54.7,0`	
`TRAC? TRACE2"`		'Read out CDP Relative of the Q branch
`0,-53.1,0,`	`1,-54.2,0,`	'Code 0 has no component at Q!
`2,-53.3,0,`	`3,-56.0,0,`	
`....`	`31,-52.1,0`	

<u>CODE DOMAIN ERROR POWER (TRACE1/TRACE2):</u>

The following is output for each channel of the selected channel type:

Code number	Code number of the channel, values between 0 to 31/15/63 depending on the channel type
Error power	In unit dB
Power ID	0 - inactive channel 1 - active channel

Three values are thus transferred for all channels:

 <Code number>, <Level>, <Power ID>, etc.

The number of output codes corresponds to the spreading factor, which depends on the channel type: PILOT/PREAMBLE: 32, DATA: 16, MAC: 64. (See table above.)
Depending on the mapping settings, the I or Q branch or the complex signal is returned. With Code Domain Overview, the I branch in TRACE1 and the Q branch in TRACE2 are always returned.

Example:

The example shows the results of the query for the PILOT channel type, in which only code 0.32 at BPSK-I with 0 dB power is active:

`INST:SEL BDO"`	'Activate 1xEV-DO BTS, implicit are CDP Relative active on screen A and General Results on screen B and PILOT channel type, mapping mode IORQ and I branch selected
`INIT:CONT OFF`	'Select single sweep
`CALC1:FEED 'XPOW:CDEP'`	'Code Domain Error Power analysis
`INIT;*WAI"`	'Start measurement with synchronization
`TRAC? TRACE1"`	'Read out CDP Relative of the I branch

`0,-52.0,1,`   `1,-51.5,0,`
`2,-56.2,0,`   `3,-53.9,0,`
   `....` `31,-55.3,0`	

`CDP:OVER ON"`	'Activate Overview mode
`TRAC? TRACE1"`	'Read out CDP Relative of the I branch

`0,-52.0,1,`   `1,-51.5,0,`
`2,-56.2,0,`   `3,-53.9,0,`
   `....`   `31,-55.3,0`
	"Same values as above

`TRAC? TRACE2"`	'Read out CDP Relative of the Q branch

`0,-54.2,0,`   `1,-51.8,0,`
`2,-51.4,0,`   `3,-54.3,0,`
   `....`   `31,-54.3,0`
	'Code 0 is inactive at Q!

CHANNEL TABLE (TRACE1):

The following is output for each active channel:

Channel type   The channel type is numerically coded as follows:

    0   = PILOT

    1   = MAC

    2   = PREAMBLE with 64 chip length

    3   = PREAMBLE with 128 chip length

    4   = PREAMBLE with 256 chip length

    5   = PREAMBLE with 512 chip length

    6   = PREAMBLE with 1024 chip length

    7   = DATA

Code class   Fixed, depending on channel type PILOT: 5, MAC: 6,

    PREAMBLE: 5 and DATA: 4 (spreading factor = 2^code class)

Code Number   Code number of channel, values between 0 and spreading factor 1

Modulation: Modulation type including mapping:

    0   = BPSK-I

    1   = BPSK-Q

    2   = QPSK

    3   = 8-PSK

    4   = 16-QAM

    Modulation types QPSK/8-PSK/16-QAM have complex values.

Absolute level In unit dBm

Relative level In unit dB, referred to the total power in the channel type

Timing offset   Referred to the first active channel in seconds

Phase offset   Referred to the first active channel in rad. If the analysis of the timing and phase offsets is not active (refer to `CDPower:TPMeas`) or if there are more than 50 active channels in the signal, a value of 9 is returned. A value of 9 is generally returned for inactive channels.

This means that 8 values are transmitted for all active channels:
<Channel type>, <Code class>, <Code number>, <Modulation>, <Absolute level>, <Relative level>, <Timing offset>, <Phase offset>, etc.

The channels are listed in the following channel type order: PILOT, MAC, PREAMBLE, DATA. Within the channel types, the channels are sorted in ascending code number order.

Example:

The example shows the results of the query for the following configuration:

```
PILOT      0.32     (CC 5)     BPSK-I      0.0dB

MAC        2.64     (CC 6)     BPSK-I    - 7.0dB

MAC        3.64     (CC 6)     BPSK-I    - 6.9dB

MAC        4.64     (CC 6)     BPSK-I    - 7.1dB

MAC       34.64     (CC 6)     BPSK-Q    - 7.1dB

MAC       35.64     (CC 6)     BPSK-Q    - 7.0dB

PRE64      2.32     (CC 5)     BPSK-I    - 0.0dB

DATA       0.16     (CC 4)     16-QAM    -12.1dB

DATA       1.16     (CC 4)     16-QAM    -12.0dB

DATA       2.16     (CC 4)     16-QAM    -12.2dB

           ...      .....      ......     ......    .......

DATA      13.16     (CC 4)     16-QAM    -12.1dB

DATA      14.16     (CC 4)     16-QAM    -12.2dB

DATA      15.16     (CC 4)     16-QAM    -12.3dB
```

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on screen A
and General Results active on screen B

INIT:CONT OFF
'Select single sweep

CALC1:FEED 'XTIM:CDP:ERR:CTAB'
```
' Analyze channel tables

```
INIT;*WAI
```

```
'Start measurement with synchronization
```

```
TRAC? TRACE1"
```
' Read out channel table

```
0 , 5,  0,  0,  15.0,   0.0, 9, 9,    'PILOT
1 , 6,  2,  0,   8.0,  -7.0, 9, 9,    'MAC
1 , 6,  3,  0,   8.1,  -6.9, 9, 9,
1 , 6,  4,  0,   7.9,  -7.1, 9, 9,
1 , 6, 34,  1,   7.9,  -7.1, 9, 9,
1 , 6, 35,  1,   8.0,  -7.0, 9, 9,
2 , 5,  0,  0,  14.9,   0.0, 9, 9,    'PREAMBLE
7 , 4,  0,  4,   2.8, -12.1, 9, 9,    'DATA
7 , 4,  1,  4,   2.9, -12.0, 9, 9,
7 , 4,  2,  4,   2.7, -12.2, 9, 9,
7 , 4,  3,  4,   2.8, -12.1, 9, 9,
.. .. .. ..   ...    ...   ...
```

```
7 , 4, 13,  4,   2.8, -12.1, 9, 9,
7 , 4, 14,  4,   2.7, -12.2, 9, 9,
7 , 4, 15,  4,   2.6, -12.3, 9, 9
```

CHANNEL TABLE (CTABle):

In addition to the results of the channel table which are output using the TRACE1 command, active timing and phase offset measurement (refer to `CDP:TPM`) also has the CTABle query command which displays the maximum values of the TIMING and PHASE OFFSET together with the associated channel type and channel.

The following values are output:
<Max. time offset in s>, <Channel Type>, <Code number for max. time>, <Code class for max. time>,
<Max. phase offset in rad>, <Channe type>, <Code number for max. phase>, <Code class for max. phase>, <Reserved 1>, ..., <Reserved 4>

The channel type is 1 for MAC and 7 for DATA.

Example:

```
INST:SEL BDO
'Activate 1xEV-DO BTS, implicit are CDP relative on Screen A
and Result Summary active on Screen B.

INIT:CONT OF
'Select single sweep

CALC2:FEED 'XTIM:CDP:ERR:CTAB'
'Analyze channel tables

CDP:TPM ON
'Activate timing and phase offset measurement

INIT;*WAI
'Start measurement with synchronization

TRAC? CTAB
'Read out maximum timing and phase offsets

-1.55E-009,1,5,6,
'Max. time offset with channel type code number and code
class of associated channel

3.37E-003,1,37,6,
''Max. phase offset with channel type code number and code
class of associated channel

0,0,0,0,0,0
'6 reserved values
```

GENERAL RESULTS/CHANNEL RESULTS (TRACE2):

The results included in GENERAL RESULTS and CHANNEL RESULTS are read out in the following order:

<FERRor>, <FERPpm>, <CERRor>, <TFRame>, <RHOPilot>, <RHO1>, <RHO2>, <PPILot>, <PMAC>, <PDATa>, <PPReamble>, <MACCuracy>, <DMTYpe>, <MACTive>, <DACTive>, <PLENGth>, <RHO>, <PCDerror> , <IQIMbalance>, <IQOFfset>, <SRATe>, <CHANnel>, <SFACtor> <TOFFset>, <POFFset>, <CDPRelative>, <CDPabsolute>, <EVMRms>, <EVMPeak>, <MTYPe>

In this instance the results have the following meaning and units:

Global results for all slots:

FERRor	Frequency error in Hz
FERPpm	Frequency error in ppm
CERRor	Chip rate error in ppm
TFRame	Trigger to frame
RHOPilot	RHO over all slots for the pilot area
RHO1	RHOoverall-1 over all slots over all chips with start of averaging at the half-slot limit
RHO2	RHOoverall-2 over all slots over all chips with start of averaging at the quarter-slot limit

Results for the selected slot:

PPILot	Absolute power in the PILOT channel type
PMAC	Absolute power in the MAC channel type
PDATa	Absolute power in the DATA channel type
PPReamble	Absolute power in the PREAMBLE channel type
MACCuracy	Composite EVM in %
DMTYpe	Modulation type in the DATA channel type
	2 = QPSK
	3 = 8-PSK
	4 = 16-QAM
MACTive	Number of active MAC channels
DACTive	Number of active DATA channels
PLENGth	Length of preamble in chips
RHO	RHO value for the selected channel type/slot

Results for the selected channel type in the selected slot:

PCDerror	Peak Code Domain Error in dB

IQIMbalance	IQ Imbalance in %
IQOFfset	IQ Offset in %

Channel results:

SRATe	Symbol rate in ksps
CHANnel	Channel rumber
SFACtor	Spreading-factor of the channel
TOFFset	Timing offset in s
POFFset	Phase offset in rad
CDPRelative	Channel power relativ in dB
CDPabsolutee	Channel power absolute in dBm
EVMRms	Error vector magnitude RMS in %
EVMPeak	Error vector mag. peak in %
MTYPe	Modulation type

        0   = BPSK-I

        1   = BPSK-Q

        2   = QPSK

        3   = 8-PSK

        4   = 16-QAM

        5   = 2BPSK (if complex analysis selected for PILOT, PREAMBLE or MAC)

Note:

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

POWER VS CHIP

The number of returned values is 2048, since one level value is available per chip.

POWER VS CHIP: <Level value in dBm>, <Level value in dBm>, etc.;

PEAK CODE DOMAIN ERR und COMPOSITE EVM (TRACE2):

The number of returned value pairs corresponds to the IQ capture length.
(Refer to the command CDPower:IQLength).

PEAK CODE DOMAIN ERROR: <Slot number>, <Level value in dB>, ...;
COMPOSITE EVM: <Slot number>, <Value in %>, ...;

<u>SYMBOL EVM (TRACE2):</u>

The number of value pairs depends on the number of symbols and is between 2 and 100. Refer in this respect to the table above in the column 'Number of symbols per slot and code'.

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

<u>POWER VS SYMBOL (TRACE2):</u>

The number of values depends on the number of symbols and is between 2 and 100. Refer in this respect to the table above in the column 'Number of symbols per slot and code'.

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

<u>SYMBOL CONST (TRACE2):</u>

The number of value pairs depends on the number of symbols and is between 2 and 100. Refer in this respect to the table above in the column 'Number of symbols per slot and code'.

Real and imaginary parts are transferred as value pairs.
<re 0>,<im 0>,<re 1>,<im 1>,.....<re n>, <im n>

<u>COMPOSITE CONST (TRACe2):</u>

The number of value pairs corresponds to the number of chips for the channel type. The value is between 64 and 1600 ships per slot. Refer in this respect to the table above in the column 'Chips per slot'.

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

<u>BITSTREAM (TRACE2):</u>

The bit stream of a slot is output. A value is read out for each bit (range 0,1), each symbol consists of 1 bit for BPSK-I/BPSK-Q, 2 bits for QPSK and 2BPSK (Complex BPSK-I/BPSK-Q analysis), 3 bits for 8-PSK and 4 bits for 16-QAM. The bit stream per slot is accordingly of different lengths. Refer in this respect to the table above in the column 'Bits per slot and code'. The number of bits is between 2 and 400.

Example of bit stream trace: 0, 0, 1, 0 , 1, 1, 0 ....

7.11.2　STATus-QUEStionable:SYNC-Register

This register contains information about the error situation in the Code Domain Power analysis of the FS-K84 option.

It can be queried with the commands "STATus:QUEStionable:SYNC:CONDition?" and "STATus: QUEStionable:SYNC[:EVENt]?" .

Bit No.	Explanation
0	Not used in the FS-K84 application
1	**K84 Frame Sync failed** This bit is set when synchronization is not possible within the application. Possible reasons for this are: 　　Wrongly set frequency 　　Wrongly set level 　　Wrongly set PN OFFSET 　　Wrongly set values for Q-INVERT or SIDE BAND INVERT 　　Invalid signal at Input
2 to 3	Not used in the FS-K84 application
4	**K84 Preamble Current Slot missing** This bit is set when the Preamble channel type is being investigated within the FS-K84 application, and there is no preamble in the current slot. The measurement results that can be read out for the Preamble channel type are not valid!
5	**K84 Preamble Overall missing** This bit is set when the Preamble channel type is being investigated within the FS-K84 application, and there is no preamble in at least one of the slots being examined. The measurement results that can be read out for the Preamble channel type are not valid if the analysis takes all slots into account. (CDP with Average, Peak Code Domain Error, Composite EVM)
6 to 14	Not used in the FS-K84 application
15	This bit is always 0.

7.12 Table of Softkeys with Assignment of IEC/IEEE bus Commands

7.12.1 MEAS key and MEAS hotkey

POWER	`:CONF<1>:CDP:MEAS POW` ` Query of results:CALC<1>:MARK<1>:FUNC:POW:RES? CPOW`
ACLR	`:CONF<1>:CDP:MEAS ACLR` ` Query of results:   :CALC<1>:MARK<1>:FUNC:POW:RES? ACP`
NO. OF ADJ CHAN	`:SENS:POW:ACH:ACP 2`
ADJUST SETTINGS	`:SENS:POW:ACH:PRES ACP|CPOW|OBW`
SWEEP TIME	`:SWE:TIM 1 s`
NOISE CORR ON OFF	`:SENS:POW:NCORR ON`
FAST ALCR ON OFF	`:SENS:POW:HSP ON`
DIAGRAM FULL SIZE	-
ADJUST REV LVL	`:SENS:POW:ACH:PRES:RLEV`

ACLR LIMIT CHECK	`:CALC:LIM:ACP ON`
	`:CALC:LIM:ACP:ACH:RES?`
	`:CALC:LIM:ACP:ALT:RES?`

EDIT ACLR LIMIT	`:CALC:LIM:ACP ON`
	`:CALC:LIM:ACP:ACH 0dB,0dB`
	`:CALC:LIM:ACP:ACH:STAT ON`
	`:CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm`
	`:CALC:LIM:ACP:ACH:ABS:STAT ON`
	`:CALC:LIM:ACP:ALT1 0dB,0dB`
	`:CALC:LIM:ACP:ALT1:STAT ON`
	`:CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm`
	`:CALC:LIM:ACP:ALT1:ABS:STAT ON`
	`:CALC:LIM:ACP:ALT2..11 0dB,0dB`
	`:CALC:LIM:ACP:ALT2..11:STAT ON`
	`:CALC:LIM:ACP:ALT2..11:ABS -10dBm,-10dBm`
	`:CALC:LIM:ACP:ALT2..11:ABS:STAT ON`

CHANNEL BANDWITH	`:SENS:POW:ACH:BWID 1.2288MHz`

ADJ CHAN BANDWITH	`:SENS:POW:ACH:BWID:ACH 30kHz`
	`:SENS:POW:ACH:BWID:ALT1 30kHz`
	`:SENS:POW:ACH:BWID:ALT2..11 30kHz`

ADJ CHAN SPACING	`:SENS:POW:ACH:SPAC:ACH 750kHz`
	`:SENS:POW:ACH:SPAC:ALT1 1.98MHz`
	`:SENS:POW:ACH:SPAC:ALT2..11 4MHz`

ACLR ABS REL	`:SENS:POW:ACH:MODE ABS`
CHAN PWR / HZ	`:CALC:MARK:FUNC:POW:RES:PHZ ON|OFF`
POWER MODE	
CLEAR/ WRITE	
	`:CALC:MARK:FUNC:POW:MODE WRIT|MAXH`
MAX HOLD	
MULT CARR ACLR	`:CONF<1>:CDP:MEAS MCAC` Query of results: `:CALC<1>:MARK<1>:FUNC:POW:RES? MCAC`
CP/ACP CONFIG	
NO. OF ADJ CHAN	`:SENS:POW:ACH:ACP 2`
NO. OF TX CHAN	`:SENS:POW:ACH:TXCH:COUN 4`
CHANNEL BANDWITH	`:SENS:POW:ACH:BWID 1.2288MHz`

CHANNEL
SPACING
	`:SENS:POW:ACH:SPAC:ACH 750kHz`
	`:SENS:POW:ACH:SPAC:ALT1 1.98MHz`
	`:SENS:POW:ACH:SPAC:ALT2..11 4MHz`

ACP REF
SETTING
	`:POW:ACH:REF:TXCH:MAN 1`
	`:POW:ACH:REF:TXCH:AUTO MIN`
	`:POW:ACH:REF:TXCH:AUTO MAX`
	`:POW:ACH:REF:TXCH:AUTO LHIG`

CP/ACP ABS REL	`:POW:ACH:MODE ABS`
CHAN PWR / HZ	`:CALC:MARK:FUNC:POW:RES:PHZ ON|OFF`
POWER MODE	
CLEAR/ WRITE	
	`:CALC:MARK:FUNC:POW:MODE WRIT|MAXH`
MAX HOLD	
ADJUST SETTINGS	`:SENS:POW:ACH:PRES MCAC`

ACP LIMIT
CHECK
	`:CALC:LIM:ACP ON`
	`:CALC:LIM:ACP:ACH:RES?`
	`:CALC:LIM:ACP:ALT:RES?`

EDIT
ACP LIMIT
	`:CALC:LIM:ACP ON`
	`:CALC:LIM:ACP:ACH 0dB,0dB`
	`:CALC:LIM:ACP:ACH:STAT ON`
	`:CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm`
	
	`:CALC:LIM:ACP:ACH:ABS:STAT ON`
	`:CALC:LIM:ACP:ALT1 0dB,0dB`
	`:CALC:LIM:ACP:ALT1:STAT ON`
	`:CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm`
	
	`:CALC:LIM:ACP:ALT1:ABS:STAT ON`
	`:CALC:LIM:ACP:ALT2..11 0dB,0dB`
	`:CALC:LIM:ACP:ALT2..11:STAT ON`
	`:CALC:LIM:ACP:ALT2..11:ABS -10dBm,-10dBm`
	
	`:CALC:LIM:ACP:ALT2..11:ABS:STAT ON`

SWEEP TIME	`:SWE:TIM 1 s`
NOISE CORR ON OFF	`:SENS:POW:NCORR ON`
FAST ACP ON OFF	`:SENS:POW:HSP ON`
DIAGRAM FULL SIZE	-
ADJUST REV LVL	`:SENS:POW:ACH:PRES:RLEV`

SPECTRUM
EM MASK
	`:CONF:CDP:MEAS ESP`
	
	Query of results: `:CALC<1>:LIM<1>:FAIL?`
	                               `:CALC:LIM:ESP:CHEC:X?;Y?`

LIMIT LINE AUTO	`:CALC:LIM:ESP:MODE AUTO`
LIMIT LINE MANUAL	`:CALC:LIM:ESP:MODE MANual` `:CALCul:LIM:ESP:VAL <numeric_value>`
LIMIT LINE USER	`:CALC:LIMit<1>:NAME <string>` `:CALC:LIMit<1>:UNIT DBM` `:CALC:LIMit<1>:CONT[:DATA] <num_value>, <num_value>, ...` `:CALC:LIMit<1>:CONT:DOMain FREQuency` `:CALC:LIMit<1>:CONT:TRACe 1` `:CALC:LIMit<1>:CONT:OFFset <num_value>` `:CALC:LIMit<1>:CONT:MODE   RELative` `:CALC:LIM<1>:UPPer[:DATA] <num_value>, <num_value>..` `:CALC:LIM<1>:UPPer:STATe ON	OFF` `:CALC:LIM<1>:UPPer:OFFset <num_value>` `:CALC:LIM<1>:UPPer:MARGin <num_value>` `:CALC:LIM<1>:UPPer:MODE Absolutee` `:CALC:LIM<1>:UPPer:SPACing LINear`

Note:

- If the y calues are entered with the command `:CALC:LIMit<1>:LOWer[:DATA]` the limit check is "failed", if the values are below the limit line

- If a user defined limit line is switched on this one has priority over the limit lines selected via AUTO or MANUAL

RESTORE STD LINES	`:CALC:LIM:ESP:RESTore`
LIST EVALUATION	`:CALCulate1:PEAKsearch:AUTO ON	OFF` With this command the list evaluation which is by default for backwards compatibility reasons off can be turned on.  `TRACe1:DATA? LIST` With this command the list evaluation results are queried in the following order: `<no>, <start>, <stop>, <rbw>, <freq>, <power abs>, <power rel>, <delta>, <limit check>, <unused1>, <unused2`
ADJUST REF LVL	`:SENS:POW:ACH:PRES:RLEV`
30kHz/1MHz TRANSITION	`:CALCIf a user defined limit line is switched on this one has priority over the limit lines selected via AUTO or MANUAL:LIM:ESP:TRAN <numeric value>`
PEAK SEARCH	`:CALC:PEAK`
PEAK PER RANGE	`:CALC:PEAK:SUBR 1...50`
MARGIN	`:CALC:PEAK:MARG -200dB...200dB`

VIEW PEAK LIST	`:TRAC? FINal1`
	The comma separated values are:
	`<freq1>, <level1>, <delta level 1>,`
	`<freq2>, <level2>, <delta level 2>, ...`

SORT BY FREQUENCY	`--`
SORT BY DELTA LIM	`--`

ASCII FILE EXPORT	`<trace no 1>, <freq1>, <level1>, <delta level 1>,`
	`<trace no 2>, <freq2>, <level2>, <delta level 2>,`
	`...`

DECIM SEP . ,	`:FORM:DEXP:DSEP POIN	COMM`
OCCUPIED BANDWIDTH	`:CONF<1>:CDPower:MEAS` Query of results: `:CALC<1>:MARK<1>:FUNC:POWer:RES? OBAN`
% POWER BANDWITH	`:SENS:POW:BWID 99PCT`
ADJUST SETTINGS	`:SENS:POW:PRES OBW`
ADJUST REF LVL	`:SENS:POW:ACH:PRES:RLEV`
STATISTICS	`:CONF:CDP:MEAS CCDF` oder `:CALC:STAT[:BTS]:CCDF[:STATe] ON` Query of results: `CALC:MARK:X?`
APD	`:CALC:STAT:APD ON`

CCDF	`:CALC:STAT:CCDF ON`
PERCENT MARKER	`:CALC:MARKr:Y:PERC 0...100%`
NO OF SAMPLES	`CALC:STAT:NSAM <value>`
SCALING	
X-AXIS REF LVL	`:CALC:STAT:SCAL:X:RLEV <value>`
X-AXIS RANGE	`:CALC:STAT:SCAL:X:RANG <value>`
Y-UNIT % ABS	`:CALC:STAT:SCAL:Y:UNIT PCT`
Y-AXIS MAX VALUE	`:CALC:STAT:SCAL:Y:UPP <value>`
Y-AXIS MIN VALUE	`:CALC:STAT:SCAL:Y:LOW <value>`
ADJUST SETTINGS	`:CALC:STAT:SCAL:AUTO ONCE`
DEFAULT SETTINGSL	`:CALC:STAT:PRES`
ADJUST SETTINGS	`:CALC:STAT:SCAL:AUTO ONCE`
CONT MEAS	`:INIT:CONT ON;` `:INIT:IMM`
SINGLE MEAS	`:INIT:CONT OFF;` `:INIT:IMM`

7.12.2 Hotkey RESULTS or Softkey CODE DOM ANALYZER

| CODE DOM POWER | `:CALC<1>:FEED "XPOW:CDP:RAT" (relative)`
`:CALC<1>:FEED "XPOW:CDP" (absolute)` |

```
CODE DOM
POWER              :CALC<1>:FEED "XPOW:CDP:RAT" (relative)
                   :CALC<1>:FEED "XPOW:CDP" (absolute)

CODE DOM
ERROR              :CALC<1>:FEED "XPOW:CDEP"

COMPOSITE
EVM                :CALC2:FEED "XTIM:CDP:MACCuracy"

PEAK CODE
DOMAIN ERR         :CALC2:FEED "XTIM:CDP:ERR:PCDomain"

POWER
VS SLOT            :CALC2:FEED "XTIM:CDP:PVSLot"

GENERAL            :CALC2:FEED "XTIM:CDP:ERR:SUMM"
RESULT             :CALC<1|2>:MARK<1>:FUNC:CDP[:BTS]:RES?
                            RHO | MACC | PCD FERR | FERP |
CHANEL                      CERR | TFR I IQOF | IQIM |
RESULTS                     SRAT | CHAN | SFAC | TOFF | POFF |
                            CDP | CDPR | EVMR | EVMP |
                            RHOP | RHO1 | RHO2 | PPILot | PMAC | PDATa|
                            PPR | MACT | DACT | PLEN |
                            MTYP | DMT  | RHOD | RHOM

SYMBOL
CONST              :CALC2:FEED "XTIM:CDP:SYMB:CONS"

SYMBOL
EVM                :CALC2:FEED "XTIM:CDP:SYMB:EVM"

BITSTEAM           :CALC2:FEED "XTIM:CDP:BSTReam"

COMPOSITE
CONST              :CALC2:FEED "XTIM:CDP:COMP:CONS"

POWER
VS SYMBOL          :CALC2:FEED "XTIM:CDP:PVSY"

SELECT
CODE               :[SENS:]CDP:CODE 0...(BASE SF-1)

SELECT

    CAPTURE
    LENGTH         :[SENS:]CDP:IQLength 2..36

    SET
    COUNT          :[SENS:]CDP:SET:COUNt 1..57 (nur R&S FSQ)

    SET TO
    ANALYZE        :[SENS:]CDP:SET:[VALue] 0..(SET COUNT-1) (only R&S FSQ)

    SELECT
    CODE           :[SENS:]CDP:CODE 0...(BASE SF-1)

    SELECT
    SLOT           :[SENS:]CDP:SLOT 0 ...(IQ_CAPTURE_LENGTH-1)

ADJUST
REF LVL            :SENS:POW:ACH:PRES:RLEV
```

7.12.3 Hotkey CHAN CONF

CODE CHAN AUTOSEARCH	`:CONF:CDP[:BTS]:CTABle[:STATe] OFF`
CODE CHAN PREDEFINED	`:CONF:CDP[:BTS]:CTAB[:STAT] ON` `:CONF:CDP[:BTS]:CTAB:SEL  <channel table name>`
EDIT CHAN CONF TABLE	---
NEW CHAN CONF TABLE	---
HEADER VALUES	`:CONF:CDP [:BTS]:CTAB:NAME "NEW_TAB"`
INSERT MAC	---
INSERT PREAMBLE	---
DELETE LINE	---
MEAS CHAN CONF TABLE	---
SAVE TABLE	--
SORT TABLE	---
PAGE UP	---
PAGE UP	---
DEL CHAN CONF TABLE	`:CONF:CDP [:BTS]:CTAB:DEL`
COPY CHAN CONF TABLE	`:CONF:CDP [:BTS]:CTAB:COPY "CTAB2"`
RESTORE STD TABLES	`:CONF:CDP [:BTS]:CTAB:REST`

7.12.4 Hotkey SETTINGS

BAND CLASS	`:CONF:CDP:BCL 1 '1900 MHz`
REVISION A 0	`:CONF:CDP [:BTS]:REV 0	A`
PN OFFSET	`:[SENS:]CDP:PNOF 0...511`
CAPTURE SETTINGS	
CAPTURE LENGTH	`:[SENS:]CDP:IQLength 2..36`
SET COUNT	`:[SENS:]CDP:SET:COUN 1..57 (nur R&S FSQ)`
SET TO ANALYZE	`:[SENS:]CDP:SET:[VAL] 0..(SET COUNT-1) (nur R&S FSQ)`
SELECT CODE	`:[SENS:]CDP:CODE 0...(BASE SF-1)`
SELECT SLOT	`:[SENS:]CDP:SLOT 0 ...(IQ_CAPTURE_LENGTH-1)`
CAPTURE LENGTH	`:[SENS:]CDP:IQL 2..50`
HEADER VALUES	`---`
PILOT	
MAC	`:[SENS:]CDP:CTYP PIL	MAC	PREamble	DATA`
PREAMBLE	
DATA	
CODE DOM CONF TABLE	`:[SENS:]CDP:OVER ON	OFF`
MAPPING AUTO	
MAPPING COMPLEX	`:[SENS:]CDP:MMOD AUTO	IOQ	COMPLex`
MAPPING I OR Q	
SELECT I Q	`:[SENS:]CDP:MAPP I	Q`
INACT CHAN THRESHOLD	`:[SENS:]CDP:ICTR -100 dB ... 0 dB`

CODE PWR ABS REL	:CALC<1>:FEED "XPOW:CDP:RAT" (relative) :CALC<1>:FEED "XPOW:CDP" (absolute)
CDP AVG ON OFF	:[SENS:]CDP:AVER ON | OFF
TIME PHASE ON OFF	:[SENS:]CDP:TPM ON | OFF
ANT DIV ON OFF	
ANT NO. 64 128	:[SENS:]CDP:ANT OFF | 1 | 2
INVERT Q ON OFF	:[SENS]:CDP:QINV ON | OFF
SIDE BAND NORN INV	:[SENS:]CDP:SBAN NORMal|INVers
NORMALIZE ON OFF	:[SENS:]CDP:NORM ON | OFF

8 Checking the Rated Specifications

- Switch off the analyzer before withdrawing or inserting modules.
- Check the position of the mains voltage selector (230 V) before switching on the device.
- Perform measurement of the set characteristics after the device has warmed up for at least 30 minutes and after self-calibration of the analyzer and the R&S SMIQ have been completed. This is the only way to ensure that the guaranteed data are complied with.

Unless specified to the contrary, all settings will be performed starting from the PRESET setting.

The following conventions apply to settings on the analyzer during measurement:

[**<Key>**]   Press a key on the front panel such as [SPAN]

[<SOFTKEY>]   Press a softkey such as . [MARKER -> PEAK]

[<tbd unit>]   Enter a value and terminate by entering the unit such as . [12 kHz]

{<nn>}   Enter values specified in the table below.

Successive entries are separated by [:] such as [**SPAN**: 15 kHz]

The values in the sections that follow are not guaranteed; only the specifications in the data sheet are binding.

8.1 Measuring equipment and accessories

Item	Device type	Recommended characteristics	Recommended device	R&S order number
1	Signal generator	Vector signal generator	R&S SMIQ with options: R&S SMIQB20 R&S SMIQB11 R&S SMIQB60 R&S SMIQK17 R&S SMIQ-Z5 PARDATA	1125.5555.xx 1125.5190.02 1085.4502.04 1136.4390.02 1154.7800.02 1104.8555.02
2	Control computer for signal generation using WinIQSIM PC that is either connected by means of a serial cable to the SMIQ, or has an IEC/IEEE bus card and connected by means of an IEC/IEEE bus cable to the SMIQ. R&S WinIQSIM Software 3.91 is installed on that PC. The software can be downloaded from the Rohde & Schwarz web site on the Internet at http://www.rohde-schwarz.com.			

8.2 Test sequence

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

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

If not done already, the WinIQSIM file with the 1xEV-DO BTS signal must be created first and transferred to the SMIQ as DO_FFULL. This is described at length in the section "Generating a 1xEV-DO forward link signal with WinIQSIM" on page 8.

Default setting on
R&S SMIQ:

[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *878.49 MHz]*
ARB MOD
   SET R&S SMIQ ACCORDING TO WAVEFORM ...
      SET R&S SMIQ ACCORDING TO WAVEFORM   *ON*
        IQ SWAP (VECTOR MODE)   *ON*
These three settings are only required once after generator preset and are used to apply, in VECTOR MODE, the IQ SWAP and, in ARB MOD, the trigger setting automatically from the waveform file generated by WinIQSIM. This is particularly present when a switch is made between different waveforms.)

      SELECT WAVEFORM... *select name 'DO_FFULL*
      STATE: *ON*

Default setting on
Analyzer   :

[PRESET]
[CENTER: *878.49 MHz]*
[AMPT: *10 dBm]*
[1xEVDO BS]
[TRIG   *EXTERN]*
[SETTINGS   *TIME/PHASE: ON]*

      [RESULTS   *CHANNEL TABLE]*

Test setup and other
settings

► Connect the RF output of the SMIQ to the RF input of the analyzer

► Connect the external trigger input of the analyzer to the TRIG1 port on the Z5 PARDATA BNC ADAPTER

► Connect the external reference output of the analyzer to the R&S SMIQ.

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

Analyzer *[SETUP:*   *REFERENCE INT]*

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

```
BS,DO,C0 :CHANNEL TAB            Type    PILOT-I
                                Code    0.32  Max T    0.76 ns  @ DATA 13.16
            CF 878.49 MHz       Slot       0  Max Ph   1.71 mrad @ DATA  5.16
```

	Type	Chan.SF	Symb Rate ksps	Modulation	Pwr Abs dBm	Pwr Rel dB	T Offs ns	Ph Offs mrad	
Ref	PILOT	0.32	38.4	BPSK-I	0.29	-0.00	0.00	0.00	**A**
10.0	MAC	2.64	19.2	BPSK-I	0.28	-0.00	0.00	0.00	
dBm	PRE64	2.32	38.4	BPSK-I	0.29	-0.00	0.00	0.00	
Att	DATA	0.16	76.8	16-QAM	-11.75	-12.12	0.00	0.00	**TRG**
40 dB	DATA	1.16	76.8	16-QAM	-11.75	-12.12	-0.28	0.19	
	DATA	2.16	76.8	16-QAM	-11.77	-12.13	0.05	0.55	
	DATA	3.16	76.8	16-QAM	-11.77	-12.13	-0.03	0.21	
	DATA	4.16	76.8	16-QAM	-11.75	-12.12	0.26	1.24	
1	DATA	5.16	76.8	16-QAM	-11.75	-12.11	-0.18	1.71	
CLRWR	DATA	6.16	76.8	16-QAM	-11.75	-12.12	0.14	-0.64	
	DATA	7.16	76.8	16-QAM	-11.76	-12.12	-0.02	-1.54	
	DATA	8.16	76.8	16-QAM	-11.77	-12.13	0.19	0.63	

```
GENERAL RESULTS                 Type      ALL

            CF 878.49 MHz
```

	Global Results		
Ref	Carr Freq Error	2.08 mHz	RHO Pilot	0.99989	**B**
10.0	Carr Freq Error	0.00 ppm	RHO overall-1	0.99989	
dBm	Chip Rate Error	0.15 ppm	RHO overall-2	0.99989	
Att	Trg to Frame	167.017333 ns			
40 dB	Results for Slot: 0			
	Power PILOT	0.29 dBm	Data Modulation Type	16-QAM	
	Power MAC	0.28 dBm	Act. MAC Channels	1	
1	Power DATA	0.36 dBm	Act. DATA Channels	16	
CLRWR	Power PREAMBLE	0.29 dBm	Preamble Length	64 Chips	
	Composite EVM	1.02 %	RHO	0.99989	

9 Relationship between Mac Index and Walsh Codes

With 1xEV-DO there are "MAC indices" to characterize channels. They are also used in Software R&S WinIQSIM.

The MAC index i can be transformed for the MAC channel type into the corresponding Walsh code for a fixed spreading factor of 64 as follows:

$$\left(\frac{i}{2}\right).64 \qquad \text{für } i = 0, 2, ..., 62 \text{ auf dem I - Zweig}$$

$$\left(\frac{i-1}{2} + 32\right).64 \quad \text{für } i = 1, 3, ..., 63 \text{ auf dem Q - Zweig}$$

The PREAMBLE channel type also uses the MAC index as a criterion for channel calculation. The spreading factor in this instance is 32. Since a constant null sequence is sent for the PREAMBLE channel type in the same way as for the PILOT, it is possible to achieve for the PREAMBLE channel type, by means of bit-by-bit complements of the Walsh code for the odd indices, that the sent symbols are inverted. Instead of the null sequence, ones are received for the odd indices, there being 64 different possibilities.

$$\left(\frac{i}{2}\right).32 \qquad \text{für } i = 0, 2, ..., 62$$

$$\overline{\left(\frac{i-1}{2}\right).32} \quad \text{für } i = 1, 3, ..., 63$$

Not all indices can be used in the 1xEV-DO system. Indices 0 and 1 are not used. Index 2 is not used with MAC and is reserved for the 76.8 kbps control channel with PREAMBLE. Index 3 is not used with MAC and is reserved for the 38.4 kbps control channel with PREAMBLE. Index 4 is the RA channel with MAC (Forward MAC Reverse Activity Channel) and is not used with Preamble. The indices are flexible from index 5 onward..

The relationships have been calculated as a look-up table in the table below:

Table 24 Relationship between an even MAC index and Walsh code for MAC and PREAMBLE

	MAC CHANNEL TYPE	PREAMBLE CHANNEL TYPE
Mac Index	Walsh Code on I-Branch	Walsh Code on I-Branch
0	0	0
2	1	1
4	*2 (RA CHANNEL)*	2
6	3	3
8	4	4
10	5	5
12	6	6
14	7	7
16	8	8
18	9	9
20	10	10
22	11	11
24	12	12
26	13	13
28	14	14
30	15	15
32	16	16
34	17	17
36	18	18
38	19	19
40	20	20
42	21	21
44	22	22
46	23	23
48	24	24
50	25	25
52	26	26
54	27	27
56	28	28
58	29	29
60	30	30
62	31	31

Table 25 Relationship between an odd MAC index and Walsh code for MAC and PREAMBLE

	MAC CHANNEL TYPE	PREAMBLE CHANNEL TYPE
Mac Index	Walsh Code on Q-Branch	Walsh Code (Bit for Bit Complement)
1	32	0
3	33	1
5	34	2
7	35	3
9	36	4
11	37	5
13	38	6
15	39	7
17	40	8
19	41	9
21	42	10
23	43	11
25	44	12
27	45	13
29	46	14
31	47	15
33	48	16
35	49	17
37	50	18
39	51	19
41	52	20
43	53	21
45	54	22
47	55	23
49	56	24
51	57	25
53	58	26
55	59	27
57	60	28
59	61	29
61	62	30
63	63	31

Glossary

1xEV-DO	First evolution data only. Packet-oriented standard for data services as a development of the CDMA2000 mobile radio system
CDEP	Code domain error power
CDP	Code domain power
Composite EVM	The composite EVM measurement determines the squared error between the real and imaginary components of the test signal and of an ideally generated reference signal (EVM referred to the total signal).
Crest-Faktor	Ratio of peak to mean value of a signal
Inactive Channel Threshold	Minimum power that a single channel must have compared to the total signal in order to be detected as the active channel
DATA	The DATA channel type is located with a length of up to 400 chips at the beginning and end of each half slot. The useful data proper are transmitted in it.
Channel type	With regard to time, the slot is divided into 4 channel types containing independent cdma signals.
MAC	The Medium Access Control channel type is 64 chips in front of and behind the PILOT. The MAC channel type contains the reverse activity (RA) channel and the MAC reverse power control (RPC) channels with which the power of the active terminals is controlled.
MC1	Multicarrier1 (a carrier system 1X)
PILOT	The PILOT channel type comprises 96 chips and is located in the center of each half-slot. It must be present in the signal for the base station signal to be detected.
PREAMLE	The first 64 to 1024 chips of the DATA channel type are replaced at the beginning of a data packet by the PREAMBLE channel type. Depending on the transmission speeds being used and whether the start of data of the packet is missed, there are therefore preambles of different length in the slot.
RA	Reverse activity channel. Indicates whether at least one terminal is transmitting to the base station.
RPC	Reverse power control. Power regulation of the data terminal equipment by the base station

SLOT	Reverse power control. Power regulation of the data terminal equipment by the base station
x.y	Term in the 1xEV-DO system for 2048 chips or a period of 1.6625 ms

Index

A

B

C

D

E

F

H

I

K

M