ROHDE&SCHWARZ

Test and Measurement
Division

Operating Manual

Software Options:
TDMA800/1900-MS for CMU-B21

R&S CMU-K27/-K28

1115.6607.02/1115.6707.02

Printed in Germany

Dear Customer,

throughout this manual, CMU-K27 and CMU-K28 is generally used as an abbreviation for the software options R&S CMU-K27 and R&S CMU-K28. The Universal Radio Communication Tester R&S CMU 200 is abbreviated as CMU200.

Tabbed Divider Overview

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Contents of Manuals for Universal Radio Communication Tester CMU

Operating Manual CMU-K27/-K28 (Software Options: TDMA (IS 136) 800/1900-MS for CMU-B21)

The present operating manual describes the application of the CMU for IS 136 mobile tests. It gives comprehensive information about the installation of the software, about manual as well as remote control of the instrument. Typical measurement tasks are explained in detail using the functions of the graphical user interface and a selection of program examples.

The manual is organized as follows:

Chapter 1	Describes the steps necessary for installing the software and putting the instrument into operation.
Chapter 2	Gives an introduction to the application of the CMU for IS 136 mobile tests and presents some typical measurement examples.
Chapter 3	Describes the operation in principle and the principles of measurement control.
Chapter 4	Represents the reference chapter providing detailed information on all functions of the user interface and their application.
Chapter 5	Describes the basics of remote control of the instrument for IS 136 mobile tests.
Chapter 6	Lists all remote control commands defined for IS 136 mobile tests. At the end of the chapter the commands are grouped together according to their function and sorted in alphabetical order.
Chapter 10	Contains an index for the operating manual.

Operating Manual CMU200/CMU300

In the operating manual for CMU basic unit you will find everything that is needed to make yourself familiar with your Universal Radio Communication Tester CMU200. This includes information about the technical specifications of the CMU, the controls and connectors on the front and rear panel, necessary steps for putting the instrument into operation, the basic operating concept, manual and remote control. Typical measurement tasks are explained in detail using the functions of the user interface and program examples.

General concepts of CMU control are described in the operating manual CMU200 and not repeated in the manuals for the individual software options.

Service Manual Instrument

The service manual informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for the maintenance of the CMU by exchanging modules.

Service Manual Modules

The service manual modules is not delivered with the instrument but may be obtained from your R&S service department with the order number 1100.4903.91.

Service manual modules contains information about the individual modules of the CMU. This comprises the test and adjustment of the modules, fault detection within the modules and the interface description.

Further Operating Manuals for Network Tests

The operating manuals listed in the following table describe the test of radio communication equipment supporting different standards by means of the CMU and the appropriate software and hardware options. The network test operating manuals are organized like the present TDMA operating manual.

		For Options		
Manual	**Order Number**	**Type**	**Description**	**Stock No.**
Operating Manual CMU-K20/-K21/-K22/-K23/-K24	1115.6088.12	CMU-K20 CMU-K21 CMU-K22 CMU-K23 CMU-K24 CMU-K42	GSM400-MS for CMU-B21 GSM900-MS for CMU-B21 GSM1800-MS for CMU-B21 GSM1900-MS for CMU-B21 GSM850-MS for CMU-B21 GPRS software extension for GSM	1115.5900.02 1115.6007.02 1115.6107.02 1115.6207.02 1115.6307.02 1115.4691.02
Operating Manual CMU-K29	1115.6888.12	CMU-K29	AMPS-MS for CMU-B21	1115.6807.02
Operating Manual CMU-K30/-K31/-K32/-K33/-K34	1115.4185.12	CMU-K30 CMU-K31 CMU-K32 CMU-K33 CMU-K34 CMU-K39 CMU-K41	GSM400-BS for CMU-B21 GSM900-BS for CMU-B21 GSM1800-BS for CMU-B21 GSM1900-BS for CMU-B21 GSM850-BS for CMU-B21 MOC/MTC EDGE for CMU-K30/31/32/33	1115.4004.02 1115.4104.02 1115.4204.02 1115.4304.02 1115.4404.02 1115.4791.02 1115.4604.02
Operating Manual CMU-K53	1115.5081.12	CMU-K53	Bluetooth for CMU	1115.5000.02
Operating Manual CMU-K65/-K66	1115.4962.12	CMU-K65 CMU-K66	WCDMA UE TX Test (3GPP/FDD) WCDMA (3GPP/FDD, DL) Generator	1115.4962.12 1115.5100.02
Operating Manual CMU-K81/-K82	1115.5581.12	CMU-K81 CMU-K82	CDMA800-MS (IS95) for CMU-B81 CDMA1900-MS (IS95) for CMU-B81	1115.5500.02 1115.5600.02
Operating Manual CMU-K83/-K84/-K85/-K86	1150.0382.12	CMU-K83 CMU-K84 CMU-K85 CMU-K86	CDMA2000 (450 MHz band) for CMU-B83 CDMA2000 (cellular band) for CMU-B83 CDMA2000 (PCS band) for CMU-B83 CDMA2000 (IMT2000 band) for CMU-B83	1150.3500.02 1150.3600.02 1150.3700.02 1150.3800.02

The GSM base station tests described in operating manual CMU-K30/-K31/-K32/-K33/-K34 require a CMU300 (Universal Radio Communication Tester for BTS). All other radio communication equipment is tested with model CMU200.

What's new in this Revision?

This operating manual describes version V3.05 of the TDMA (IS 136) 800/1900-MS software. Compared to previous versions, this new firmware provides numerous extensions and improvements. The new features described in this manual are listed below.

New Features	**Description**	**Refer to...**
Measurements	Improved layout and control of all measurement menus.	Chapter 4
Connection Control, Group Configuration	Group Configuration menu removed; functionality included in Connection Control menu (Analyzer or MS Signal tab) Improved layout and control of Connection Control menu with separate tabs for input and output signals.	Chapter 4, TDMA Module Tests (Non Signalling) TDMA Mobile Tests (Signalling) → Connection Control
Wideband Power	Wideband power measurement also available in Non Signalling test mode.	Chapter 4, TDMA Module Tests (Non Signalling) → Connection Control – Analyzer
Autoranging	The maximum RF input level can be set automatically according to the power of the RF input signal.	Chapter 4, TDMA Module Tests (Non Signalling) → Connection Control – Analyzer Chapter 4, TDMA Mobile Tests (Signalling) → Connection Control – MS Signal
Receiver Quality – BER	Configuration of up to 5 test setups possible.	Chapter 4, TDMA Module Tests (Non Signalling) → Receiver Quality Measurements
Receiver Quality – EMAHO	Extended Mobile Assisted Handoff (EMAHO) available, if supported by the mobile under test.	Chapter 4, TDMA Mobile Tests (Signalling) → Receiver Quality Measurements
Call Release	The mobile stores the control channel number before releasing a call. This speeds up consecutive call attempts.	Chapter 4, TDMA Mobile Tests (Signalling) → Connection Control – Connection
Speech Codec	In Signalling mode, the input and output signals of the speech codec (option CMU-B52) can be switched into the primary or secondary audio circuit (with option CMU-B41, Audio Generator and Analyzer).	Chapter 4, TDMA Mobile Tests (Signalling) → Connection Control – AF/RF ⊖↔
Speech Mode	In the *Handset* mode, it is possible to set up a voice connection between the CMU and a mobile via an R&S Handset.	Chapter 4, TDMA Mobile Tests (Signalling) → Connection Control – Connection
Mobile Info	Extended list of mobile parameters available.	Chapter 4, TDMA Mobile Tests (Signalling) → Connection Control – Connection
Protocol version	The CMU recognizes an extended list of protocol versions	Chapter 6, `[SENSe:]MSSinfo:PVERsion?`

Frequently Used Abbreviations

ACP	*Adjacent Channel Power*
Adj. Chan.	*Adjacent Channel*
AF	*Audio Frequency*
AMPS	*Advanced Mobile Phone System*
Att.	*Attenuation*
Avg.	*Average*
BER	*Bit Error Rate*
BS	*Base Station (=CMU)*
BSMC	*Base Station Manufacturer's Code*
Carr.	*Carrier*
Ch. / Chan.	*Channel*
CIR	*Carrier to Interference Ratio*
Config.	*Configuration*
CW	*Continuous Wave*
DCC	*Digital Color Code*
DCCH	*Digital Control Channel*
Det.	*Detected*
DIC	*Delay Interval Compensation*
Disp.	*Display*
Dist.	*Distortion*
D-line	*Display line*
DMAC	*Digital Mobile Attenuation Code*
DQPSK	*Differential Quadrature Phase-Shift Keying*
DTC	*Digital Traffic Channel*
DTX	*Discontinuous Transmission*
DVCC	*Digital Voice Color Code*
DVCC	*Digital Verification Color Code*
EBCCH	*Extended Broadcast Control Channel*
EMAHO	*Extended Mobile Assisted Handoff*
ERP	*Effective Radiated Power*
ESN	*Electronic Serial Number*
EVM	*Error Vector Magnitude*
Ext. / Extern.	*External*
FBCCH	*Fast Broadcast Control Channel*
Freq.	*Frequency*
IF	*Intermediate Frequency*
IMSI	*International Mobile Subscriber Id. Number*
IS 136	*By IS 136 mobile phones we understand devices supporting the North American TDMA standard, specified in TIA/EIA-136.xxx (once IS-136) and related standards*
Lev.	*Level*
MAC	*Mobile Attenuation Code*
Magn.	*Magnitude*
MAHO	*Mobile-Assisted Handoff*
Max.	*Maximum*
MCC	*Mobile Country Code*
MIN	*Mobile Identification Number*
Min.	*Minimum*
MNC	*Mobile Network Code*
Mod.	*Modulation*
MPCI	*Mobile Protocol Capability Indicator*
MS	*Mobile Station*
MSID	*Mobile Station Identity*
MSIN	*Mobile Subscriber Id. No.*
Oversamp.	*Oversampling*
Ovw.	*Overview*
PFC	*Paging Frame Class*
PRBS	*Pseudo Random Bit Sequence*
Ref.	*Reference*
Reg.	*Registration*
Rel.	*Relative*
RF	*Radio Frequency*
RMS	*Root Mean Square (averaging)*
RSS	*Received Signal Strength*
RSSI	*Received Signal Strength Indication*
Short.	*Shortened*
SID	*System Identity*
SMS	*Short Message Service*
SN	*(Electronical) Serial Number*
SOC	*System Operator Code*

Src.	*Source*
STU	*Secure Terminal Unit*
Sync., Synch.	*Synchronization*
TDMA	*Time Division Multiple Access*
TMSI	*Temporary Mobile Station Identity*
tr.	*Transmitted*
Trg.	*Trigger*
TSC	*Training Sequence (Code), corresponding to synchronization pattern*
TX	*Transmitter*
Vect.	*Vector*
WER	*Word Error Rate*

Contents

1 Installation 1.1

1 Installation

This chapter describes the installation and update of the software options TDMA (IS 136) 800/1900-MS for the Universal Radio Communication Tester CMU200.

Before proceeding to perform any of the steps described in this manual, please make sure that the instrument is properly connected and put into operation according to the instructions given in chapter 1 of the CMU operating manual. The hardware and software options available are shown in the *Startup* menu. The status of the software option required for TDMA (IS 136) mobile tests is indicated in the lines "CMU-K27 IS136 800-MS" and "CMU-K27 IS136 1900-MS":

- If a version number is indicated, the CMU is ready to perform TDMA (IS 136) measurements. In this case you may skip this chapter, except if you wish to update the current software version or activate another version.
- If *disabled* is indicated, the software option must be enabled using a key code; see section *Creating a new Software Configuration* on page 1.3.
- If *not installed* is indicated, the software must be installed via the PCMCIA interface or the floppy disk drive, see below.

Software Installation or Update

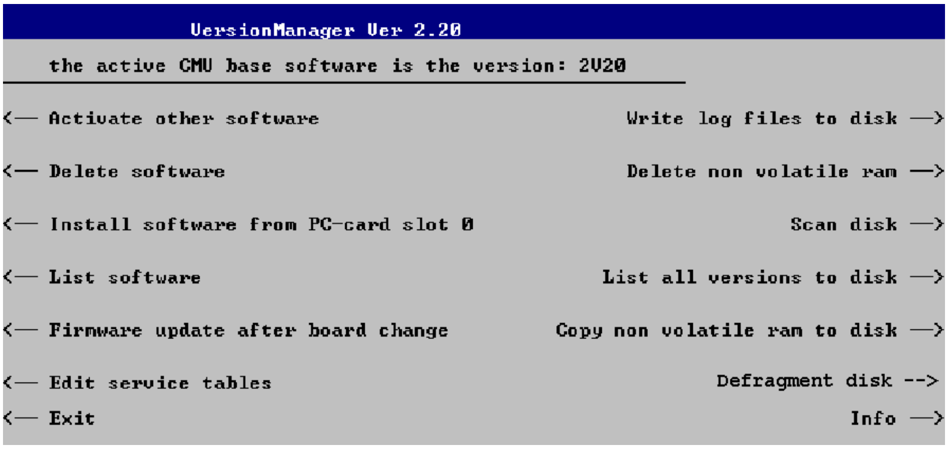
The CMU is always delivered with the latest software version available. New CMU software versions are available for download on the R&S Lotus Notes Service board. To be loaded via the PCMCIA interface, the software must be copied to one or several flash disks/memory cards or PCMCIA hard disks. An appropriate memory card CMU-Z1, order no. 1100.7490.02, can be obtained from Rohde & Schwarz.

Note: *If your CMU is equipped with a floppy disk drive (option CMU-U61), a set of installation floppy disks must be generated instead of a flash disk. All other steps do not depend on the storage medium.*

To install the *TDMA (IS 136) 800/1900-MS* option proceed as follows:

- ➢ Switch off the CMU.
- ➢ Insert the flash disk into one of the two slots of the PCMCIA interface.
- ➢ Switch on the CMU.

The installation is started automatically while the CMU performs its start-up procedure. To this end the *VersionManager* is called up (for a detailed description of the *VersionManager* refer to chapter 1 of the CMU operating manual or to the on-line help accessible via *Info):*

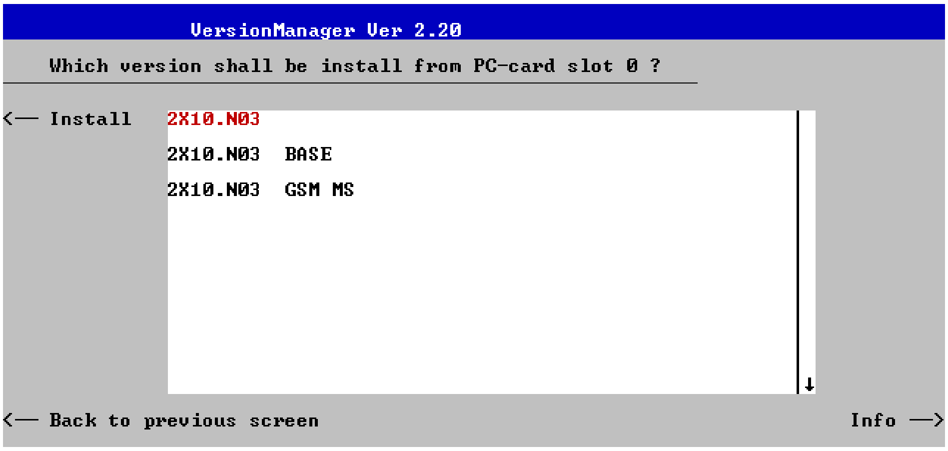


the active CMU base software is the version: 2V20

Softkey no. 5 on the left softkey bar, *Install software...,* is used to install new software from an external storage medium. The CMU automatically recognizes the storage medium and indicates the corresponding slot number: Slot 0 or 1 denotes the left or right slot of the PCMCIA interface. If a floppy disk is used the menu option reads *Install software version <version> from floppy.*

➢ Press left softkey no. 5 *(Install software...)* to start the installation.

If your storage medium contains several installation versions, the software version selection dialog is opened (the software names and versions in the following figures are given as examples only):



VersionManager Ver 2.20

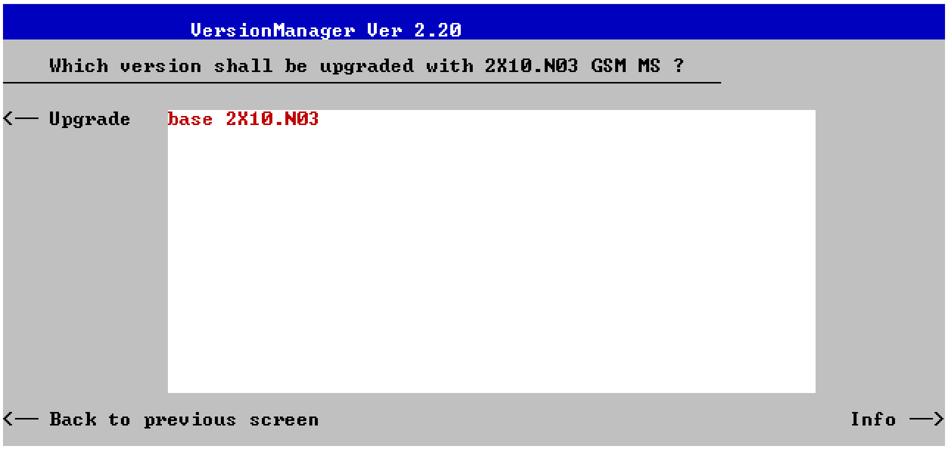
Which version shall be install from PC-card slot 0 ?

2X10.N03
2X10.N03 BASE
2X10.N03 GSM MS

➢ Use the rotary knob or the cursor keys to scroll the list and select the *TDMA (IS 136) 800/1900-MS* software version you intend to install.

➢ Press *Install* to start the installation.

The installation is started. To be operable on your instrument, a network option must be combined with a compatible version of the CMU base software. Any base software version installed on the CMU hard disk can be combined with one or several network options to form an independent software configuration. If none of the configurations is compatible to the new *TDMA (IS 136)* option, the *VersionManager* displays an error message and takes you back to the software selection dialog; see section *Creating a new Software Configuration* on page 1.3. Otherwise, the following upgrade selection dialog is opened:



VersionManager Ver 2.20

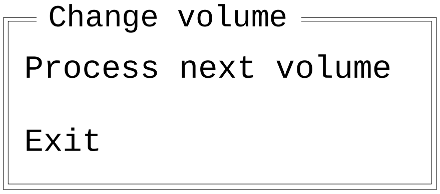
Which version shall be upgraded with 2X10.N03 GSM MS ?

base 2X10.N03

The upgrade selection dialog displays a list of base software versions that can be combined with the new *TDMA (IS 136) 800/1900-MS* software.

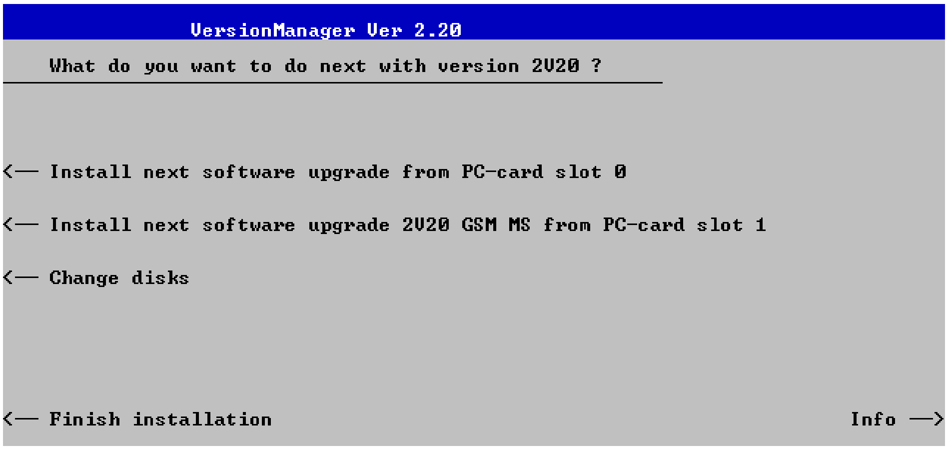
➢ Select the appropriate base version and press *Upgrade*.

The new *TDMA (IS 136) 800/1900-MS* option is added to the configuration or updates the previous *TDMA (IS 136) 800/1900-MS* version of the configuration. To indicate that the storage medium must be changed the CMU issues the *Change volume* message:



- Replace the current disk with the disk requested.
- Use the cursor up/down keys to select “Process next volume” (default setting).
- Press *ENTER* to confirm that the new disk has been inserted and to continue the installation.

After processing the last disk the CMU displays the following screen:



What do you want to do next with version 2V20 ?

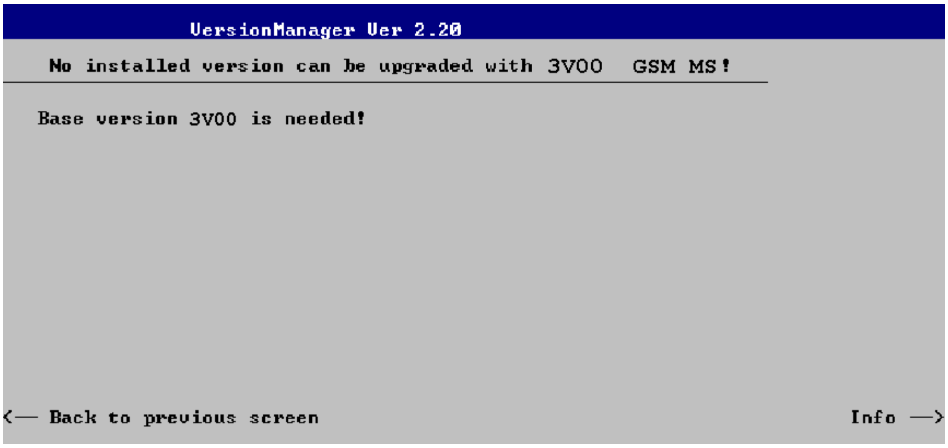
- If you wish to install or upgrade other software versions, press left softkey no 4 or 5 *(Install next software...)* or insert new storage medium into the PCMCIA slot or floppy disk drive and press *Change disks*.
- To finish the installation, remove all disks from the drive and press *Finish installation*.

The *VersionManager* is closed and the CMU is rebooted. The new firmware options are now operational and listed in the *Menu Select* menu together with their version number. Besides, the last software configuration installed is automatically taken as the active one in the next measurement session.

Creating a new Software Configuration

The CMU handles base software versions and network options on a separate basis. Different versions of the base software can be combined with different options to create new firmware configurations. For example, it is possible to update the base software without affecting the associated network options or vice versa. Moreover, the same base software version can be installed several times and combined with different network options (and vice versa), so it may enter into several firmware configurations.

If no compatible base software version can be found on the hard disk, then the CMU will refuse to install a new *TDMA (IS 136) 800/1900-MS* software option selected in the software selection dialog (see previous section). Instead, it displays the following error message:

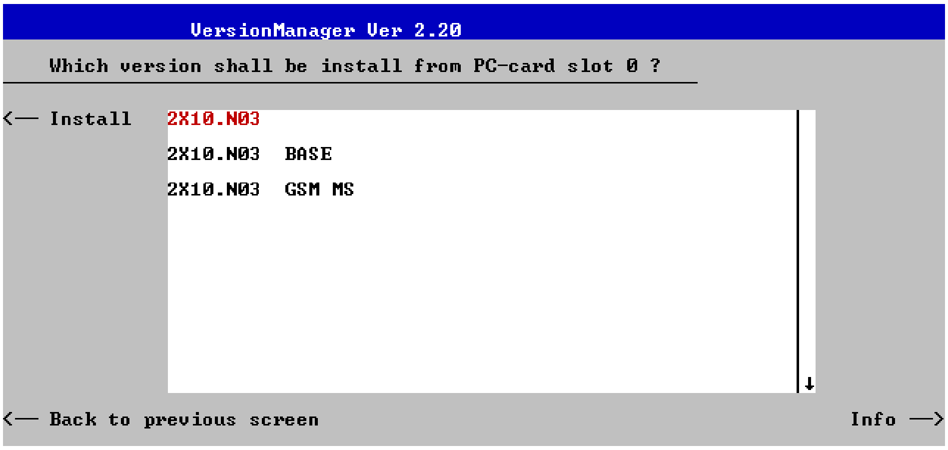


VersionManager Ver 2.20

No installed version can be upgraded with 3V00 GSM MS!

Base version 3V00 is needed!

➢ Press *Back to installation* to return to the software version selection dialog.



VersionManager Ver 2.20

Which version shall be install from PC-card slot 0 ?

2X10.N03

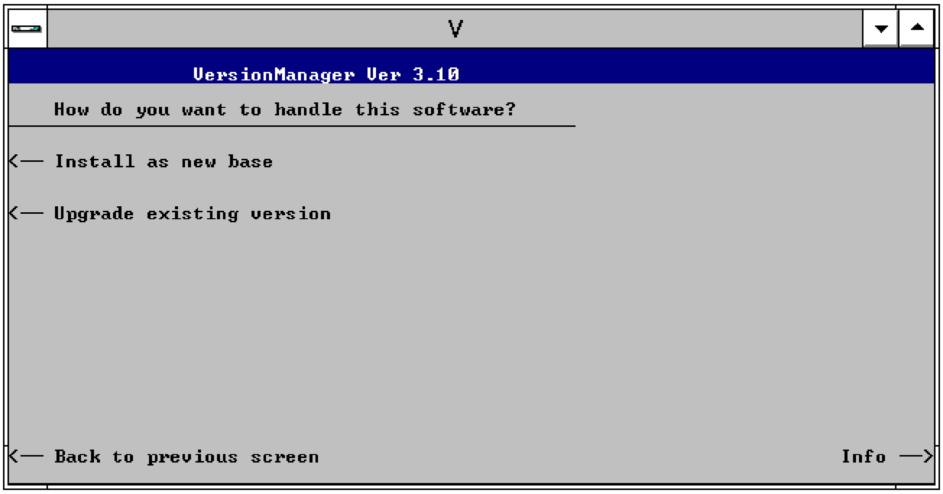
2X10.N03 BASE

2X10.N03 GSM MS

➢ Select a base software version that is compatible to your *TDMA (IS 136) 800/1900-MS* software option and press *Install*.

Note: *The* TDMA (IS 136) 800/1900-MS *firmware version number must be identical to the base software version number.*

With a new base software version, it is possible to either update an existing configuration or create a new one. A dialog selecting between the two alternatives is opened:



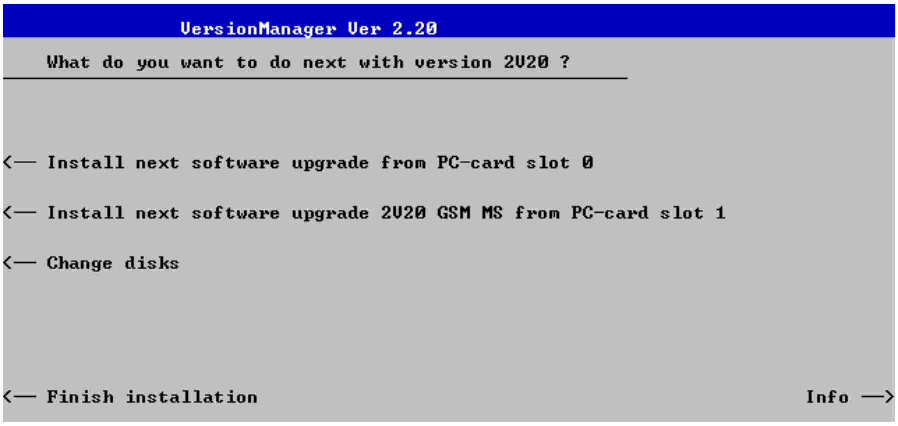
VersionManager Ver 3.10

How do you want to handle this software?

Note: *This dialog is skipped if the new base software version is not compatible with any of the existing configurations. An incompatible new base software must be installed as a new base software.*

- If you wish to add a new configuration to your hard disk, press *Install as new base*.
- To upgrade an existing configuration with the selected base software version in order to make it compatible to the new *TDMA (IS 136) 800/1900-MS* software option, press *Upgrade existing version*. The existing version to be upgraded must be selected in an additional dialog.

The installation is performed as described in section *Software Installation or Update* on p. 1.1 ff. After adding the new base software as a new configuration or updating the existing configuration, the CMU displays the following screen:



- Press left softkey no 4 or 5 *(Install next software...)* and proceed as described in section *Software Installation or Update* on p. 1.1 ff. to install the new *TDMA (IS 136) 800/1900-MS* version and assign it to the new configuration.

Enabling Software Options

A new CMU software option purchased is ready to operate after it is enabled by means of a key code supplied with the option. This key code is to be entered into the *Option Enable* popup window which in turn can be opened via from the *Setup – Options* menu. For details refer to Chapter 4 of the CMU200 operating manual.

Note: *Together with options* AMPS-MS*, the TDMA800-MS and TDMA1900-MS software option is part of a single software package termed AMPS/TDMA-MS, so the three options must be installed or updated together. However, they must be enabled and operated separately. Software installation and enabling of software options are completely independent from each other.*

Contents

2 Getting Started

The following chapter presents a sample IS 136 mobile test with the universal radio communication tester CMU. It is intended to provide a quick overview of the function groups *IS 136 800/1900-MS Non Signalling* and *IS 136 800/1900-MS Signalling* and to lead through the most common tests which are performed on IS 136 mobile phones.

Before starting any measurement with the CMU, please note the instructions given in chapter 1 of the operating manual for the CMU basic unit for putting the instrument into operation. In chapters 2 to 4 of that manual you will also find information on customizing the instrument and the display according to your personal preferences. General notes on controls, menu types, and on the entry or selection of values and parameters are given in chapter 3 of the CMU manual and will not be repeated here.

For installation instructions for the *IS 136 800/1900* software (CMU-K27/-K28) refer to chapter 1 of the present manual.

The tests reported below include

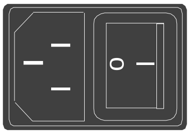
- Connection of the phone and selection of the IS 136 function group
- Basic settings in the *Non Signalling* mode
- Signalling parameters and call setup
- Power and modulation measurements in *Signalling* mode

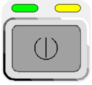
The steps to perform are explained on the left side of each double-page together with the results obtained on the CMU screen. On the right side, additional information is given. We also point out alternative settings and related measurements which could not be reported in detail.

The principles of manual operation are discussed in chapter 3. For a systematic explanation of all menus, functions and parameters including IS 136 background information refer to the reference part in chapter 4.

Preparing an IS 136 Mobile Phone Test

This chapter describes how to use the CMU for IS 136 mobile phone tests. As a prerequisite for starting the session, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the CMU200 operating manual. Furthermore, the IS 136 software must be properly installed following the instructions given in chapter 1 of the present manual.

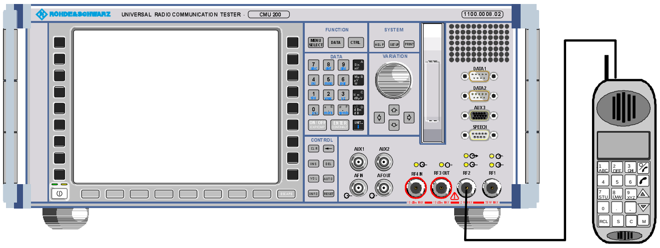




Step 1

- ➢ Switch on the CMU using the mains switch at the rear. ①
- ➢ Check the operating mode of the instrument at the *ON/STANDBY* key on the front panel.②

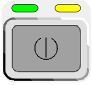
⇓



Step 2

- ➢ Connect the bi-directional RF connector RF 2 of the CMU to the antenna connector of the mobile phone. ③
- ➢ Make sure that the mobile phone is supplied with the correct operating voltage (battery or power supply).④

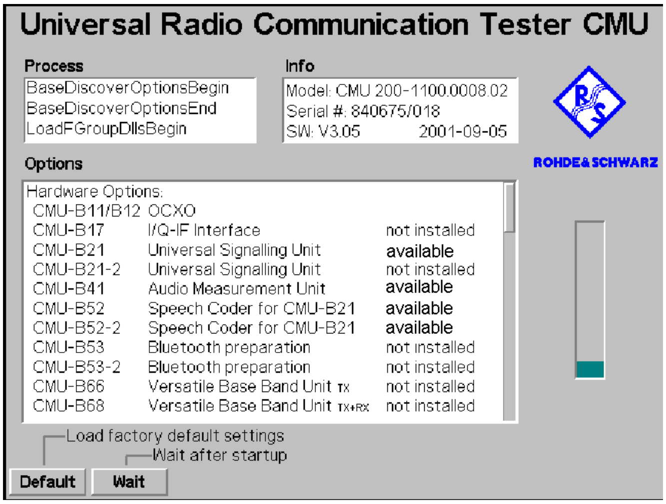
⇓



Step 3

- ➢ Switch on the CMU by pressing the *ON/STANDBY* key on the front panel.

⇓



Universal Radio Communication Tester CMU

Process

BaseDiscoverOptionsBegin
BaseDiscoverOptionsEnd
LoadFGroupDllsBegin

Info

Model: CMU 200-1100.0008.02
Serial #: 840675/018
SW: V3.05 2001-09-05

Options

Hardware Options:

CMU-B11/B12	OCXO	
CMU-B17	I/Q-IF Interface	not installed
CMU-B21	Universal Signalling Unit	available
CMU-B21-2	Universal Signalling Unit	not installed
CMU-B41	Audio Measurement Unit	available
CMU-B52	Speech Coder for CMU-B21	available
CMU-B52-2	Speech Coder for CMU-B21	available
CMU-B53	Bluetooth preparation	not installed
CMU-B53-2	Bluetooth preparation	not installed
CMU-B66	Versatile Base Band Unit TX	not installed
CMU-B68	Versatile Base Band Unit TX+RX	not installed

The startup menu is displayed while the CMU performs a power-up test. ⑤

After a few seconds the CMU displays the last menu used in the previous session.

Additional Information...

... on Step 1

① **Mains switch on the rear panel**

When the mains switch at the rear is set to the OFF position, the complete instrument is disconnected from the power supply. When the mains switch is set to the ON position, the instrument is in standby mode or in operation, depending on the position of the power switch on the front panel.

② ***ON/STANDBY* key on the front panel**

The *ON/STANDBY* key at the front of the instrument determines whether the instrument is in standby mode or in operation.

Standby mode:
Only the reference frequency oscillator is supplied with operating voltage, and the yellow LED (STANDBY) is illuminated.

Operation:
The green LED (ON) is illuminated and all modules of the instrument are supplied with operating voltage.

... on Step 2

③ **RF connection of the mobile phone**

A high-quality cable should be used for this connection, ideally with an attenuation of less than 0.5 dB. For portable phones, the car installation set supplied by telephone manufacturers can be used.

④ **Power supply for the mobile phone**

In case the mobile phone is operated from an external power supply, make sure that it is capable of supplying the maximum peak current required. As IS 136 mobile phones generate bursted RF signals, they often show a pulse-shaped current consumption. Problems may arise if power supplies are used which cannot provide such currents with a constant voltage.

Alternative Settings and Measurements

☞ chapter 1 of CMU manual

The CMU provides two bidirectional RF connectors RF1 and RF2 differing by their input and output level ranges. RF2 is the recommended standard connector for IS 136 mobile phones (handheld phones, see data sheet).

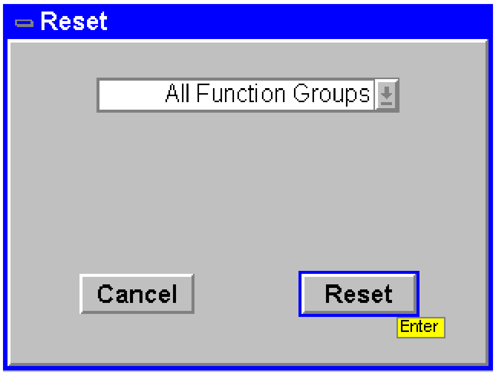
The unidirectional connectors RF4 IN and RF3 OUT are intended for connection of modules requiring high input levels or modules with low RF output levels. RF4 IN and RF3 OUT can also be used to connect IS 136 mobiles off the air via antennas.

Input and output connectors can be selected in the AF/*RF* ⊙ tab of the *Connect. Control* menu.

Step 4

- ➢ Press the *RESET* key.

The *Reset* popup menu is opened.

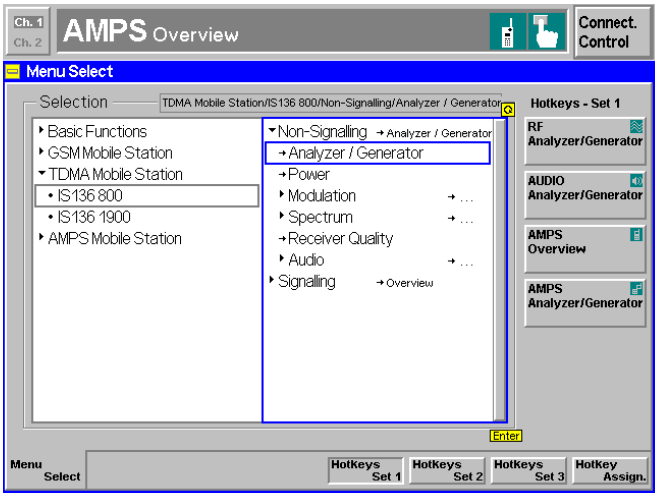


- ➢ Use the left and right arrow keys to toggle between the two buttons *Cancel* and *Reset*.
- ➢ Select *Reset* and press the *ENTER* key.
- ➢ In the popup window opened *(Are you sure?)*, select *Yes* to confirm the instrument reset.

The CMU indicates that it performs a general reset of all device settings and is then ready to carry out the following steps. The *Reset* popup menu is closed automatically.

Step 5

- ➢ Press the *Menu Select* key to open the *Menu Select* menu.⑥



The *Menu Select* menu indicates the function groups available. If a function group is selected the corresponding modes and measurement menus are indicated.

- ➢ Select the *IS 136 800-MS* function group.
- ➢ Select the *Non Signalling* test mode.
- ➢ Select the *Analyzer/Generator* menu.
- ➢ Press the *Enter* key to activate the measurement selected and open the *Analyzer/Generator* menu.

Additional Information...

Alternative Settings and Measurements

... on Step 4

⑤ **Startup menu**

The startup menu displays the following information:

- The status of the startup test *(Process)*
- The device name, serial number and software version *(Info)*
- The options and equipment installed *(Options)*
- The progress of the startup test (*Startup* bar graph)

Before starting a measurement, a reset is recommended to set the instrument with all its functions into a definite state.

☞ chapter 4 of CMU manual

That chapter also contains information on customizing the CMU.

... on Step 5

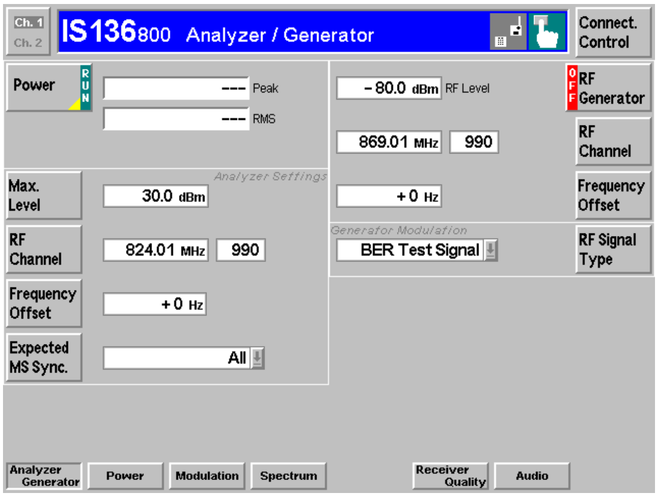
⑥ **Menu Select menu**

The *Menu Select* menu shows all function groups installed on your CMU. Function Group *IS 136 800/1900-MS* is subdivided in the two measurement modes *Non Signalling* and *Signalling*, each containing a number of measurement menus.

☞ chapter 3

Non Signalling Mode

In the *Non Signalling* mode, a specific RF signal can be generated and a RF signal with IS 136 characteristics analyzed. Compared to the *Signalling* mode test times may be reduced considerably. Moreover, the measurements are not restricted to the specified channel and MS output power ranges of the network.①



Power: --- Peak, --- RMS

RF Level: -80.0 dBm

RF Generator: OFF

RF Channel: 869.01 MHz 990

Max. Level: 30.0 dBm

Frequency Offset: +0 Hz

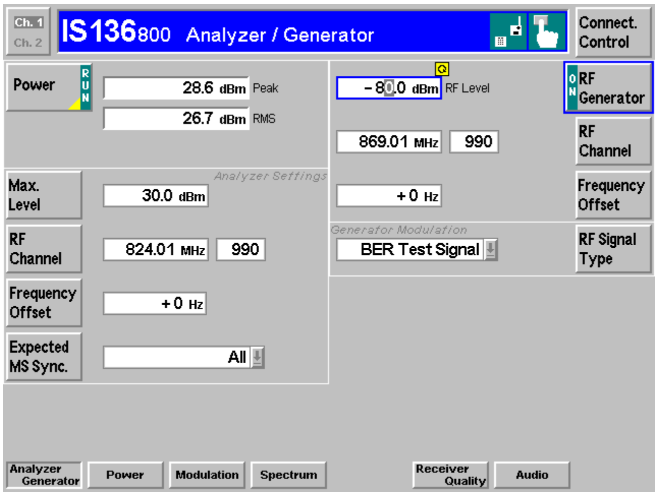
RF Signal Type: BER Test Signal

RF Channel: 824.01 MHz 990

Frequency Offset: +0 Hz

Expected MS Sync.: All

⇓



Power: 28.6 dBm Peak, 26.7 dBm RMS

RF Level: -80.0 dBm

RF Generator: ON

RF Channel: 869.01 MHz 990

Max. Level: 30.0 dBm

Frequency Offset: +0 Hz

RF Signal Type: BER Test Signal

RF Channel: 824.01 MHz 990

Frequency Offset: +0 Hz

Expected MS Sync.: All

Step 1

The *Analyzer/Generator* menu configures the signals generated by the RF generator of the CMU and sets the RF analyzer.②

At present, all parameters are set to default values. They can be changed directly in the *Analyzer/Generator* menu. User-defined parameters will be saved for later sessions when the CMU is switched off.

In addition, the current results for the peak and average burst power *(Peak* and *RMS)* of the received RF signal are displayed. The output fields show "---", indicating that no valid measurement results are available. ③

- ➢ Press the *Max. Level* softkey and adapt the maximum expected RF input level to the output power of the mobile. ④
- ➢ Press the *RF Chan.* softkey and set the RF channel equal to the traffic carrier channel of the mobile phone.

The peak and average burst power of the RF input signal is now indicated in the output fields associated to the *Power* softkey.

The other measurement menus of the *Non Signalling* test mode are accessible via the hotkeys across the bottom of the menu. They are largely identical in both test modes and will therefore be discussed in the *Signalling Mode* sections below.

Step 2

- ➢ Press the *Menu Select* key to open the *Menu Select* menu again.
- ➢ Select the *Signalling* test mode.
- ➢ Select the *Overview* menu.
- ➢ Press the *Enter* key to activate the measurement selected.

Additional Information...

Alternative Settings and Measurements

Non Signalling Mode

① **Test mode of the mobile phone**

To demonstrate the features of the *Non Signalling* mode, we use an IS-136 mobile phone that has been set to its "test mode". The settings and properties of the test mode depend on the mobile type.

The CMU *Non Signalling* mode is also suitable for module tests.

... on Step 1

② **Analyzer/Generator menu**

In the right half, the *Analyzer/Generator* menu contains two configuration panels to configure the RF generator and to select a bit modulation sequence for the generated RF signal *(RF Signal Type)*.

The analyzer settings and measurement results are located in the left half of the menu.

The assignment between carrier frequency and channel number is according to IS 136 specifications. As the CMU simulates a base station, the generator signal corresponds to the forward path (signal direction from the base station towards the mobile station), the signal analyzed corresponds to the reverse path (signal direction from the mobile station towards the base station). The channel/frequency assignment changes accordingly.

The RF frequency can be set in multiples of 10 kHz. With an additional *Frequency Offset*, an RF signal with an arbitrary frequency that is in the range supported by the tester can be generated and analyzed.

☞ chapter 4

To facilitate and speed up the operation, many CMU settings are accessible from different menus. The RF generator and analyzer settings are also part of the *Signal tab* in the *Connect. Control* menu.

Selecting a definite *RF Signal Type* implies that a signal with definite characteristics is generated.

On the other hand, selecting a definite synchronization pattern in the *Analyzer Settings* panel *(Expected MS Sync.* softkey) implies that only signals with this sync. pattern are analyzed.

③ **Measurement and Generator State**

The state indication of the different measurements and generators is included in the corresponding softkeys. For ongoing measurements, the results in the output fields are constantly updated.

For various reasons, an output field may fail to show a valid measurement result (indication "---"):

- The analyzer settings do not match the properties of the input signal.
- The input signal is missing.
- The measurement is switched off *(OFF* is indicated in the softkey controlling the measurement).

The current options for the measurement state are *RUN* (default) and *OFF*. A third state, *HLT*, occurs after a single-shot measurement is terminated (see p. 2.13).

Once selected, the *Power* measurement can be switched off and on by means of the toggle key *ON/OFF*.

Generators may also be switched on (state *ON)* and off (state *OFF)* by means of the *ON/OFF* key.

④ **Max. Level**

The *Max. Level* softkey sets the maximum RF input power which can be measured and is used to adjust the RF input path to the expected power of the measured signal. The permissible range *Max. Level* depends on the RF connector and the external attenuation used.

☞ Chapter 4

The RF *Max. Level* can also be set in the *Group Config.* menu.

Signalling Mode

In the *Signalling* mode the CMU first transmits a control channel signal to which the mobile is able to synchronize. A call can then be established from either the CMU or the mobile. The measurement must be triggered by the signal transmitted by the mobile or by the CMU signalling unit; an external trigger signal can not be used.

Call Setup and Signalling Parameters

The signalling process is controlled via the *Connection Control* popup menu. The first of four *Signalling* tabs contained in the *Connection Control* popup menu is automatically displayed when the *Signalling* Mode is selected (see *Menu Select* menu on page 2.4, for the following examples, *IS-136 800-MS Signalling Meas*. with the *Overwiew* menu was selected).

Waiting for mobile registration or call from the mobile.

MS Signal:
DCCH / DTC MAC 6 / 6
BS Signal:
CtrlChan(DCCH) 716
Slot Configuration 1&4
RF Level -80.0 dBm
Traffic Chan(DTC) 1
Slot Configuration 1&4
RF Level -80.0 dBm
Bit Stream Echo

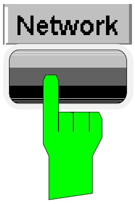
Network:
SID 4
SOC Off
AF/RF
Connector In RF2
Ext. Att. In 0.0 dB
Connector Out RF2
Ext. Att. Out 0.0 dB

Step 1

The *Signalling (Signal On)* tab indicates the parameters characterizing the signals generated by the CMU *(BS Signal)*.① In addition the system identity, the mobile attenuation codes, and the characteristics of the input and output connectors are shown.②

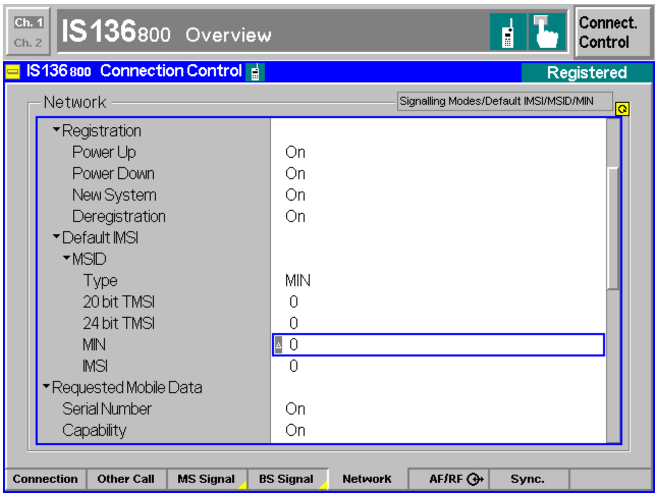
Below the list, the *Wideband Power* softkey shows the current status of the wideband power measurement for RF input signals, the current measured peak power and its ratio to the effective radiated power of the mobile.③

⇓



Step 2

➢ Press the *Network* hotkey.



Registration
Power Up On
Power Down On
New System On
Deregistration On
Default IMSI
MSID
Type MIN
20 bit TMSI 0
24 bit TMSI 0
MIN 0
IMSI 0
Requested Mobile Data
Serial Number On
Capability On

The *Network* tab is displayed. ④

➢ Press the *ON/OFF* key to expand the menu tables.

➢ Select the *MSID* field and enter the identifiy of your mobile phone.

Additional Information...

Alternative Settings and Measurements

... on Step 1

① **BS Signal**

The CMU is able to generate two different RF carrier signals (traffic channel and control channel) which can be configured separately. This allows a complete simulation of what happens in a real IS 136 network.

☞ chapter 4.

The control and traffic channels are configured in the *Network* tab of the Connection Control menu. To access this tab press the associated hotkey.

② **Network Identity, ⊙/Ext.Att.**

The network is identified by the code numbers SID (System Identity) and MCC (Mobile Country Code). These codes are transmitted to the mobile station on the control channel. The CMU uses the default SID shown in the diagram on the left side.

Input/output connectors suitable for the type of measurements and signal levels must be chosen – see section *RF connection* on page 2.3. An external input/output attenuation value can be specified in order to compensate for known attenuations of the input/output signal like those caused by cables.

☞ chapter 4.

The network identity and other parameters characterizing the network are configured in the *Network* tab of the Connection Control menu. To access this tab press the associated hotkey (see below).

Input/output connectors and external attenuations are configured in the *AF/RF* ⊙ tab.

③ **Input level**

The *Wideband Power* softkey has no configuration menu assigned but can be used like any other softkey controlling a measurement. In particular, it is used to switch over between the measurement states *RUN* and *OFF* (softkey selection plus *ON/OFF* key) and *RUN/HLT* (softkey selection plus *CONT/HALT* key).

☞ CMU manual chapter 3.

See also the diagrams on measurement control in chapter 5 of the CMU manual.

... on Step 2

④ **Network parameters**

The *Network* tab defines a variety of parameters related to the network and the operating mode of the mobile station.

The purpose of these settings is to simulate the operating conditions of a mobile station in the IS 136 network as realistically as possible. Many of the settings have an impact on the speed of the *Signalling* measurements.

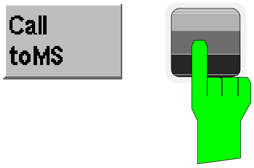
As a prerequisite for setting up a call from the tester, the MSID (Mobile Station Identity) of the mobile phone under test must be known. Depending on the mobile type, the MSID can be either a 20 or 24-bit TMSI, a 34-bit MIN, or a 50-bit IMSI.

☞ Chapter 4.

If the MSID is not reported to the CMU, it is unable to set up a call. However, a registration or a call can be initiated from the mobile station. After first registration, or after a call has been established for the first time, the MIN is transferred to the tester and is available for future calls. MS registration can also be enabled or disabled in the *Network* tab.

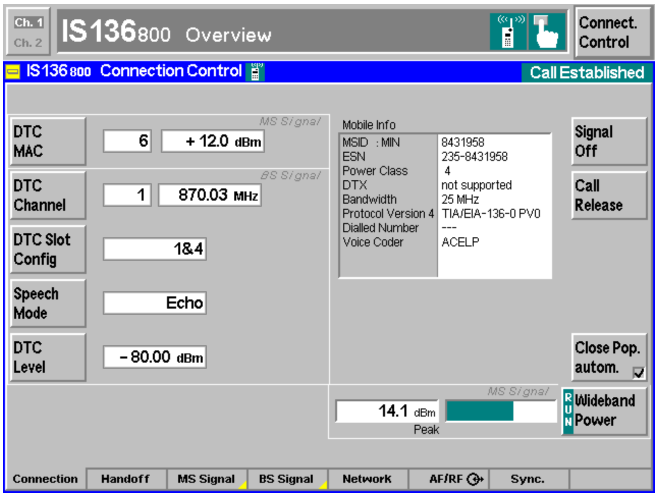
Step 3

⇓



- ➢ Press the *Call to MS* softkey.

The header message *Paging in progress* is displayed. When the mobile starts ringing, the *Signalling (Alerting)* tab is displayed.



DTC MAC: 6, + 12.0 dBm

DTC Channel: 1, 870.03 MHz

DTC Slot Config: 1&4

Speech Mode: Echo

DTC Level: - 80.00 dBm

Mobile Info

MSID : MIN	8431958
ESN	235-8431958
Power Class	4
DTX	not supported
Bandwidth	25 MHz
Protocol Version 4	TIA/EIA-136-0 PV0
Dialled Number	---
Voice Coder	ACELP

Close Pop. autom. ☑

14.1 dBm Peak

As soon as the mobile is picked up, the *Signalling (Call Established)* tab is displayed (this tab is closed automatically after a short while but can be reopened by pressing the *Connect. Control* softkey).

The *Signalling (Call Established)* tab presents a comprehensive list of the signalling parameters (see *Mobile Info* on page 2.11).

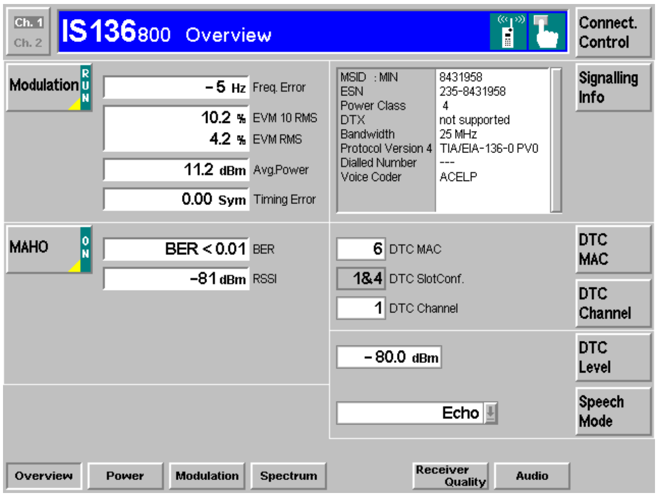
Besides the mobile attenuation code *(DTC MAC)* ⑤, the parameters of the traffic channel signals transmitted by the CMU *(BS Signal)* ⑥ can be configured.

Step 4

⇓

- ➢ Press the *Connect. Control* softkey or the *ESCAPE* key.

The *Connect. Control* menu is closed; the CMU displays the *Overview* menu.



- 5 Hz Freq. Error

10.2 % EVM 10 RMS

4.2 % EVM RMS

11.2 dBm Avg.Power

0.00 Sym Timing Error

BER < 0.01 BER

-81 dBm RSSI

MSID : MIN	8431958
ESN	235-8431958
Power Class	4
DTX	not supported
Bandwidth	25 MHz
Protocol Version 4	TIA/EIA-136-0 PV0
Dialled Number	---
Voice Coder	ACELP

6 DTC MAC

1&4 DTC SlotConf.

1 DTC Channel

- 80.0 dBm

Echo

The *Overview* menu indicates the most important settings in the function group *IS 136-MS Signalling* and the main results of the *Modulation* measurement and the *MAHO* reports. Moreover the signalling info from the mobile station is displayed. ⑦

Additional Information...

Alternative Settings and Measurements

... on Step 3

⑤ **Mobile Attenuation Code (MAC)**

Dynamic power control is used in IS 136 networks to reduce the output power of the mobile station as far as possible: In practice the mobile station is set to one of eleven Mobile Attenuation Codes *(MAC)* ranging from 0 to 10, where MAC equal to 0 corresponds to the largest nominal output power.

The *power class* characterizes the nominal maximum output power of the mobile. The Effective Radiated Power (ERP) of the mobile is a function of both its MAC and its power class.

The MAC can be used to control the maximum expected RF input level at the CMU and to vary the RF input power for the individual measurements.

☞ Chapter 4.

MAC levels and power classes are listed in section *Overview of the Function Group* in chapter 4.

⑥ **Traffic channel**

The channel number of the BS traffic channel signal is defined according to IS 136 specifications as explained for the *Non Signalling* mode (forward path, see *Analyzer/Generator menu* on page 2.7).

☞ Chapter 4.

MAC, Traffic Channel and Trigger

The MAC of the mobile station and the traffic channel number can be changed in all measurement groups while a call is established. This is in contrast to the *Non Signalling* mode where no settings concerning the device under test can be made.

Finally the two test modes differ in the trigger settings available: In the *Non Signalling* mode an external trigger signal can be used whereas in *Signalling* mode, the measurements must be triggered either by the input signal or by the CMU signalling unit.

☞ Chapter 4.

... on Step 4

⑦ **Mobile Info**

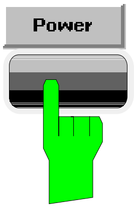
The *Mobile Info* list shows the basic properties of the connected mobile station. Note that the values shown are no default values (like the *Default MSID* set in the *Network* tab) but represent the information provided by the mobile station and transferred to the CMU. The parameters are therefore available in the *Call Established* and *Registered* signalling states only.

☞ Chapter 4.

For a comprehensive overview of signalling states and possible transitions refer to the figure at the beginning of section *IS 136 Mobile Tests*.

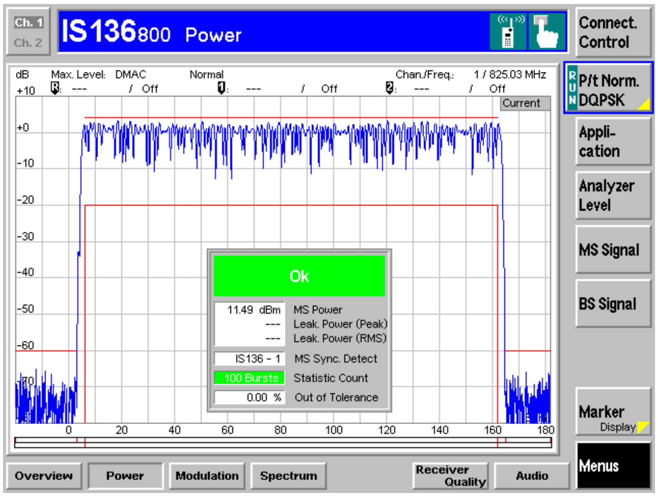
Power Measurements

As described above, all measurement menus in *IS 136 800-MS Signalling* mode can be called up from the *Menu Select* menu. Once a measurement menu is opened, the hotkeys can be used to switch over to any of the other measurements.



Step 1

- ➢ Press the *Power* hotkey to switch over to the graphical measurement menu *Power*.



Max. Level: DMAC / Off — Normal / Off — Chan./Freq.: 1 / 825.03 MHz / Off

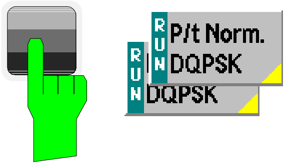
11.49 dBm	MS Power
---	Leak. Power (Peak)
---	Leak. Power (RMS)
IS136 - 1	MS Sync. Detect
100 Bursts	Statistic Count
0.00 %	Out of Tolerance

The *Power* menu shows the power of the current burst as a function of time. ①

Together with the burst power, a tolerance template as specified in the standard is displayed. Settings (at present, the default settings) and scalar results are displayed in two parameter lines above the diagram and in a message box positioned in the center of the diagram.

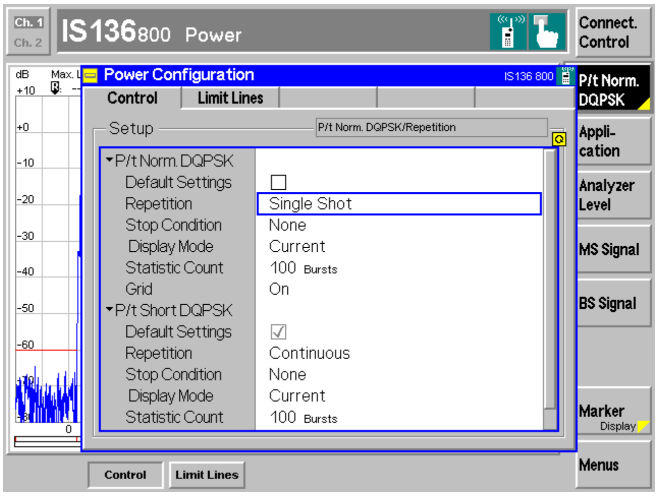
Various tools allowing to take a closer look at the measurement results are provided in the graphical measurement menu.

⇓



Step 2

- ➢ Select (press) the *P/t Norm. DQPSK* softkey.
- ➢ Press the selected *P/t Norm. DQPSK* softkey again to call up the *Power Configuration* menu.



P/t Norm. DQPSK	
Default Settings	☐
Repetition	Single Shot
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Grid	On
P/t Short DQPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts

The *Control* tab of the *Power Configuration* menu defines the scope of the *Power* measurement. To pick just one example of the settings, we limit the number of bursts measured.②

- ➢ Press the *ON/OFF* key to expand the menu tables.
- ➢ Select *Single Shot* in the *Repetition* table line of the *P/t Norm. DQPSK* section.③
- ➢ Press the *ESCAPE* key to close the *Power Configuration* menu and return to the main menu.

The *Power* measurement is stopped after one statistics cycle. The status indication next to the *Power* softkey is set to *HLT*.④

Additional Information...

Alternative Settings and Measurements

... on Step 1

① **Power menu**

The diagram in the *Power* menu shows a normal burst with a length of 162 symbols (application *P/t Norm. DQPSK*; shortened bursts, which are 20 symbols shorter, can be measured in the *P/t Short. DQPSK* application). The time scale of the diagram ranges from –20 symbols to 181 symbols covering the useful part, the rising and falling edges plus a time margin before and after the burst. The ordinate ranges from –80 dB to +10 dB, the 0-dB reference level is equal to the carrier power.

☞ chapter 4.

The reference level can be modified in the *Analyzer* tab of the *Connection Control* menu or by means of the *Analyzer Level* softkey.

... on Step 2

② **Power Configuration menu**

The *Power Configuration* menu contains two tabs defining

- The repetition mode, the stop condition, the display mode and statistic count *(Control)*
- The limit lines *(Limit Lines)*

☞ chapter 3.

Settings made in the *Power Configuration* menu apply to power measurements only.

Settings made in the *Connect. Control* menus apply to the entire function group *IS 136 800/1900 Signalling*.

③ **Repetition mode and Stop Condition**

If no stop condition is imposed *(Stop Condition = None),* the *Repetition* mode determines whether the measurement is

- Continued until explicitly stopped by the operator *(Continuous)*
- Stopped after one statistic count *(Single Shot)*

By default, a statistic count comprises 100 bursts. With *Stop Condition = On Limit Failure*, the measurement is stopped after the first burst which is out of tolerance.

☞ chapter 3.

The stop condition *On Limit Failure* should be selected if the limit check represents the main purpose of the measurement.

The limits can be modified in the *Limit Lines* tab of the *Power Configuration* menu.

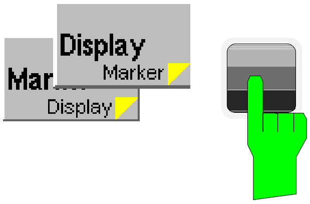
④ **Measurement in the HLT state**

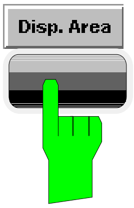
The average and peak power of the last burst measured is indicated in the output fields *Average* and *Peak*.

In contrast, the modulation measurement is still running. The results for the frequency and phase errors are periodically updated.

☞ CMU200 manual

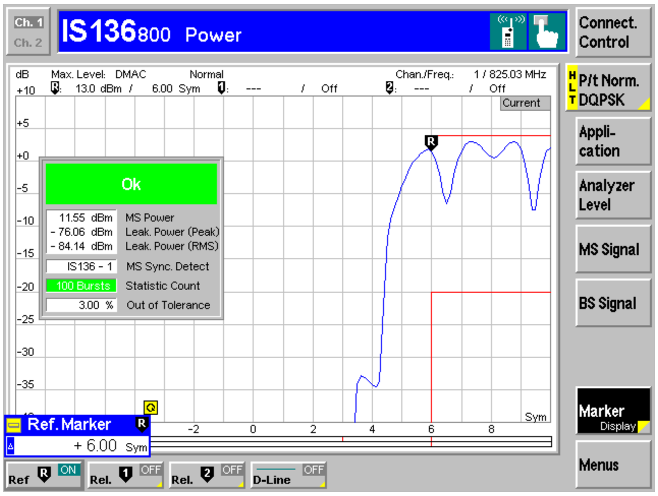
See the sections on measurement control in chapter 3 and 5.





Step 4

- ➢ Press the *Marker/Display* softkey twice to change the hotkeys displayed below the diagram.①
- ➢ Press the *Display Area* hotkey to open a window offering a list of different zoom areas.



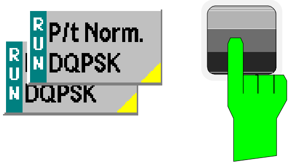
Ok	
11.55 dBm	MS Power
- 76.06 dBm	Leak. Power (Peak)
- 84.14 dBm	Leak. Power (RMS)
IS136 - 1	MS Sync. Detect
100 Bursts	Statistic Count
3.00 %	Out of Tolerance

Ref. Marker R
+ 6.00 Sym

If you select *Left Upper Corner* the CMU zooms in on the left upper corner of the burst.

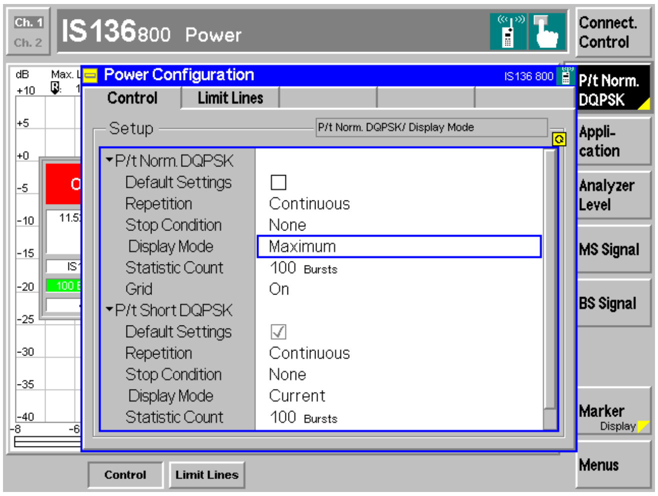
- ➢ Press the *Display/Marker* softkey twice and the *Ref R* hotkey. Enter an abscissa value (in bits) to position a reference marker onto the trace.②

The coordinates (time and burst power) of the reference marker are displayed in the second parameter line.



Step 5

- ➢ Press the *P/t Norm. DQPSK* softkey twice to reopen the *Power Configuration* menu.



Power Configuration

Control | Limit Lines

Setup — P/t Norm. DQPSK/ Display Mode

▾P/t Norm. DQPSK	
Default Settings	☐
Repetition	Continuous
Stop Condition	None
Display Mode	Maximum
Statistic Count	100 Bursts
Grid	On
▾P/t Short DQPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts

- ➢ Select the *Control* tab.
- ➢ Set the *Repetition* mode to *Continuous* to restart the measurement.
- ➢ Set the *Display Mode* to *Maximum.*③

Instead of the current burst power, the maximum burst power ever measured at each point in time is shown in the diagram. As no stop condition is set, the measurement will continue running until explicitly terminated.

Additional Information...

... on Step 4

① **Softkeys and hotkeys**

To enlarge the diagram area of the graphical measurement menus the left softkey column is suppressed. The functionality of each softkey on the right side is extended by hotkeys assigned to the softkeys. These hotkeys are displayed across the hotkey bar below the diagram when the softkey is selected.

The *Marker/Display* softkey toggles with the *Display/Marker* softkey (with different hotkeys) if it is pressed repeatedly.

Some of the softkey/hotkey combinations offer settings that can be also accessed via configuration menus. For example, the settings offered by the *Analyzer Level* softkey are equivalent to the *RF Analyzer Level* section in the *MS Signal* tab of the *Connection Control* menu. Identical settings overwrite each other; the last value entered is valid for the whole function group.

② **Markers**

Markers are a graphical tool used to locate points on a trace and read out their coordinates. A reference marker and two delta markers may be defined in the *Power* menu.

The reference marker R measures the absolute level of the trace, the delta markers 1 and 2 measure the distance between their position and the reference marker.

... on Step 5

③ **Display mode**

If the measurement extends over several bursts the CMU calculates four different traces one of which can be selected by the *Display Mode*. The purpose of the four traces is to give an overview of the range and arithmetic mean value of the levels detected at any point on the time axis. The following traces can be displayed:

Current	Current burst level
Maximum	Maximum of all burst levels measured
Minimum	Minimum of all burst levels measured
Average	Average of all burst levels measured in the last statistic count.

The *Statistic Count* input field defines how many evaluation periods are grouped together to form a statistics cycle. For IS 136 measurements an evaluation period is equal to the propagation time of a burst (this definition holds even if a continuous carrier signal is transmitted). In our example the statistics cycle comprises 100 bursts (default value).

Alternative Settings and Measurements

☞ chapter 4.

The *Application* softkey switches between the applications of the *Power* measurement.

The *Analyzer Level* softkey configures the RF input path and the trigger settings.

The *MS Signal* softkey determines the frequency and channel of the measured signal.

The *BS Signal* softkey configures the forward traffic channel signal of the CMU.

The *Marker/Display* softkey sets markers and D-lines.

The *Display/Marker* softkey defines the time axis and the zoom area.

☞ chapter 4.

In addition to markers, a D-line can be used to measure a particular level in the diagram.

☞ chapter 3.

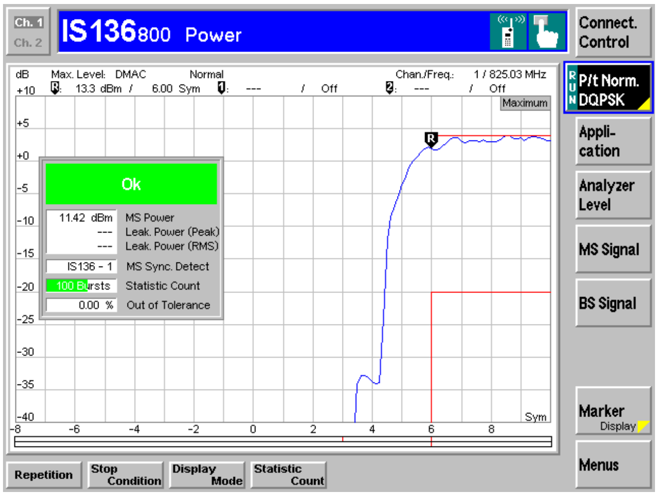
To refine the statistical evaluation, a suitable combination of the statistic count, repetition mode, stop condition and display mode should be selected.

Step 6

- ➢ Press the *ESCAPE* key to close the *Power Configuration* menu and return to the main menu.

⇓

⇓



Max. Level: DMAC Normal Chan./Freq.: 1 / 825.03 MHz
R: 13.3 dBm / 6.00 Sym 1: --- / Off 2: --- / Off

11.42 dBm MS Power
--- Leak. Power (Peak)
--- Leak. Power (RMS)
IS136 - 1 MS Sync. Detect
100 Bursts Statistic Count
0.00 % Out of Tolerance

The trace is now continuously measured and updated in the display. With the display mode *Maximum,* trace values will be replaced only if a current measured value at a particular test point exceeds all values measured previously.

Additional Information...

Out-of-tolerance power measurements

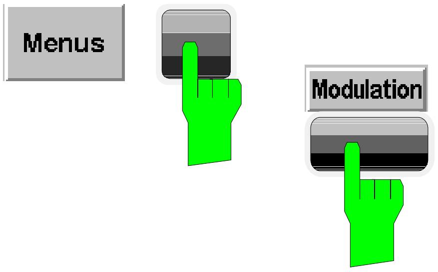
If a power measurement is out of tolerance, please ensure that the attenuation of any cables and/or antenna couplers used is being taken into account by the CMU. As most IS 136 power levels must be within +2 dB/–4 dB of the nominal value given in the specifications, even a small attenuation can result in an out-of-tolerance measurement.

External attenuation values for each input/output may be entered in the *AF/RF* ⊙→ tab of the *Connection Control* menu

The cables, RF connections and antenna couplers must also be in good condition for satisfactory measurements. Dirty or broken RF connections can cause problems at the high frequencies used by IS 136 networks.

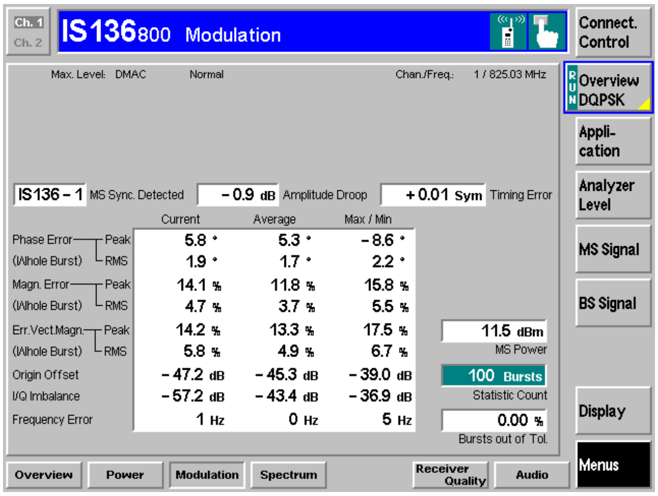
Modulation Measurements

To switch over to the *Modulation* measurement, we use again the hotkey bar.



Step 1

- ➢ Press the *Menus* softkey to display the measurement groups available in the hotkey bar.
- ➢ Press the *Modulation* hotkey to open the *Modulation* menu.



Max. Level: DMAC Normal Chan./Freq.: 1 / 825.03 MHz

IS136 - 1 MS Sync. Detected | -0.9 dB Amplitude Droop | +0.01 Sym Timing Error

		Current	Average	Max / Min
Phase Error (Whole Burst)	Peak	5.8 °	5.3 °	-8.6 °
	RMS	1.9 °	1.7 °	2.2 °
Magn. Error (Whole Burst)	Peak	14.1 %	11.8 %	15.8 %
	RMS	4.7 %	3.7 %	5.5 %
Err.Vect.Magn. (Whole Burst)	Peak	14.2 %	13.3 %	17.5 %
	RMS	5.8 %	4.9 %	6.7 %
Origin Offset		-47.2 dB	-45.3 dB	-39.0 dB
I/Q Imbalance		-57.2 dB	-43.4 dB	-36.9 dB
Frequency Error		1 Hz	0 Hz	5 Hz

11.5 dBm MS Power

100 Bursts Statistic Count

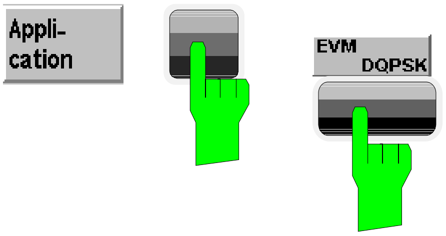
0.00 % Bursts out of Tol.

The *Modulation – Overview* menu displays the main results of the Modulation measurement.①

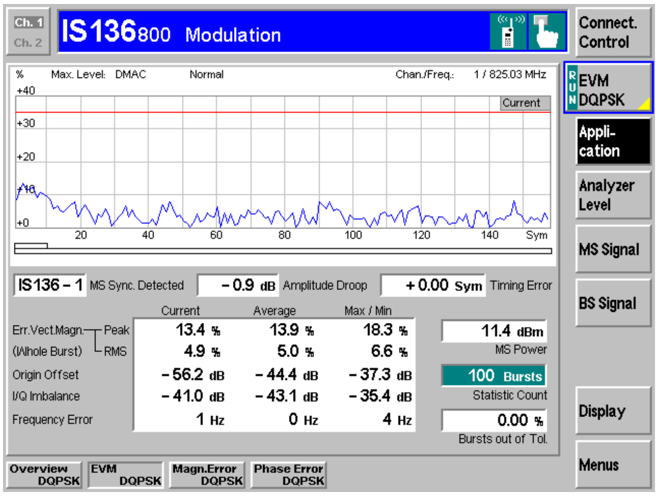
If a result exceeds the tolerances, the corresponding output field is red, and an arrow pointing upwards/downwards indicates that the result is above/below the limit.

⇓

Step 2



- ➢ Press the *Application* softkey to display the different applications within the *Modulation* menu.②
- ➢ Press the *EVM DQPSK* hotkey to switch over to the corresponding application.



Max. Level: DMAC Normal Chan./Freq.: 1 / 825.03 MHz

IS136 - 1 MS Sync. Detected | -0.9 dB Amplitude Droop | +0.00 Sym Timing Error

		Current	Average	Max / Min
Err.Vect.Magn. (Whole Burst)	Peak	13.4 %	13.9 %	18.3 %
	RMS	4.9 %	5.0 %	6.6 %
Origin Offset		-56.2 dB	-44.4 dB	-37.3 dB
I/Q Imbalance		-41.0 dB	-43.1 dB	-35.4 dB
Frequency Error		1 Hz	0 Hz	4 Hz

11.4 dBm MS Power

100 Bursts Statistic Count

0.00 % Bursts out of Tol.

The *Modulation – EVM DQPSK* menu displays the Error Vector Magnitude (EVM) of the current burst as a function of time.③

The output fields below correspond to the ones shown in the *Overview* application.

The remaining measurement menus can be operated in analogy to the *Power* and *Modulation* measurement described so far. For an introduction to each measurement group refer to chapter 4 of this manual.

Additional Information...

Alternative Settings and Measurements

.... on Step 1

① **Statistical quantities**

The table in the *Overview* menu reports peak and RMS-averaged values of quantities characterizing the errors of the modulation vector. In addition, the scalar modulation results *Origin Offset, I/Q Imbalance,* and *Frequency Error* are indicated. The values in the three columns of the table are calculated as follows:

- The *Current* column contains the results for the current burst.
- The *Average* column contains the currents results averaged over the last statistics cycle.
- The *Max./Min.* column contains the extreme values of the current results for all bursts measured.

☞ chapter 3.

The averaging prescription for the different results in the table is explained in detail in chapter 3 and in chapter 4, section *Modulation Measurements – Measurement Results.*

... on Step 2

② **Applications**

Applications are different measurements belonging to the same measurement group. Each application is assigned its own set of configuration parameters. Therefore, the applications of a measurement group can be configured individually and serviced in parallel.

The *Modulation* menu comprises the four applications *Overview*, *EVM DQPSK, Magn. Error DQPSK,* and *Phase Error DQPSK.*

☞ Chapter 5 of CMU200 manual

Another set of applications is provided in the *RX Tests* menu.

③ **Measured values and limits**

The limits may be modified in the *Limits* tab of the *Modulation Configuration* Menu which is opened by pressing the *Overview DQPSK* softkey twice. The *Modulation Configuration* menu is analogous to the *Power Configuration* menu explained on the previous pages. According to the requirements of the measurements the two configuration menus differ in two respects:

- Errors of the modulation vector (i.e. the phase errors, magnitude errors, and the error vector magnitude) are relevant within the useful part of the burst. Therefore, fixed limits are specified. It is not necessary to discriminate between different areas of the burst (see item ② below).
- The absolute value of the phase error is a measure of the quality of modulation, whereas the sign is of secondary interest. This is why the display modes *Minimum* and *Maximum* can not be selected separately, the CMU displays the extreme values instead (display mode *Minimum/Maximum*).

☞ chapter 4.

The principle of *Modulation* measurements and the measured quantities are explained at the beginning of section *Modulation Measurements.*

Contents

3 Manual Control

This chapter gives a brief survey of the operating concept and structure of the user interface for IS 136-MS tests. The CMU was designed for maximum operating convenience and flexibility. All instrument functions are grouped together in menus, each of them provides a number of related configuration settings or displays a group of measured quantities. All menus show a similar structure so that many settings, once defined, can be used in several menu groups. Switchover between the different menu groups and test modes *(Non Signalling – Signalling)* is possible at any time.

In the following, the different measurement modes and measured quantities are discussed. Settings and measurement parameters frequently encountered are explained from a general point of view.

The formal aspects of measurement control are discussed in more detail in chapter 5 *(Remote Control – Basics)*. For a presentation of the CMU's control elements, menu types and dialog elements within the menus refer to chapter 3 of the operating manual for the CMU200 basic unit.

Menu Structure

The menus used to control IS 136-MS measurements can be arranged in different ways. From a functional point of view, they form the following groups:

- The two function groups *IS 136 800-MS* and *IS 136 1900-MS*
- The two test modes *Signalling* and *Non Signalling* provided for each function group
- General configurations *Connection Control),* measurement groups *(Analyzer/Generator, Overview, Power, Modulation, Spectrum, Receiver Quality),* and configurations specific to these measurement groups *(Power Configuration, Modulation Configuration, Spectrum Configuration, Receiver Quality Configuration)*.

In a more formal sense, the CMU uses main menus, popup menus, graphical measurement menus and dialog windows of various size. This aspect is discussed in chapter 3 of the CMU operating manual.

Test Modes

IS 136-MS measurements are performed in one of the two modes *Signalling* or *Non Signalling*. The *Non Signalling* mode is typically used for module tests or test of mobiles in a special "test mode". The *Signalling* mode serves to measure the mobile phone performance under realistic operating conditions where the CMU mimics an IS 136 base transceiver station.

Definition

The term signalling denotes all actions necessary to establish, control and terminate a communication between the base station (CMU) and the mobile phone. The signalling messages conveyed allow the mobile station and the network to discuss the management of issues either related to the user or concerning technical aspects of the communication.

Non Signalling Mode

In the IS 136 (TDMA) *Non Signalling* mode, the CMU generates an RF test signal and analyzes the signal with IS 136 characteristics (i.e. with definite level, definite phase and frequency, and bit content) retransmitted by the device under test. No signalling parameters are transferred, and no call is set up, so that test times can be reduced considerably. The test signal may be inside or outside the designated IS 136 channel range.

Normal burst signals are generated and analyzed. Transmitter quality measurements (burst power versus time, modulation parameters, adjacent channel power in frequency and time-domain representation) and receiver quality measurements (sensitivity) can be performed. The measurement may be triggered by an external signal.

Signalling Mode

In the *Signalling* mode, the CMU transmits a control channel (DCCH) signal *(BS Signal)* to which the mobile phone can synchronize. With this signal, a call setup and registration of the mobile may be initiated by either the mobile or the CMU. A call from the current to another network can be set up, and an established call can be handed off from the current to another network.

The CMU is able to configure a broad range of network parameters, to vary the settings for control channel (DCCH) and traffic channel (DTC) signals, and to monitor the mobile-assisted handoff reports (MAHO, Extended MAHO) of the mobile phone. Both normal and shortened burst signals can be analyzed. Measurements of the burst power versus time, the modulation parameters, and the adjacent channel power in frequency and time-domain representation can be performed.

Symbols for Signalling Mode and State

The *signalling mode* and *state* is indicated to the left of the operating mode in each main menu and graphical measurement menu (see chapter 3 of CMU200 operating manual). The following symbols occur in function group *IS 136 800/1900-MS:*

📱	Non signalling mode
📱	Signalling mode, Signal Off
📱	Signalling mode, Signal On
📱	Signalling mode, Synchronized
📱	Signalling mode, Call Established

Configurations

The CMU offers a wide range of settings for the signal generators and analyzers, the signalling procedures, and the individual measurements. Configurations may apply to the whole function group *(Connection Control,* signalling parameters) or to a particular measurement.

Connection Control

The *Connect. Control* softkey is located to the right of the title bar in each main and graphical measurement menu. It opens a popup menu with several tabs configuring and controlling

- The signal generators and analyzers of the instrument *(Analyzer and Generator* in Non Signalling, *MS Signal* and *BS Signal* in Signalling mode)
- The CMU receiver settings, input path configuration, and trigger settings (included in *Analyzer, MS Signal)*
- The RF connectors to be used and the external attenuation *(AF/RF Input/Output)*
- The reference signal and the system clock *(Sync.)*
- In *Signalling* mode, all actions changing the CMU's signalling state *(Connection)*
- In *Signalling* mode, a call *(Other Call)* or a handoff *(Handoff)* to another network
- In *Signalling* mode, parameters of the network and the mobile station under test *(Network)*

All settings made in the *Connect. Control* menu are valid for the whole function group. Many of them can be overwritten, however, by means of the softkeys and hotkeys offered in the graphical measurement menus.

Configuration of measurements

A popup menu offering specific settings is assigned to most measurement groups *(Power, Modulation, Spectrum, Receiver Quality).* The following parameters can be defined in separate tabs:

- The repetition mode, stop condition, statistic count and display mode for the measurement *(Control)*
- Tolerances for the measured quantities *(Limits, Limit Lines)*

These settings are explained in more detail below (see section *General Settings* on page 3.5).

Configuration via hotkeys

The softkeys and associated hotkeys in the graphical measurement menus provide the most important configurations for the current measurement; see chapter 4 and chapter 3 of the CMU200 operating manual. Settings made via hotkeys supersede the corresponding *Connection Control* settings.

Measurement Groups

Measurement results are indicated in two different ways:

- Discrete values and parameters are displayed in output fields, lists and tables. In remote control, these results are referred to as scalars.
- Traces are displayed in a Cartesian coordinate system, the time forming the x-axis scale. Relatively small sets of test points are generally viewed in a bar graph. In remote control, results of this type are referred to as arrays.

While the measurement is running in repetition mode *Continuous* (see page 3.5), the results are constantly updated. As shown in the table below, some of the measurement groups are different in the two test modes.

Table 3-1 Measurement Groups in the *Signalling* and *Non Signalling* Mode

Non Signalling	**Signalling**
Digital TDMA (Function groups IS 136 800/1900-MS)	
Wideband Power Measurement of the peak power of the input signal using a wideband filter at the CMU's RF Frontend.	**Wideband Power** Measurement of the peak power of the input signal using a wideband filter at the CMU's RF Frontend.
IS 136: Analyzer/Generator Configuration of the RF signal generated and analyzer settings; results of the peak and RMS power measurement.	**IS 136: Overview** Configuration of the traffic channel and indication of the scalar *Modulation* results and a selection of signalling parameters.
IS 136: Power Measurement of the normal burst power as a function of time with evaluation of the peak power, statistical results, limit check. Single points of the trace may be evaluated using graphical tools (markers, D-Line).	**IS 136: Power** Measurement of the normal or shortened burst power as a function of time with evaluation of the peak power, statistical results, limit check. The measurement can be performed at variable DTC MAC levels of the mobile phone. Single points of the trace may be evaluated using graphical tools (markers, D-Line).
IS 136: Modulation Measurement of the phase error, magnitude error or error vector magnitude derived from the modulation vector as a function of time. Scalar modulation quantities such as the frequency error, average and RMS phase error, I/Q imbalance, origin offset, amplitude droop, as well as statistical results and the results of the limit check are indicated in addition.	**IS 136: Modulation** Measurement of the phase error, magnitude error or error vector magnitude derived from the modulation vector as a function of time. Scalar modulation quantities such as the frequency error, average and RMS phase error, I/Q imbalance, origin offset, amplitude droop, as well as statistical results and the results of the limit check are indicated in addition. The measurement can be performed at variable DTC MAC levels of the mobile phone.
IS 136: Spectrum Measurement of the average and peak power in the adjacent, first and second alternate channels (frequency-domain representation), or the burst power in a given adjacent or alternate channel as a function of time (time-domain representation). Statistical evaluations and a limit check are performed in addition.	**IS 136: Spectrum** Measurement of the average and peak power in the adjacent, first and second alternate channels (frequency-domain representation), or the burst power in a given adjacent or alternate channel as a function of time (time-domain representation). Statistical evaluations and a limit check are performed in addition. The measurement can be performed at variable DTC MAC levels of the mobile phone.
IS 136: Receiver Quality Single-shot bit error rate test including limit check.	**IS 136: Receiver Quality** Configuration and readout of the mobile-assisted handoff (MAHO and Extended MAHO) report of the mobile phone and the current channel quality.

A graphical overview of the menus is given at the end of this chapter.

General Settings

A number of settings can be made in several of the configuration menus assigned to the measurement groups. In combination, these settings define the scope of the measurement, i.e. the number of bursts measured and the results displayed. The following brief overview is intended to avoid confusion of terms.

Application

Applications are different measurements belonging to the same measurement group. They effectively split up a measurement group into various related subgroups which can be configured separately.

They are selected via the *Application* softkey in the graphical measurement menus.

Statistic Count

The term *statistic count* denotes the integer number of bursts which form one measurement cycle. Together with the *repetition mode* and the *stop condition,* the statistic count determines when exactly the measurement is stopped.

The *statistic count* is set in the *Control* tab of the configuration popup-menus assigned to the two measurement groups *Power, Modulation* and *Spectrum.*

Repetition Mode

The *repetition mode* defines when a measurement that is not stopped by a limit failure (see stop condition *On Limit Failure* below) will be terminated. Two modes are available for all measurements:

Single Shot The measurement is stopped after one *statistic count*.

Continuous The measurement is continued until explicitly terminated by the user; the results are periodically updated.

A third repetition mode is available with remote control:

Counting Repeated single shot measurement with a fixed number of statistic counts. The calculation of average, minimum and maximum traces (see *Display Mode* below) starts again from the beginning after each measurement cycle.

The *repetition mode* is set in the *Control* tab of the configuration popup-menus assigned to the three measurement groups *Power*, *Modulation* and *Receiver Quality.*

Note: *In contrast to other measurement settings, thee repetition modes in manual and remote control are independent and do not overwrite each other. In most measurements, the default repetition mode in manual control is* Continuous *(observe results over an extended period of time), the default mode in remote control is* Single Shot *(perform one measurement and retrieve results).*

Stop Condition

A *stop condition* can be set for most measurements:

None The measurement is performed according to its repetition mode, irrespective of the measurement results and the limits set.

On Limit Failure The measurement is stopped as soon as one of the limits is exceeded, irrespective of the repetition mode set. If no limit failure occurs, it is performed according to its repetition mode.

The *stop condition* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups.

Display Mode

In graphical measurement diagrams, the *display mode* defines which of the measured and calculated traces is displayed if the measurement extends over several bursts. In general, traces are evaluated at a set of fixed, equidistant test points (samples). After n bursts, n measurement results per test point have been taken. After a single shot measurement extending over c bursts, c measurement results per test point are available.

Current	The current burst, i.e. the last result for all test points, is displayed.
Minimum	At each test point, the minimum value of all bursts measured is displayed.
Maximum	At each test point, the maximum value of all bursts measured is displayed.
Max./Min.	At each test point, the extreme value of all bursts measured is displayed, i.e. the maximum or minimum, whichever has a larger absolute value.
Average	At each test point, a suitably defined average over all bursts measured is displayed; see paragraph entitled *Calculation of average quantities* below.

Note the difference in the calculation of *Average* on one hand, *Minimum, Maximum* and *Max./Min.* on the other hand, if the measurement extends over more than one statistic count (repetition mode *Continuous,* measurement time longer than one statistic count).

After evaluation of the different traces, the burst power is logarithmized and plotted in a semi-logarithmic diagram.

The *display mode* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups *Power, Modulation,* and *Spectrum.*

Calculation of average quantities

The *Average* traces in the *Power, Modulation,* and *Spectrum* menus are obtained as follows:

Let c be the number of bursts forming one statistics cycle (one *statistic count)* and assume that n bursts have been measured since the start of the measurement. In calculating the *Average* trace, the following two situations are distinguished:

n ≤ c Single shot measurement or continuous measurement during the first statistics cycle: At each test point, *Average* trace no. n is calculated from *Average* trace no. n – 1 and *Current* trace no. n according to the following recurrence:

$$Avg(n) = \frac{n-1}{n} Avg(n-1) + \frac{1}{n} Curr(n) \qquad (n = 1, \ldots, c)$$

The *Average* trace represents the arithmetic mean value over all n bursts measured.

n > c Continuous measurement after the first statistics cycle: At each test point, *Average* trace no. n is calculated from *Average* trace no. n – 1 and *Current* trace no. n according to:

$$Avg(n) = \frac{c-1}{c} Avg(n-1) + \frac{1}{c} Curr(n) \qquad (n > c)$$

Scalar quantities are averaged in analogy to *Average* traces. The formulas hold for n = 1 where the average trace becomes equal to the current trace (statistics off).

Calculation of statistical quantities

In *Power, Modulation,* and *Spectrum* measurements the statistical functions *Average, Minimum, Maximum* and *Minimum/Maximum* are applied to a set of test points depending on two independent parameters:

- The time, i.e. the abscissa values t_i, i ranging from 1 to the total number of test points comprising the trace.

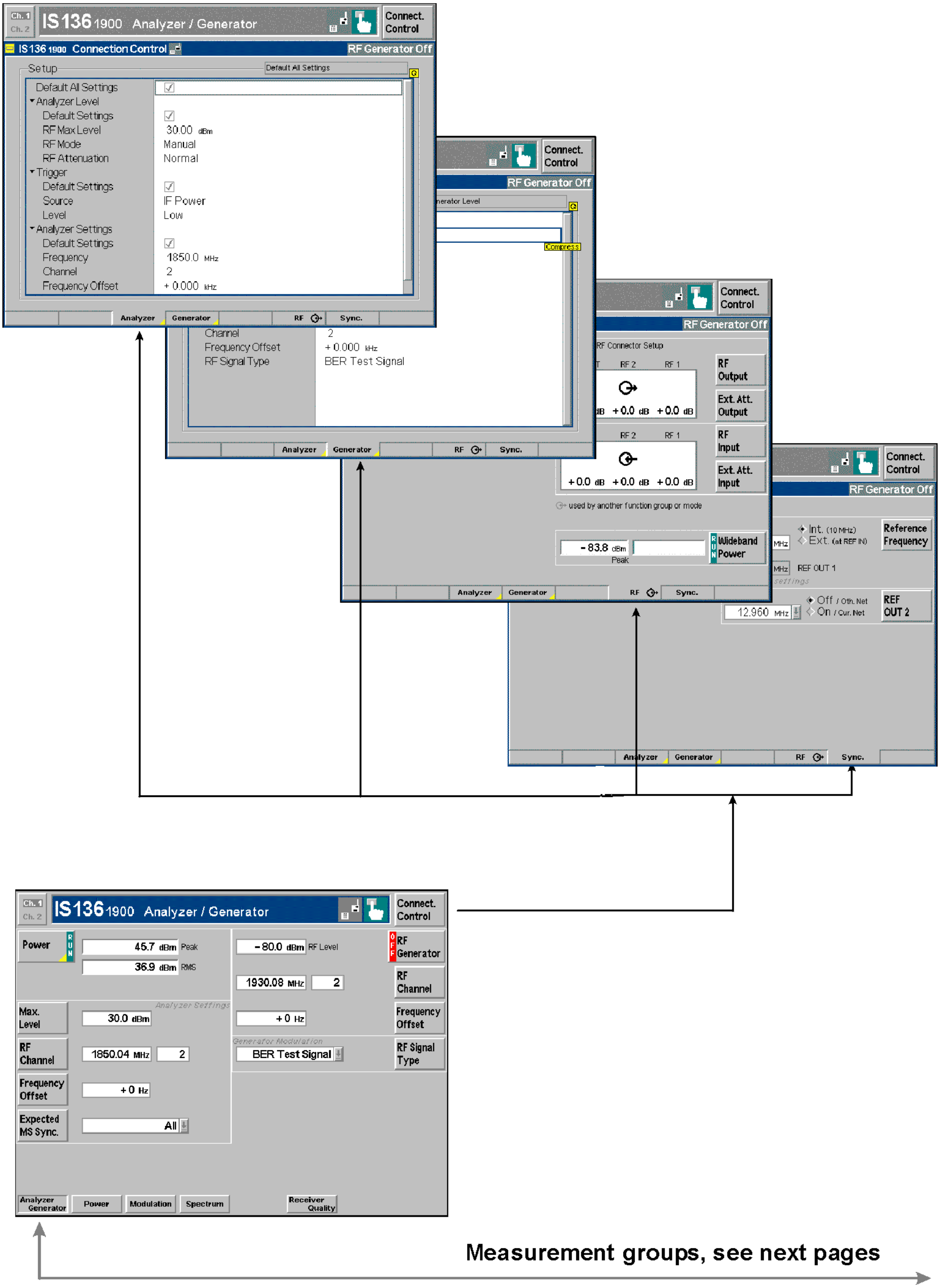
- The burst number ranging from 1 to the number n of the current burst.

The result of the statistical operations depends on the parameter range considered and – in the case of statistics functions evaluated over several parameters – on the order of evaluations. This is why the definition of statistical quantities deserves some attention and is explained in the relevant sections in chapter 4. Some particular examples are:

1. In the *Power vs Time* menu, the quantity *Average Burst Power* denotes the average power of the current burst. i.e. the arithmetical mean value of all test points t_i located in the central (useful) part of the burst.
2. In the *Modulation* menu, the quantities *Frequency Error*, *Phase Error RMS* and *Phase Error Peak* are calculated for all bursts measured. The result for the current burst is entered in the *Current* column of the output table. The results in the *Minimum/Maximum* column correspond to the extreme value of the *Current* results calculated over all bursts measured. The results in the *Average* column correspond to the arithmetical mean value of the *Current* results calculated over the last c bursts measured where c is the number of bursts forming one statistic count.
3. In the *Spectrum* menu, the peak and effective burst power in the designated and the adjacent channels are calculated for all bursts measured. The quantities *ACP Peak* and *ACP RMS* are the results for the current burst. *ACP Peak (Max.)* denotes the maximum of all *ACP Peak* values in the current measurement, *ACP RMS (Max.)* the maximum of all *ACP RMS* values in the current measurement, and *ACP RMS (Avg.)* the average of all *ACP RMS* values in the last statistics cycle.

Menu Overview

IS 136 Non Signalling – General Configurations



IS 136 1900 Connection Control – RF Generator Off

Setup
Default All Settings ☑
Analyzer Level
Default Settings ☑
RF Max Level 30.00 dBm
RF Mode Manual
RF Attenuation Normal
Trigger
Default Settings ☑
Source IF Power
Level Low
Analyzer Settings
Default Settings ☑
Frequency 1850.0 MHz
Channel 2
Frequency Offset + 0.000 kHz

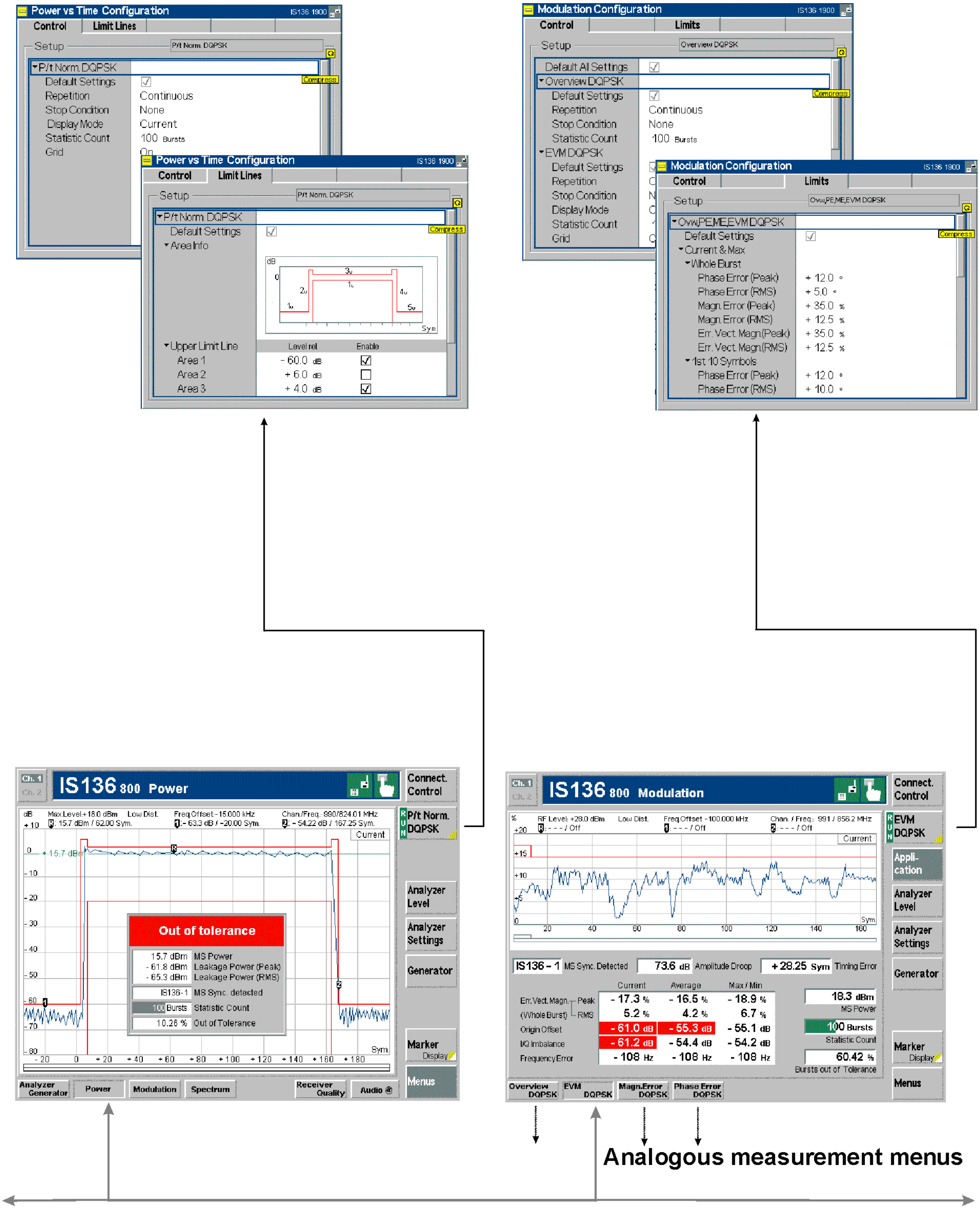
Channel 2
Frequency Offset + 0.000 kHz
RF Signal Type BER Test Signal

IS 136 1900 Analyzer / Generator

Power: 45.7 dBm Peak; 36.9 dBm RMS
Max. Level: 30.0 dBm
RF Channel: 1850.04 MHz, 2
Frequency Offset: + 0 Hz
Expected MS Sync.: All
RF Generator: − 80.0 dBm RF Level
RF Channel: 1930.08 MHz, 2
Frequency Offset: + 0 Hz
RF Signal Type: BER Test Signal

Measurement groups, see next pages

IS 136 Non Signalling – Power and Modulation



Power vs Time Configuration – Control

Setup: P/t Norm. DQPSK

▾P/t Norm. DQPSK
Default Settings ☑
Repetition Continuous
Stop Condition None
Display Mode Current
Statistic Count 100 Bursts
Grid On

Power vs Time Configuration – Limit Lines

Setup: P/t Norm. DQPSK

▾P/t Norm. DQPSK
Default Settings ☑
▾Area Info

▾Upper Limit Line	Level rel.	Enable
Area 1	- 60.0 dB	☑
Area 2	+ 6.0 dB	☐
Area 3	+ 4.0 dB	☑

Modulation Configuration – Control

Setup: Overview DQPSK

Default All Settings ☑
▾Overview DQPSK
Default Settings ☑
Repetition Continuous
Stop Condition None
Statistic Count 100 Bursts
▾EVM DQPSK
Default Settings
Repetition
Stop Condition
Display Mode
Statistic Count
Grid

Modulation Configuration – Limits

Setup: Ovw,PE,ME,EVM DQPSK

▾Ovw,PE,ME,EVM DQPSK
Default Settings ☑
▾Current & Max
▾Whole Burst
Phase Error (Peak) + 12.0 °
Phase Error (RMS) + 5.0 °
Magn. Error (Peak) + 35.0 %
Magn. Error (RMS) + 12.5 %
Err. Vect. Magn.(Peak) + 35.0 %
Err. Vect. Magn.(RMS) + 12.5 %
▾1st 10 Symbols
Phase Error (Peak) + 12.0 °
Phase Error (RMS) + 10.0 °

IS136 800 Power

Max.Level: +18.0 dBm Low Dist. Freq.Offset: -15.000 kHz Chan./Freq.: 990/824.01 MHz
R: 15.7 dBm / 62.00 Sym. 1: - 63.3 dB / -20.00 Sym. 2: - 54.22 dB / 167.25 Sym.

Out of tolerance

15.7 dBm MS Power
- 61.8 dBm Leakage Power (Peak)
- 65.3 dBm Leakage Power (RMS)
IS136-1 MS Sync. detected
100 Bursts Statistic Count
10.26 % Out of Tolerance

IS136 800 Modulation

RF Level: +28.0 dBm Low Dist. Freq.Offset -100.000 kHz Chan. / Freq.: 991 / 856.2 MHz
R: - - - / Off 1: - - - / Off 2: - - - / Off

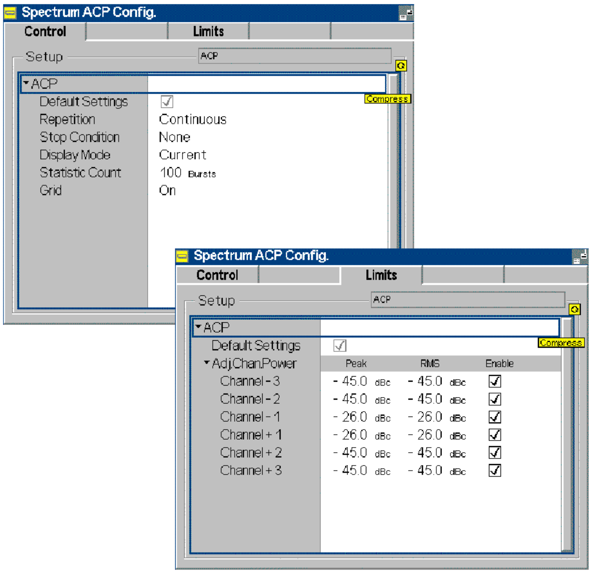
IS136 – 1 MS Sync. Detected
73.6 dB Amplitude Droop
+ 28.25 Sym Timing Error

		Current	Average	Max / Min
Err. Vect. Magn. (Whole Burst)	Peak	- 17.3 %	- 16.5 %	- 18.9 %
	RMS	5.2 %	4.2 %	6.7 %
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

18.3 dBm MS Power
100 Bursts Statistic Count
60.42 % Bursts out of Tolerance

Analogous measurement menus

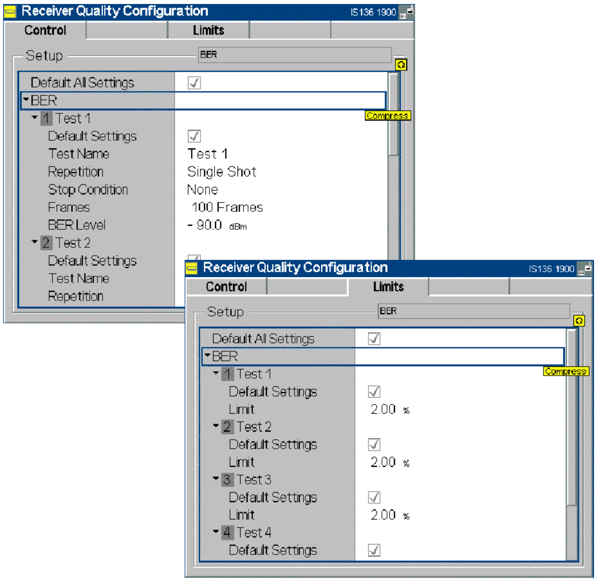
IS 136 Non Signalling – Spectrum and Receiver Quality



ACP
Default Settings ☑
Repetition Continuous
Stop Condition None
Display Mode Current
Statistic Count 100 Bursts
Grid On

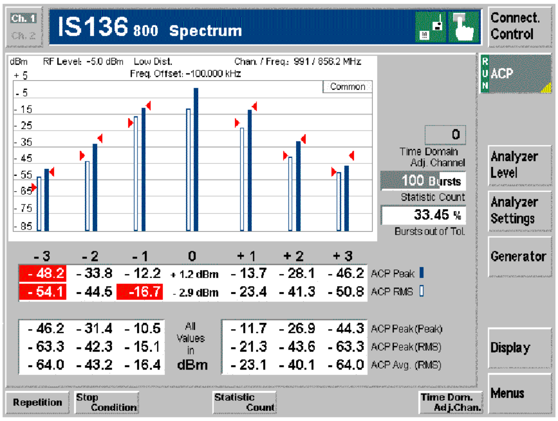
ACP
Default Settings ☑
AdjChanPower

	Peak	RMS	Enable
Channel - 3	- 45.0 dBc	- 45.0 dBc	☑
Channel - 2	- 45.0 dBc	- 45.0 dBc	☑
Channel - 1	- 26.0 dBc	- 26.0 dBc	☑
Channel + 1	- 26.0 dBc	- 26.0 dBc	☑
Channel + 2	- 45.0 dBc	- 45.0 dBc	☑
Channel + 3	- 45.0 dBc	- 45.0 dBc	☑



Default All Settings ☑
BER
1 Test 1
Default Settings ☑
Test Name Test 1
Repetition Single Shot
Stop Condition None
Frames 100 Frames
BER Level - 90.0 dBm
2 Test 2
Default Settings ☑
Test Name
Repetition

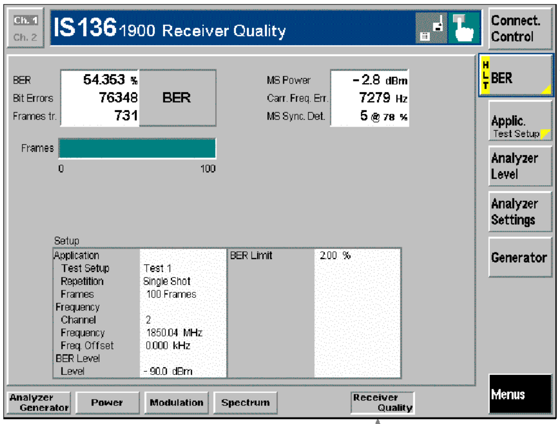
Default All Settings ☑
BER
1 Test 1
Default Settings ☑
Limit 2.00 %
2 Test 2
Default Settings ☑
Limit 2.00 %
3 Test 3
Default Settings ☑
Limit 2.00 %
4 Test 4
Default Settings ☑



RF Level: -5.0 dBm Low Dist. Chan. / Freq.: 991 / 856.2 MHz
Freq. Offset: -100.000 kHz

0 Time Domain Adj. Channel
100 Bursts Statistic Count
33.45 % Bursts out of Tol.

- 3	- 2	- 1	0	+ 1	+ 2	+ 3	
- 48.2	- 33.8	- 12.2	+ 1.2 dBm	- 13.7	- 28.1	- 46.2	ACP Peak
- 54.1	- 44.5	-16.7	- 2.9 dBm	- 23.4	- 41.3	- 50.8	ACP RMS
- 46.2	- 31.4	- 10.5	All Values in dBm	- 11.7	- 26.9	- 44.3	ACP Peak (Peak)
- 63.3	- 42.3	- 15.1		- 21.3	- 43.6	- 63.3	ACP Peak (RMS)
- 64.0	- 43.2	- 16.4		- 23.1	- 40.1	- 64.0	ACP Avg. (RMS)



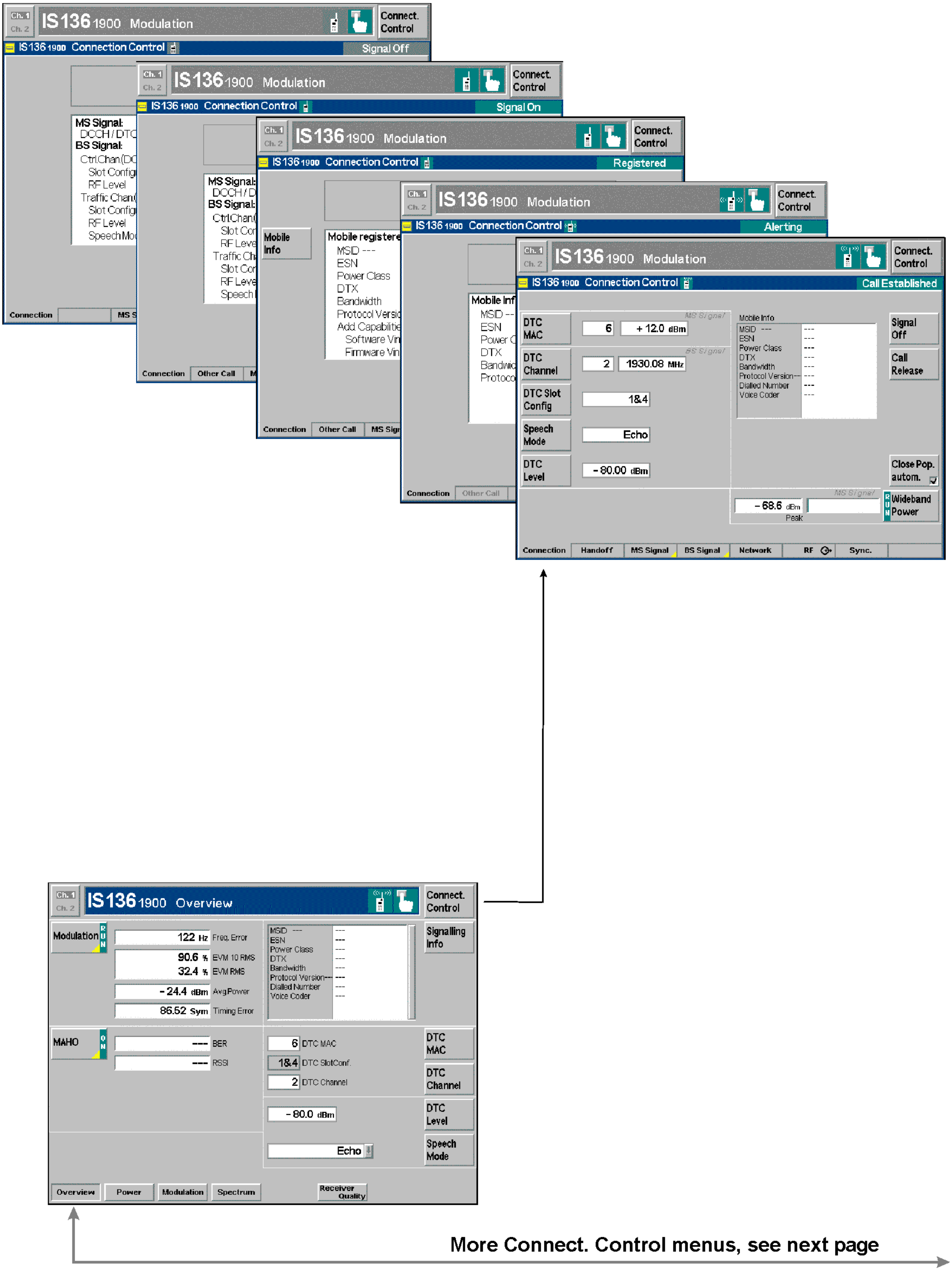
BER 54.353 %
Bit Errors 76348
Frames tr. 731
BER

MS Power - 2.8 dBm
Carr. Freq. Err. 7279 Hz
MS Sync. Det. 5 @ 78 %

Setup
Application
Test Setup Test 1
Repetition Single Shot
Frames 100 Frames
Frequency
Channel 2
Frequency 1850.04 MHz
Freq. Offset 0.000 kHz
BER Level
Level - 90.0 dBm
BER Limit 2.00 %

Alternative measurement menu, see Power

IS 136 Signalling – General Configurations I



Connection Control (Call Established):

DTC MAC 6 + 12.0 dBm
DTC Channel 2 1930.08 MHz
DTC Slot Config 1&4
Speech Mode Echo
DTC Level – 80.00 dBm
Wideband Power – 68.6 dBm

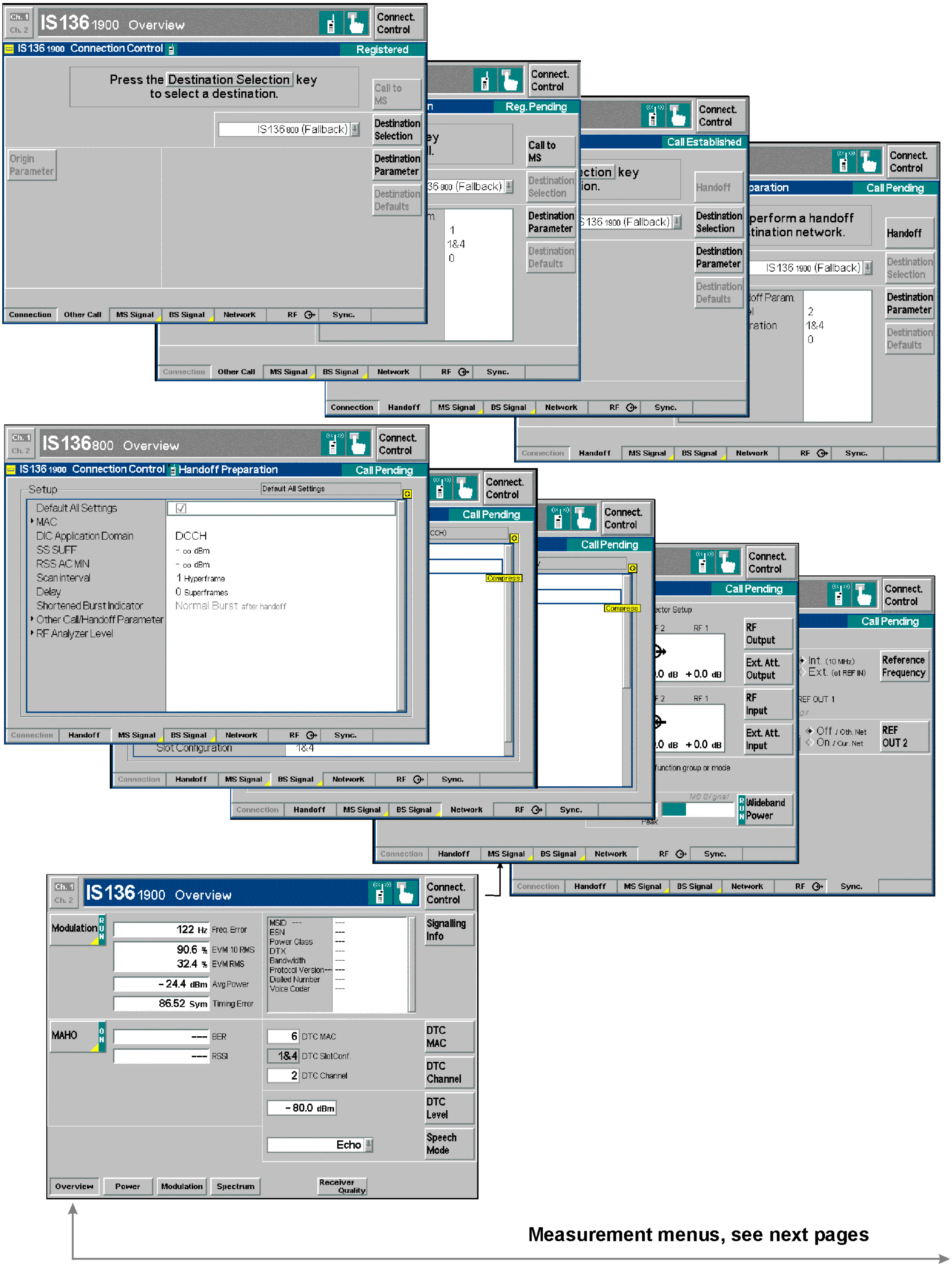
Mobile Info
MSID ---
ESN ---
Power Class ---
DTX ---
Bandwidth ---
Protocol Version ---
Dialed Number ---
Voice Coder ---

Overview:

122 Hz Freq. Error
90.6 % EVM 10 RMS
32.4 % EVM RMS
– 24.4 dBm AvgPower
86.52 Sym Timing Error
--- BER
--- RSSI
6 DTC MAC
1&4 DTC SlotConf.
2 DTC Channel
– 80.0 dBm
Echo

More Connect. Control menus, see next page

IS 136 Signalling – General Configurations II



IS 136 1900 Overview

IS 136 1900 Connection Control – Registered

Press the Destination Selection key to select a destination.

IS136 800 (Fallback)

IS 136 800 Overview

IS 136 1900 Connection Control – Handoff Preparation – Call Pending

Setup – Default All Settings

Default All Settings	☑
MAC	
DIC Application Domain	DCCH
SS SUFF	– ∞ dBm
RSS AC MIN	– ∞ dBm
Scan interval	1 Hyperframe
Delay	0 Superframes
Shortened Burst Indicator	Normal Burst after handoff
Other Call/Handoff Parameter	
RF Analyzer Level	

IS 136 1900 Overview

122	Hz	Freq. Error
90.6	%	EVM 10 RMS
32.4	%	EVM RMS
– 24.4	dBm	Avg Power
86.52	Sym	Timing Error
---		BER
---		RSSI

MSID	---
ESN	---
Power Class	---
DTX	---
Bandwidth	---
Protocol Version	---
Dialed Number	---
Voice Coder	---

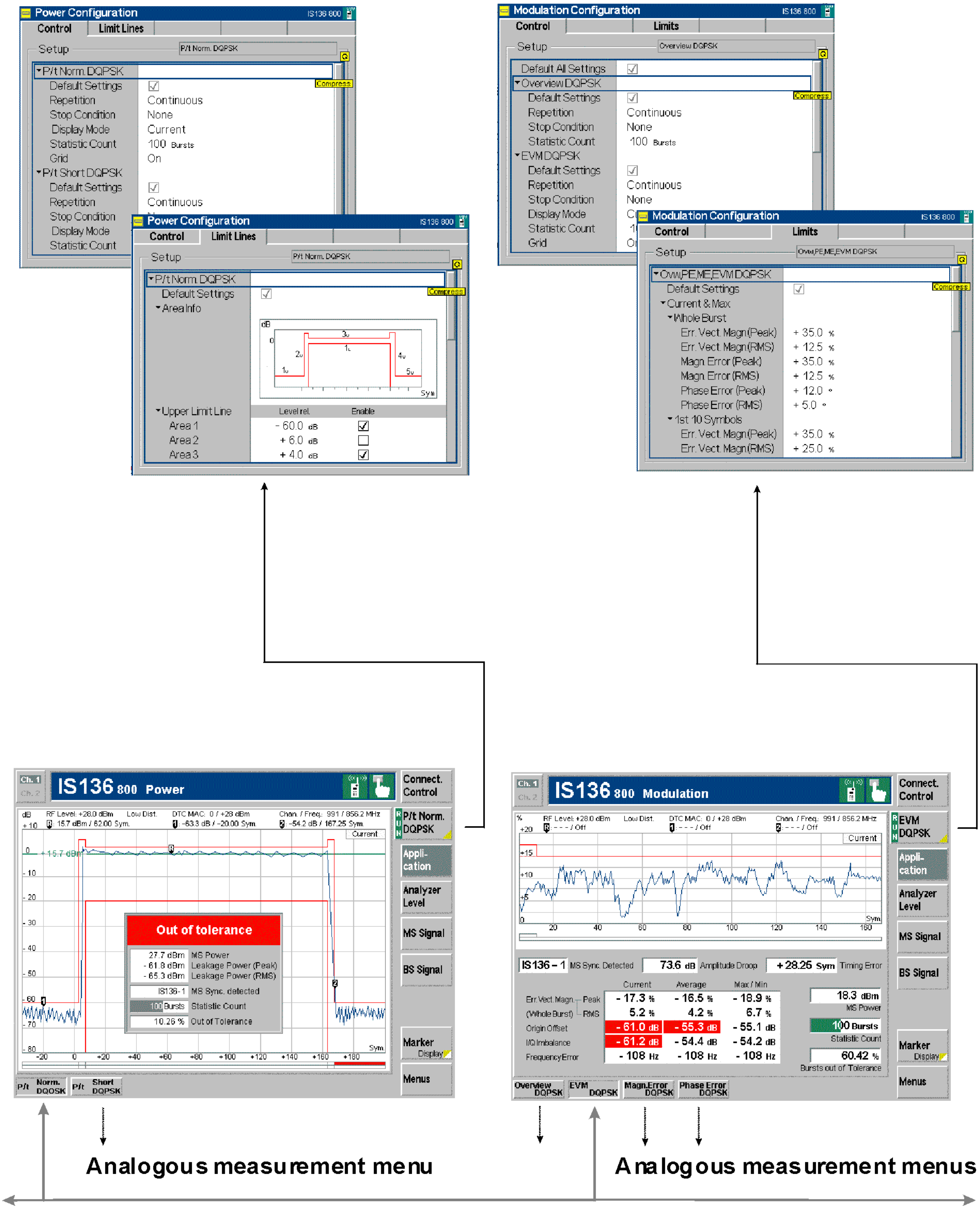
6	DTC MAC
1&4	DTC SlotConf.
2	DTC Channel

– 80.0 dBm

Echo

Measurement menus, see next pages

IS 136 Signalling – Power and Modulation



Power Configuration – Control | Limit Lines

Setup: P/t Norm. DQPSK

- P/t Norm. DQPSK
  - Default Settings ☑
  - Repetition: Continuous
  - Stop Condition: None
  - Display Mode: Current
  - Statistic Count: 100 Bursts
  - Grid: On
- P/t Short DQPSK
  - Default Settings ☑
  - Repetition: Continuous
  - Stop Condition
  - Display Mode
  - Statistic Count

Power Configuration – Limit Lines

Setup: P/t Norm. DQPSK

- P/t Norm. DQPSK
  - Default Settings ☑
  - Area Info
  - Upper Limit Line

	Level rel.	Enable
Area 1	- 60.0 dB	☑
Area 2	+ 6.0 dB	☐
Area 3	+ 4.0 dB	☑

Modulation Configuration – Control | Limits

Setup: Overview DQPSK

- Default All Settings ☑
- Overview DQPSK
  - Default Settings ☑
  - Repetition: Continuous
  - Stop Condition: None
  - Statistic Count: 100 Bursts
- EVM DQPSK
  - Default Settings ☑
  - Repetition: Continuous
  - Stop Condition: None
  - Display Mode
  - Statistic Count
  - Grid

Modulation Configuration – Limits

Setup: Ovw,PE,ME,EVM DQPSK

- Ovw,PE,ME,EVM DQPSK
  - Default Settings ☑
  - Current & Max
    - Whole Burst
      - Err. Vect. Magn (Peak): + 35.0 %
      - Err. Vect. Magn (RMS): + 12.5 %
      - Magn Error (Peak): + 35.0 %
      - Magn Error (RMS): + 12.5 %
      - Phase Error (Peak): + 12.0 °
      - Phase Error (RMS): + 5.0 °
    - 1st 10 Symbols
      - Err. Vect. Magn (Peak): + 35.0 %
      - Err. Vect. Magn (RMS): + 25.0 %

IS136 800 Power

RF Level +28.0 dBm Low Dist.; DTC MAC 0 / +28 dBm; Chan. / Freq. 991 / 856.2 MHz

1: 15.7 dBm / 62.00 Sym.; 1: -63.3 dB / -20.00 Sym.; 2: -54.2 dB / 167.25 Sym.

Out of tolerance

27.7 dBm	MS Power
- 61.8 dBm	Leakage Power (Peak)
- 65.3 dBm	Leakage Power (RMS)
IS136-1	MS Sync. detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

IS136 800 Modulation

RF Level +28.0 dBm Low Dist.; DTC MAC 0 / +28 dBm; Chan. / Freq. 991 / 856.2 MHz

IS136 – 1 MS Sync. Detected; 73.6 dB Amplitude Droop; + 28.25 Sym Timing Error

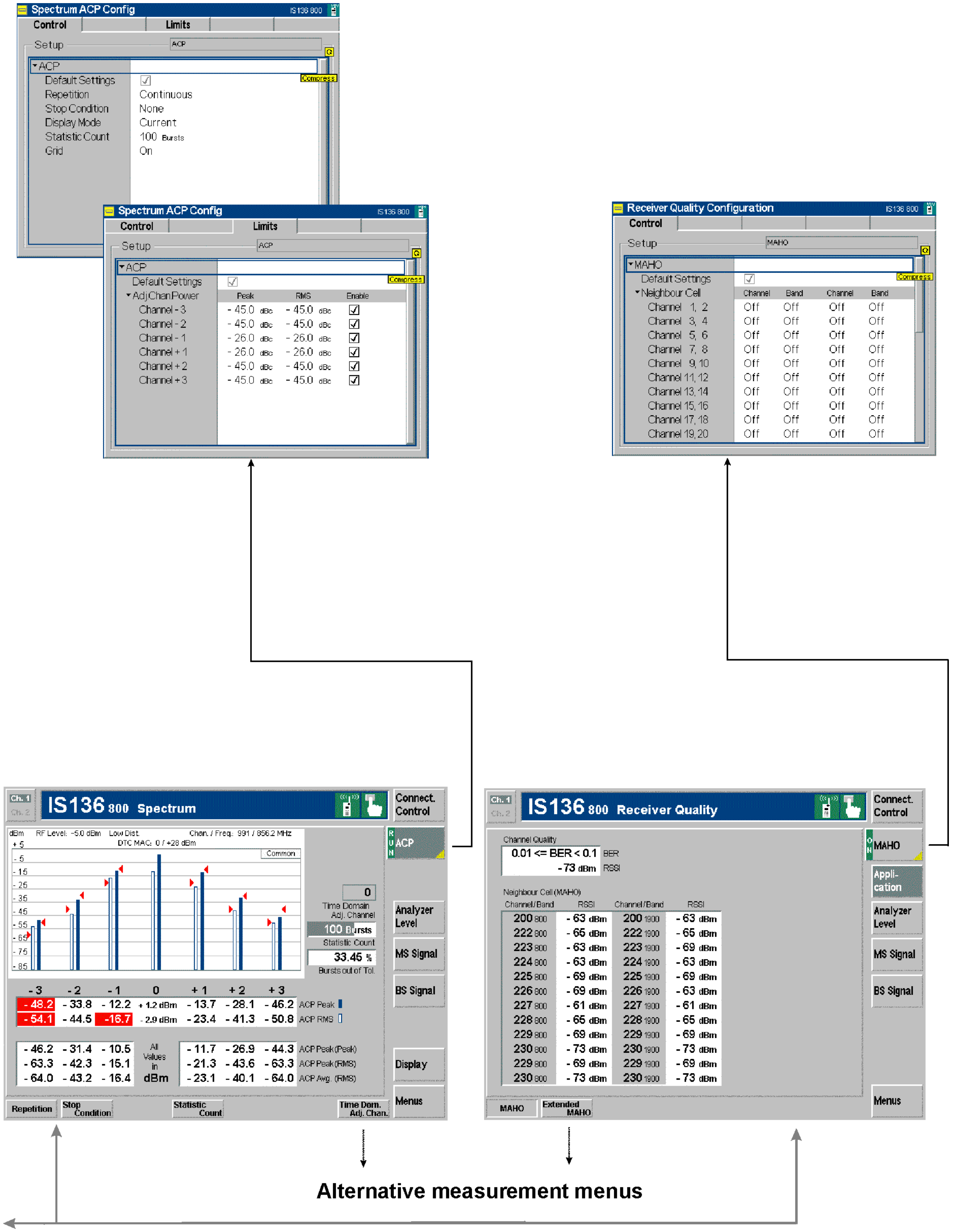
	Current	Average	Max / Min
Err.Vect.Magn. (Whole Burst) Peak	- 17.3 %	- 16.5 %	- 18.9 %
RMS	5.2 %	4.2 %	6.7 %
Origin Offset	- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance	- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error	- 108 Hz	- 108 Hz	- 108 Hz

18.3 dBm MS Power; 100 Bursts Statistic Count; 60.42 % Bursts out of Tolerance

Analogous measurement menu

Analogous measurement menus

IS 136 Signalling – Spectrum and Receiver Quality



Spectrum ACP Config IS136 800

Control | Limits

Setup: ACP

ACP

Default Settings	☑
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Grid	On

Spectrum ACP Config IS136 800

Control | Limits

Setup: ACP

ACP

Default Settings ☑

AdjChanPower

	Peak	RMS	Enable
Channel - 3	- 45.0 dBc	- 45.0 dBc	☑
Channel - 2	- 45.0 dBc	- 45.0 dBc	☑
Channel - 1	- 26.0 dBc	- 26.0 dBc	☑
Channel + 1	- 26.0 dBc	- 26.0 dBc	☑
Channel + 2	- 45.0 dBc	- 45.0 dBc	☑
Channel + 3	- 45.0 dBc	- 45.0 dBc	☑

Receiver Quality Configuration IS136 800

Control

Setup: MAHO

MAHO

Default Settings ☑

Neighbour Cell

	Channel	Band	Channel	Band
Channel 1, 2	Off	Off	Off	Off
Channel 3, 4	Off	Off	Off	Off
Channel 5, 6	Off	Off	Off	Off
Channel 7, 8	Off	Off	Off	Off
Channel 9, 10	Off	Off	Off	Off
Channel 11, 12	Off	Off	Off	Off
Channel 13, 14	Off	Off	Off	Off
Channel 15, 16	Off	Off	Off	Off
Channel 17, 18	Off	Off	Off	Off
Channel 19, 20	Off	Off	Off	Off

IS136 800 Spectrum

RF Level: -5.0 dBm Low Dist. Chan. / Freq.: 991 / 856.2 MHz DTC MAC: 0 / +28 dBm

Time Domain Adj. Channel: 0

Statistic Count: 100 Bursts

Bursts out of Tol.: 33.45 %

- 3	- 2	- 1	0	+ 1	+ 2	+ 3	
- 48.2	- 33.8	- 12.2	+ 1.2 dBm	- 13.7	- 28.1	- 46.2	ACP Peak
- 54.1	- 44.5	-16.7	- 2.9 dBm	- 23.4	- 41.3	- 50.8	ACP RMS
- 46.2	- 31.4	- 10.5	All Values in dBm	- 11.7	- 26.9	- 44.3	ACP Peak (Peak)
- 63.3	- 42.3	- 15.1		- 21.3	- 43.6	- 63.3	ACP Peak (RMS)
- 64.0	- 43.2	- 16.4		- 23.1	- 40.1	- 64.0	ACP Avg. (RMS)

IS136 800 Receiver Quality

Channel Quality

0.01 <= BER < 0.1 BER

-73 dBm RSSI

Neighbour Cell (MAHO)

Channel / Band	RSSI	Channel / Band	RSSI
200 800	- 63 dBm	200 1900	- 63 dBm
222 800	- 65 dBm	222 1900	- 65 dBm
223 800	- 63 dBm	223 1900	- 69 dBm
224 800	- 63 dBm	224 1900	- 63 dBm
225 800	- 69 dBm	225 1900	- 69 dBm
226 800	- 69 dBm	226 1900	- 63 dBm
227 800	- 61 dBm	227 1900	- 61 dBm
228 800	- 65 dBm	228 1900	- 65 dBm
229 800	- 69 dBm	229 1900	- 69 dBm
230 800	- 73 dBm	230 1900	- 73 dBm
229 800	- 69 dBm	229 1900	- 69 dBm
230 800	- 73 dBm	230 1900	- 73 dBm

Contents

4 Functions and their Application

4 Functions and their Application

This chapter explains in detail all functions for the measurement of IS 136 mobile stations.

It is divided into two sections describing the following function groups and test modes:

1. Digital TDMA module tests *(IS 136 800/1900-MS Non Signalling)*
2. Digital TDMA mobile tests *(IS 136 800/1900-MS Signalling)*

The specifications for the two digital bands (800 MHz and 1900 MHz, corresponding to the function groups I*S 136 800-MS* and *IS 136 1900-MS)* are largely analogous. The two function groups are therefore described together in common sections; differences between the bands are pointed out throughout the text.

This reference chapter is organized according to the provided measurements and configurations (see graphical overview at the end of chapter 3). In contrast to chapter 6, *Remote Control – Commands,* general measurement configurations are relegated to the end of each section. The description of each softkey, select or input field is followed by the corresponding remote-control commands. Similarly, the description of the commands in chapter 6 also contains the corresponding menus of the user interface.

Each menu and each panel is briefly described first and then illustrated together with its call button. The menu functions are explained in the following way:

Softkey	Short function definition
Designation of select/input field	Definition of field function. Further description of the field: purpose, interaction with other settings, notes... • *Parameter 1* Description of parameter 1 • *Parameter 2* Description of parameter 2 • ... Further description of the parameters: purpose, interaction with other settings, notes...
Remote control	`Remote-control command (long form)  Parameter1 | Parameter2 ...`

For all numerical values, including their ranges and default settings, please refer to the description of the remote-control commands in chapter 6.

The description of the operating concept is to be found in chapter 3 of the operating manual for the CMU basic instrument; besides, a description of measurement control and the essential settings and an overview of the most important menus is given at the end of chapter 3 in the present IS 136 manual. A comprehensive index listing important keywords and the proper names of all menus, dialog elements and softkeys is appended to the end of this manual.

TDMA Module Tests (Non Signalling Mode)

This section provides detailed information on the measurement and configuration menus defined in function groups *IS 136 800/1900-MS Non Signalling*. It is organized like a typical measurement session including the following stages:

1. General settings *(Analyzer/Generator)* and display of generator signals
2. Measurement menus *(Power, Modulation, Spectrum, Receiver Quality):* performance of the measurements, output of measurement results, specific measurement configurations
3. Global configurations *(Connection Control)*

Measurement Menu Analyzer/Generator

The main menu *Analyzer/Generator* configures the signals of the RF generator and the signals received and analyzed by the CMU. At the same time, it controls the *Power* measurement and displays the current peak and RMS results.

The RF generator and analyzer settings are also provided in the *Analyzer* and *Generator* tabs of the menu group *Connection Control*:

Analyzer Settings panel	*Analyzer* tab	See page 4.46 ff.
Generator Settings panel	*Generator* tab	See page 4.52 ff.

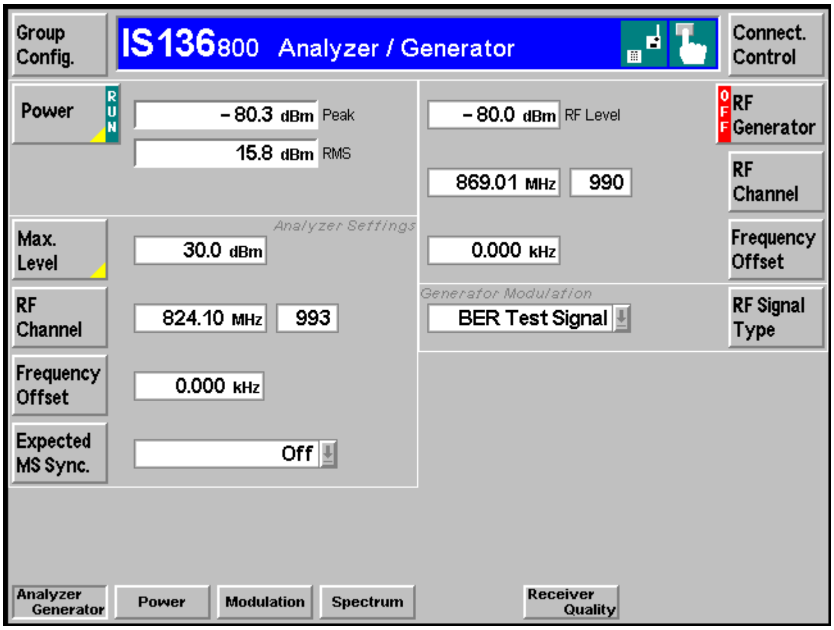
The remaining panel indicates the power parameters of the signal received by the CMU (peak and effective values):

Panel Power	Results of burst power measurement

The behavior of the signal power as a function of time can be analyzed in the measurement group *Power*.

The main menu *Analyzer/Generator* is opened via the main menu *Menu Select* (with associated key at the front of instrument). The hotkeys across the bottom of the menu switch over to the remaining measurement menus of the function group *IS 136 800-MS Non Signalling Mode*.

Menu Select



Power: -80.3 dBm Peak, 15.8 dBm RMS

Max. Level: 30.0 dBm

RF Channel: 824.10 MHz, 993

Frequency Offset: 0.000 kHz

Expected MS Sync.: Off

RF Generator: -80.0 dBm RF Level

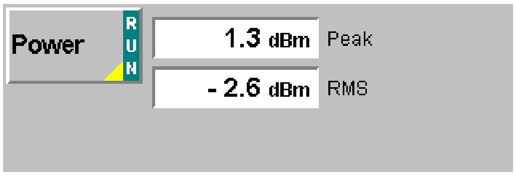
RF Channel: 869.01 MHz, 990

Frequency Offset: 0.000 kHz

RF Signal Type: BER Test Signal

Fig. 4-1 Measurement menu Analyzer / Generator

Power Panel



1.3 dBm Peak

- 2.6 dBm RMS

The panel *Power* contains one measurement control softkey plus two output fields indicating the peak and effective power of the RF input signal. The effective power is also indicated in the info box in the graphical measurement menu *Power* (see page 4.4 ff.).

Power

The *Power* softkey controls the *Power* measurement and indicates its status*(RUN | HLT | OFF)*.

The measurement status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The *Power* softkey corresponds to the *P/t Norm. DQPSK* softkey of the *Power* measurement menu (see page 4.4 ff.); the status labels on both softkeys always coincide.

Measurement configuration

Pressing the *Power* softkey twice opens the popup menus *Power Configuration* (see page 4.13 ff.).

Remote control

```
INITiate:POWer
ABORt:POWer
STOP:POWer
CONTinue:POWer
```

Peak
RMS

Peak and effective power of the current burst in dBm measured with a 100 kHz Gaussian filter. As no comparison is made between different bursts the result does not depend on the repetition mode (single shot or continuous measurement).

Remote control

```
READ[:SCALar]:POWer[:RESult]?
FETCh[:SCALar]:POWer[:RESult]?
SAMPle[:SCALar]:POWer[:RESult]?     Response: <Result>
```

Power Measurements

The menu group *Power* comprises the functions for measuring the RF power of the received burst signal as a function of time. The measurement results are displayed in the graphical measurement menu *Power,* the popup menu *Power Configuration* is used for configuration of the measurements.

Measurement Menu (Power)

The graphical measurement menu *Power* displays the results of the power measurement (burst analysis).

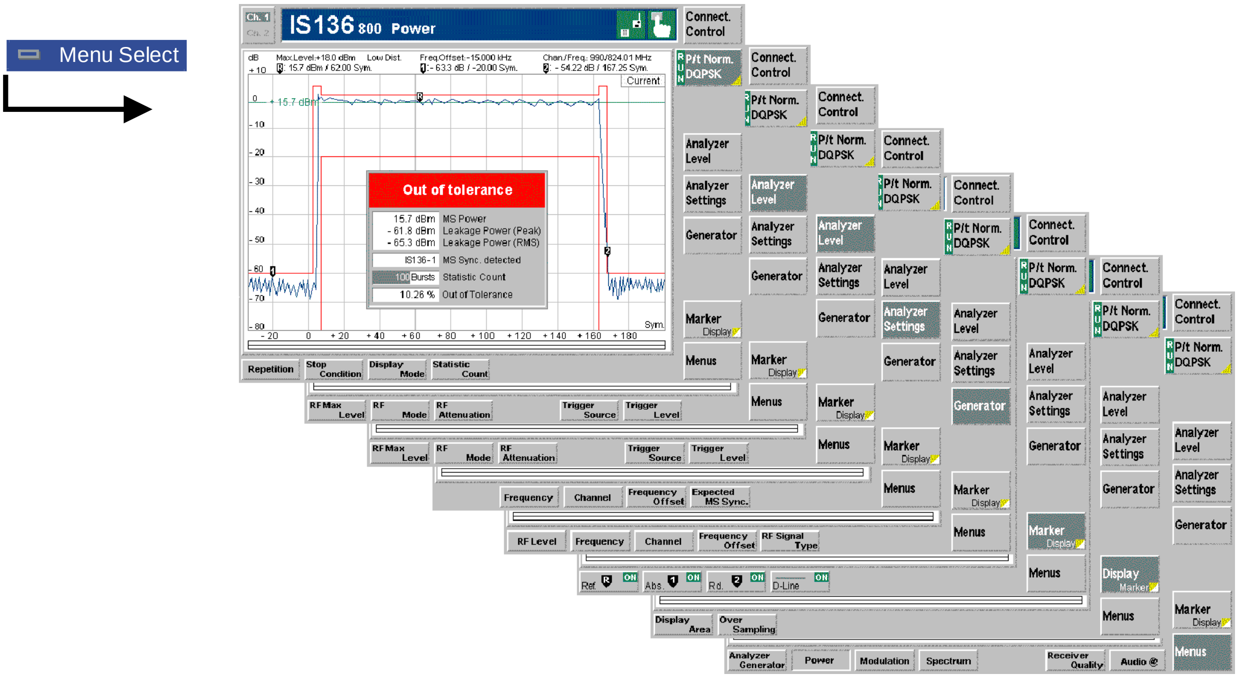
- The measurement control softkey *P/t Norm. DQPSK* indicates the status of the power measurement *(RUN* | *HLT* | *OFF)* and opens the configuration menu *Power Configuration.* The hotkeys associated to the measurement control softkey define the scope of the measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys (e.g. the hotkeys *Frequency, Channel, Frequency Offset,* and *Expected MS Sync.* belong to the softkey *Analyzer Settings).* The softkey/hotkey combinations provide test settings and switch over between different measurements.

Types of settings

The purpose of the *Power* menu (and of all other measurement menus) is to provide quick access to all settings and to present the measurement results at a glance. The softkeys/hotkey combinations provide two different types of settings:

- General settings are valid for all applications of function group *IS 136 800/1900-MS Non Signalling.* Changing general settings in an arbitrary application will have an impact on all measurements and applications of the function group. All general settings are also provided in the *Connection Control* menu (see p. 4.46 ff.). Examples of general settings are the RF input level (softkey *Analyzer Level)* and the configuration of the RF generator (softkey *RF Generator)*.
- Specific settings are relevant for one application only, or they can be set independently for several applications. Changing specific settings in an application will not affect the other measurements and applications of the function group. No specific settings are provided in the *Connection Control* menu (see p. 4.46 ff.). Examples of specific settings are the *Repetition* mode (to be set independently for all applications) and *Display Area* (relevant for *Power* measurements only).

The measurement menu *Power* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or using the *Menus – Power* hotkey. The hotkeys associated to the *Menus* softkey switch over between the *Power* menu and the remaining measurement menus of function group *IS 136 800/1900 Non Signalling*.



Out of tolerance

15.7 dBm MS Power
- 61.8 dBm Leakage Power (Peak)
- 65.3 dBm Leakage Power (RMS)
IS136-1 MS Sync. detected
100 Bursts Statistic Count
10.26 % Out of Tolerance

Fig. 4-2 Measurement menu Power

Test Settings

The settings for the *Power* menu are accessible via softkey/hotkey combinations. If a softkey (located in the softkey bar on the right side of the menu) is selected and an associated hotkey (displayed across the bottom of the menu) is pressed, a popup window indicating the current setting and enabling an entry will appear.

Example:

Analyzer Settings

The *Analyzer Settings* softkey displays a hotkey bar including the hotkey labeled *Frequency*.

Frequency

The *Frequency* hotkey opens the input window *Frequency*.


Frequency
856.2 MHz

Input windows indicate the current parameter value (in this case: the RF input frequency) or a list of possible settings. Parameters are changed by

- Overwriting/incrementing numerical values (for numerical parameters)
- Selecting from the list of parameters (for select parameters)

a) Measurement Control

The *Power* measurement is controlled by means of the measurement control softkey below the *Connect. Control* softkey and the associated hotkeys.

P/Norm. DQPSK

The *P/t Norm. DQPSK* softkey controls the measurement and indicates its status *(RUN* **|** *HLT* **|** *OFF)*. This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key.

Remote control
```
INITiate:POWer[:NBURst][:DQPSK] etc.
FETCh:POWer[:NBURst][:DQPSK]:STATus?
```

Measurement configuration

Pressing the *P/t Norm. DQPSK* softkey twice opens the popup menu *Power Configuration* (see page 4.13). Besides, the measurement control softkey provides hotkeys to define the scope of the measurement. All these settings are described in more detail in section *Measurement Control (Power Configuration – Control)* on page 4.13 ff.

Repetition

The hotkey *Repetition* determines the repetition mode of the measurement *(Single Shot* or *Continuous* measurement).

Remote control
```
CONFigure:POWer[:NBURst][:DQPSK]:CONTrol:REPetition
  <Repetition>,<StopCond>,<Stepmode>
```

Stop Condition

The *Stop Condition* hotkey sets a stop condition for the measurement *(None* or *On Limit Failure)*.

Remote control
```
CONFigure:POWer[:NBURst][:DQPSK]:CONTrol:REPetition
             <Repetition>,<StopCond>,<Stepmode>
where <Applic> = MODulation | HNOise
```

Display Mode

The hotkey *Display Mode* determines the display mode of the measurement curve.

Remote control
no display mode set, the four measurement curves are accessible via
```
FETCh:ARRAy:POWer[:NBURst][:DQPSK][:CURRent]?
FETCh:ARRAy:POWer[:NBURst][:DQPSK]:MINimum?
FETCh:ARRAy:POWer[:NBURst][:DQPSK]:MAXimum?
FETCh:ARRAy:POWer[:NBURst][:DQPSK]:AVERage? etc.
```

Statistic Count

The *Statistic Count* hotkey defines the number of bursts per statistic cycle.

Remote control
```
CONFigure:POWer[:NBURst][:DQPSK]:CONTrol
  <Mode>,1 ... 1000 | NONE
```

b) Signal Settings

Analyzer Level

The *Analyzer Level* softkey controls the level in the RF input signal path. The input level settings are also provided in the *Analyzer* tab of the *Connection Control* menu. For a detailed description see section *Table-Oriented Version* on p. 4.49 ff.

RF Max. Level

The *RF Max. Level* hotkey sets the maximum expected input level in dBm.

Remote control
```
[SENSE:]LEVel:MAXimum  <Level>
```

RF Mode

The *RF Mode* hotkey determines how the input level is defined.

Manual	Manual input via *RF Max. Level* hotkey
Auto	Automatic setting according to the power of the applied signal.

Remote control

```
[SENSE:]LEVel:MODE  MANual | AUTOmatic
```

RF Attenuation

The *RF Attenuation* hotkey selects a strategy for tuning the RF analyzer.

Normal	Input signal is kept unchanged
Low Noise	Enhanced mixer level. This setting ensures the full dynamic range of the CMU and is therefore recommended for *Power* and *Spectrum* measurements.
Low Distortion	Decreased mixer level. This setting ensures a high transmission reserve and is therefore recommended for *Modulation* measurements.

Remote control

```
[SENSE:]LEVel:ATTenuation  NORMal | LNOIse | LDIStortion
```

Trigger Source

The *Trigger Source* hotkey determines the trigger condition.

Free Run	Trigger by incoming burst that the CMU searches in the TDMA frame
RF Power	Trigger on power (rising edge) of incoming burst, wideband trigger at the Front End
IF Power	Narrow-band trigger
Extern	External trigger signal fed in via connector AUX3 (pin 8)

Remote control

```
TRIGger[:SEQuence]:SOURce
          FRUN | RFPOWer | IFPOWer | EXTern
```

Trigger Level

The *Trigger Level* hotkey determines the trigger level. This softkey is enabled for trigger source *RF Power* or *IF Power* only.

Remote control

```
TRIGger[:SEQuence]:THReshold LOW | MEDium | HIGH
```

Analyzer Settings

The *Analyzer Settings* softkey configures the RF analyzer, in particular by setting the frequency of the RF channel measured and the expected synchronization pattern. The settings are described in more detail in section *Control of Input Signals (Connection Control – Analyzer)* on p. 4.46 ff.

Frequency

The *Frequency* hotkey defines the signal frequency in MHz of the RF voice signal to be analyzed.

Remote control

```
[SENSe:]RFANalyzer:FREQuency <Frequency>
```

Channel

The *Channel* hotkey defines the channel number of the RF voice signal to be analyzed.

Remote control

```
[SENSe:]RFANalyzer:FREQuency:UNIT CH
[SENSe:]RFANalyzer:FREQuency <CH_Number>
```

Frequency Offset

The *Frequency Offset* hotkey defines the frequency offset of the RF voice signal to be analyzed.

Remote control
```
[SENSe:]RFANalyzer:FREQuency:OFFSet <Offset>
```

Expected MS Sync

The *Expected MS Sync.* hotkey defines a synchronization pattern for the measured signal.

Remote control
```
[SENSe:]RFANalyzer:EMSSync <SyncPattern>
```

Generator

The *Generator* softkey configures the RF signal generated.

The following generator settings are described in more detail in section *Control of Output Signals (Connection Control – Generator)* on p. 4.52 ff.

RF Level

The *RF Level* hotkey defines the RF generator level in dBm.

Remote control
```
SOURce:RFGenerator:LEVel <Level>
```

Frequency

The *Frequency* hotkey defines the frequency of the RF generator signal in MHz.

Remote control
```
SOURce:RFGenerator:FREQuency <Frequency>
```

Channel

The *Channel* hotkey defines the IS 136 channel number of the generator signal.

Remote control
```
SOURce:RFGenerator:FREQuency:UNIT CH
SOURce:RFGenerator:FREQuency <Channel>
```

Frequency Offset

The *Frequency Offset* hotkey defines a frequency offset relative to the signal frequency or IS 136 channel frequency defined with the *Frequency* or *Channel* hotkeys.

Remote control
```
SOURce:RFGenerator:FREQueny:OFFset <Offset>
```

RF Signal Type

The *RF Signal Type* hotkey selects a bit modulation sequence for the generated RF signals.

Remote control
```
SOURce:RFGenerator:MODulation:RFS:TYPE <Sequence>
```

Marker Display

The *Marker/Display* softkey positions up to 3 markers and a D-line in the test diagram and displays their values.

If pressed once again, the selected *Marker/Display* softkey changes to the *Display/Marker* softkey, see below.

Markers are graphical tools for marking points on the measurement curve and for numerical output of measured values. The measurement menu Power provides a reference marker and two further markers which permit to measure spacings (delta marker 1 and 2).
The coordinates of the three markers are indicated in the format Ordinate value (level)/abscissa value (time) in a parameter line above

	the test diagram. The position of the reference marker is expressed in absolute units (level in dBm and time in bits), the delta marker by absolute or relative values (relative level in dB or time differences from the reference marker).
D-line	The D-line (display line) is a horizontal line that can be positioned to mark and read out an arbitrary level in the test diagram.

Ref R

The hotkey *Ref. R* switches the reference marker on or off (use the *ON/OFF* key).

The reference marker is represented by the symbol R in the test diagram. The marker position (abscissa) is defined in the input field *Ref. Marker R*. The marker can be positioned to arbitrary time values. It is switched off in the default setting *(Off).* The marker level is given by the measurement curve at the marker position.

The position of all markers can be varied using the roll-key.

Remote control
No command, screen configuration only.

Rel 1

The *Rel. 1* hotkey switches the delta marker 1 on or off (use the *ON/OFF* key).

The delta marker 1 is represented by the symbol 1 in the test diagram. The marker position (abscissa) is defined in the input field *Rel. Marker 1*. The marker can be positioned to arbitrary time values. If its position is outside the diagram area it will be invisible and its coordinates will be "<abscissa_value> / - - -". The marker is switched off in the default setting *(Off).* The marker level is given by the measurement curve at the marker position.

The toggle switch *Rel 1 Config* pops up when the hotkey is pressed for the second time. It defines whether the position of delta marker 1 is measured and indicated in absolute units (dBm) or relative to the reference marker.

Remote control
No command, screen configuration only.

Rel 2

The *Rel. 2* hotkey switches the delta marker 2 on or off (use the *ON/OFF* key). Functions and remote control are analogous to delta marker 1.

D-Line

The *D-Line* hotkey switches the D-line in the test diagram on or off.

The D-line is a horizontal, colored auxiliary line in the test diagram and is used for marking a level value and for measuring level differences. The level (ordinate) is determined in the input field *D-Line* and indicated on the D-line. The permissible value range is the diagram area, the default setting is Off.

The switch *D-Line Config.* is opened by pressing *D-Line* twice and determines whether the D-line level is expressed in absolute units (in dBm, setting absolute) or relative to the Max. Level (in dB, setting relative).

Remote control
No command, screen configuration only.

Display
Marker

The *Display/Marker* softkey zooms or shifts the graphical display. It is selected by pressing the *Marker/Display* softkey twice. If pressed once again, the selected *Display/Marker* softkey changes back to the *Marker/Display* softkey, see above.

Display Area

The *Display Area* hotkey selects the displayed screen area.

It is possible to select either the complete burst (see Fig. 4-6), or zoom in to a particular area:

Full Range	Display of complete burst in the time range –20 symb. to 181 symb. and levels between –80 dBc and +10 dBc
Useful Part	full time range, trace magnified around the reference level (–60 dBc to +10 dBc)
Left Upper Corner	trace magnified around the left upper corner (symbols –8 to +10, –40 dBc to +10 dBc)
Rising Edge	full level range, time axis from –8 symb. to 10 symb.
Right Upper Corner	trace magnified around the right upper corner (symbols 156 to 174, –40 dBc to +10 dBc)
Falling Edge	full level range, time axis from –150 symb. to 168 symb

The screen setting and the measurement do not affect each other.

Remote control
No command, screen configuration only.

Over-sampling

The *Oversampling* hotkey defines the oversampling factor of the displayed signal.

The oversampling factor indicates how many samples are taken per symbol. Oversampling factors of 1 (corresponding to 202 test points over the whole display range) or 8 (corresponding to 1616 test points) are available.

Remote control

```
CONFigure:POWer[:NBURst][:DQPSk]:TIME:OVERsampling 1 | 8
```

Menus

The *Menus* softkey displays the hotkey bar for changing to the other measurement groups. The main measurement menu within each group is directly opened by pressing the associated hotkey.

Measurement Results

The values shown in the measurement menu *Power* can be divided into three groups:

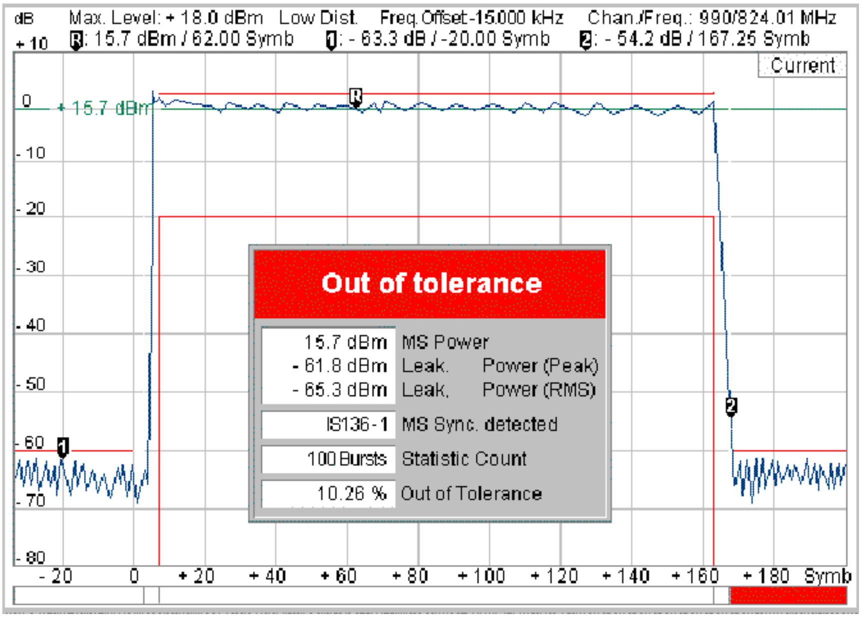
- Setting values
- Scalar measurement results (single values)
- Arrays (the trace plotted as a function of time)

These values are indicated in two parameter lines, the test diagram and an info box:

Parameter line 1|2

Test diagram

Info box



Max. Level: + 18.0 dBm Low Dist. Freq.Offset -15.000 kHz Chan./Freq.: 990/824.01 MHz

R: 15.7 dBm / 62.00 Symb 1: - 63.3 dB / -20.00 Symb 2: - 54.2 dB / 167.25 Symb

Out of tolerance

15.7 dBm - 61.8 dBm - 65.3 dBm	MS Power Leak. Power (Peak) Leak. Power (RMS)
IS136 - 1	MS Sync. detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

Fig. 4-3 Display of measurement results (Power menu)

Settings/ scalar measurement results

Settings and scalar measurement results are indicated in the two parameter lines above the test diagram and in the info box, a popup window in the middle of the graphical screen *Power*.

1st parameter line

The first parameter line contains the following settings:

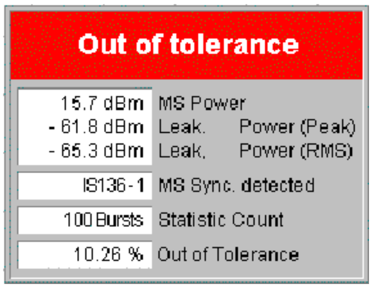
Max. Level	Maximum expected input level as set in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.49 ff.)
Attenuation	Setting for the attenuation of the input level *(Normal, Low Noise, Low Distortion)* as set in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.49 ff.)
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq	RF channel and associated frequency

2nd parameter line

The second parameter line contains the following marker values:

R	Level and time of reference marker
1	Level and time of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Level and time of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Info box



Out of tolerance

15.7 dBm - 61.8 dBm - 65.3 dBm	MS Power Leak. Power (Peak) Leak. Power (RMS)
IS136 - 1	MS Sync. detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

The info box contains the following settings:

Statistic Count	Number of bursts per statistics cycle.

In addition, the following scalar results are indicated:

MS Power	Average power of current burst measured with a 100 kHz Gaussian filter (irrespective of the display mode selected and of the current trace).
Leak. Power	Mobile station transmit power during the carrier-off state; both the maximum (Peak) and effective (RMS) value is indicated; the latter is averaged over the carrier-off period[1].
MS Sync. Detect.	IS 136 standard synchronization pattern detected (see section *Table-Oriented Version* on p. 4.49 ff.). *No TSC* is indicated if no synchronization pattern could be found; '---' if the measurement is switched off (search not activated).
Out of Tolerance	*OK* or message if the result is out of the tolerance template defined in the *Limit Lines* tab of the configuration menu, see page 4.15 ff. The message refers to the displayed trace which in turn depends on the display mode selected. The following messages may be displayed:

OK	Trace matches the tolerance template
Fail	Trace does not match the tolerance template
Invalid	Burst too short or synchronization pattern not found
Out of Range	No power ramp found
No TSC	Synchronization pattern not found
Overflow	Signal level too high
Underflow	Signal level too low
No trigger	No trigger signal detected in external/RF/IF trigger mode
Off	Measurement off

Remote control

Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?
FETCh[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?
SAMPle[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?

CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:CURRent
                                       [:RESult]:MATChing?
```

Traces (arrays)

The measurement result is displayed as a continuous measurement curve (trace) in the test diagram together with the limit lines, markers and the D-line, if defined.

The curve in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in symbols). The displayed result depends on various test settings. The display mode for the trace *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram.

The scale of both axes can be adjusted via the *Display Area* hotkey (see above).

Remote control

```
READ:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?
FETCh:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?
SAMPle:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult]? etc.
CALCulate:POWer[:NBURst][:DQPSk]:CURRent[:RESult]
  :MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?  etc.
```

---

[1] For *Max. Level* settings larger than +10 dBm the leakage power is determined according to the 2-shot method described on page 4.17.

Measurement Configurations (Power Configuration)

The popup menu *Power Configuration* contains two tabs to determine the parameters of the power measurement including the error tolerances.

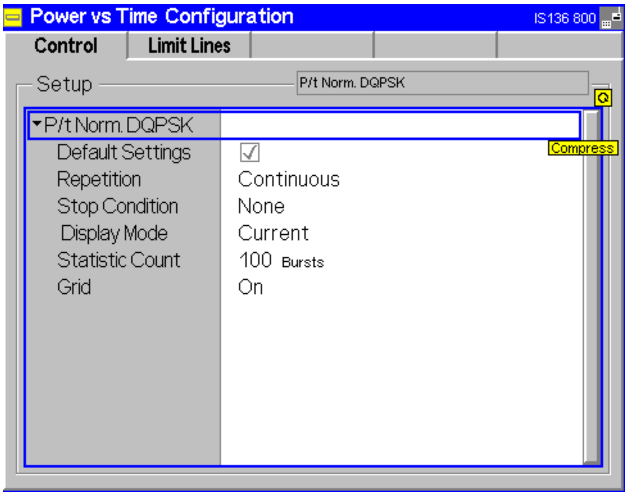
The popup menu *Power Configuration* is activated by pressing the measurement control softkey *P/t Norm. DQPSK* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Power Configuration – Control)

The *Control* tab controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The type of measurement curve displayed *(Display Mode)*
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*

Besides, it configures the power diagram by adding or removing the *Grid*.



P/t Norm. DQPSK

Default Settings	☑
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Grid	On

Fig. 4-4 Power Configuration – Control

Default Settings The *Default Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote Control `CONFigure:Power[:NBURst][:DQPSk]:CONTrol:DEFault ON | OFF`

Repetition The *Repetition* field determines the repetition mode:

Single Shot Single-shot measurement: the measurement is stopped after a statistics cycle (or after a stop condition is met, see below). A stopped measurement is indicated by the status display *HLT* in the *Power* softkey.

Unless otherwise stated, a statistics cycle corresponds to the number of bursts/evaluation periods set under *Statistic Count*.

Continuous Continuous measurement: The CMU continues the measurement until it is terminated explicitly (or until the stop condition for the measurement is met, see below). The measurement results are valid after one statistics cycle; however, the measurement is continued, and the output is continuously updated. An ongoing measurement is indicated by the status display *RUN* in the softkey *Power*.

Single shot should be selected if only a single measurement result is required under fixed conditions. The continuous measurement is suitable for monitoring the evolution of a measured quantity in time, for example for adjustments.

Note: *In remote mode, the counting measurement (counting mode) is available as a further measurement mode with a defined number of measurement cycles to be performed, see chapter 6 of this manual.*

Remote control

```
CONFigure:Power[:NBURst][:DQPSk]:CONTrol:REPetition
       CONTinuous | SINGleshot | 1 ... 10000,<StopCondition>,
                                                <Stepmode>
```

Stop Condition The *Stop Condition* field defines a stop condition for the measurement:

NONE	Continue measurement irrespective of the results of the limit check
On Limit Failure	Stop measurement as soon as the limit check fails (one of the tolerances is exceeded)

Remote control

```
CONFigure:Power[:NBURst][:DQPSk]:CONTrol:REPetition
         <REPetition>,SONerror | NONE,<Stepmode>
```

Display Mode The *Display Mode* field defines which of the four measured and calculated traces is displayed. The traces differ in the way the burst power *p(t)* at a fixed point in time *t* is calculated if the measurement extends over several bursts:

Current	Measured value for current burst
Minimum	Minimum over a number of bursts
Maximum	Maximum over a number of bursts
Average	Average value over a number of bursts

The number of bursts for calculation of the statistics values *Minimum, Maximum* and *Average* – and thus the result – depends on the measurement mode set (see section *Measurement Control (Power Configuration – Control)* on page 4.13). In detail, this implies:

Single shot	Display of minimum, maximum and average value from the performed statistics cycle
Continuous	Display of minimum and maximum from all bursts already measured. The **average value**, however, is calculated according to the prescription in Chapter 3, section *General Settings.*

Remote control No display mode set, the four traces are accessible via

```
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:CURRent:[:RESult]?
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:AVERage:[:RESult]?
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:MINimum:[:RESult]?
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:MAXimum:[:RESult]? etc.
```

Statistic Count The parameter *Statistic Count* defines the length of a statistics cycle in terms of burst periods.

The settings *1* and *Off* (press *ON/OFF* key) are equivalent. A statistics cycle is equal to the duration of a single shot measurement.

Remote control

```
CONFigure:Power[:NBURst][:DQPSk]:CONTrol
             <MODE>,1 ... 1000 | OFF
```

Grid The *Grid* parameter switches the grid in the graphical test diagram on or off. By default, the grid is switched on.

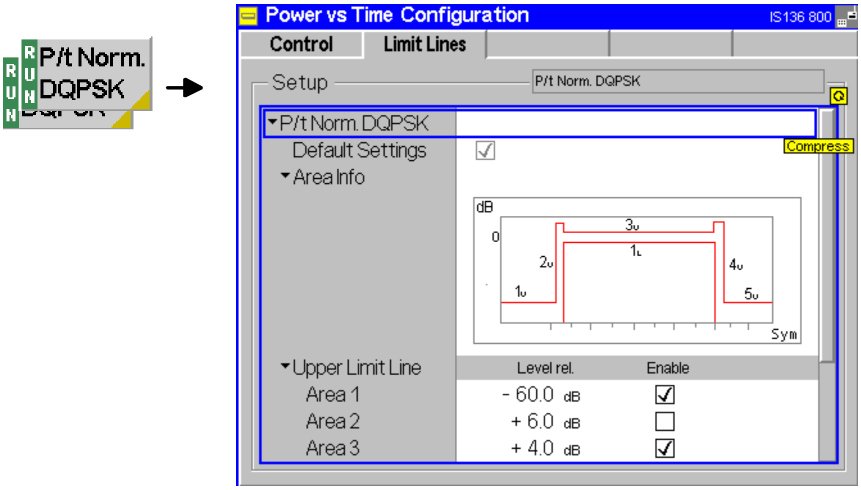
Remote control

```
CONFigure:Power[:NBURst][:DQPSk]:CONTrol:GRID  ON | OFF
```

Limit lines (Power Configuration – Limit Lines)

The tab *Limit Lines* defines the limit lines for the *Power* measurement. The tab contains:

- A preview of the defined limit lines *(Area Info)*
- Definition of the limit lines for the normal burst section by section *(Upper Limit Line, Lower Limit Line)*



Setup: P/t Norm. DQPSK

▾P/t Norm. DQPSK

Default Settings ☑

▾Area Info

▾Upper Limit Line	Level rel.	Enable
Area 1	- 60.0 dB	☑
Area 2	+ 6.0 dB	☐
Area 3	+ 4.0 dB	☑

Fig. 4-5 Power Configuration – Limit Lines

Default Settings The *Default Settings* switch assigns default values to all settings in the *Limit Lines* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote Control

```
CONFigure:Power[:NBURst][:DQPSk]:LIMit:DEFault  ON | OFF
```

Burst power As a function of time, the bursts can be divided into different areas. These areas are used as a basis for the definition of the limit lines and are shown in the following diagram (Fig. 4-6).

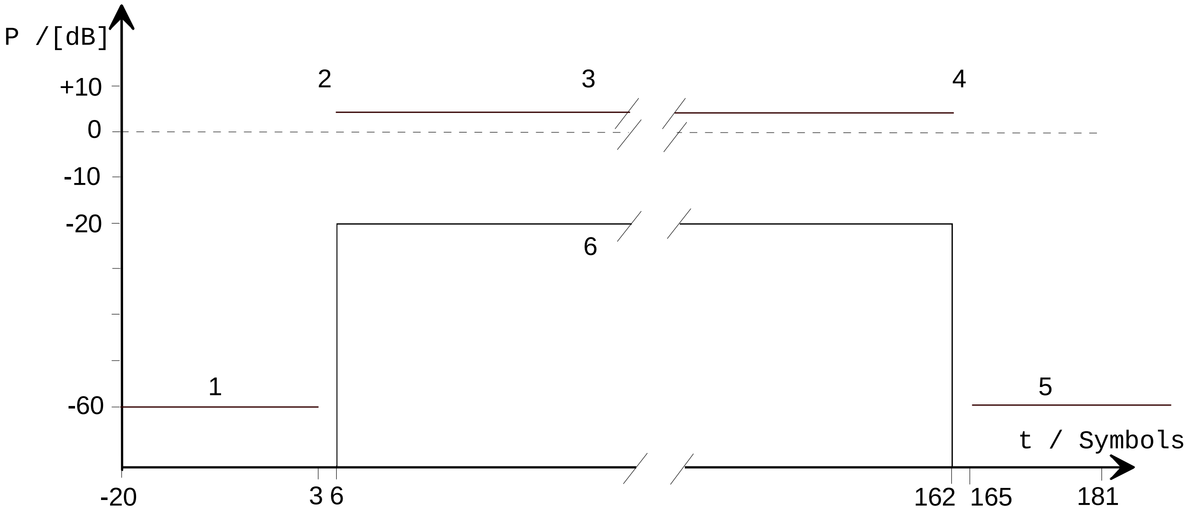


Fig. 4-6 Tolerance mask (limit lines) for normal bursts

Note: *In Non Signalling mode, normal bursts can be measured by the CMU. The reference level (0 dB line) is equal to the power of the received signal in the carrier-on state. The analysis of normal and shortened bursts from mobiles with various attenuation codes (MAC) is described in section* IS 136 Measurements with Signalling*.*

Default The *Default* switch assigns default values to all fields in the *Limit Lines* tab (the default values for the limit lines correspond to the tolerance template in Fig. 4-6; they are also quoted in chapter 6 of this manual).

Remote control

```
CONFigure:Power[:NBURst][:DQPSk]:LIMit[:LINE]
                 [:ASYMmetrical]:DEFault  ON | OFF
```

Area Info The *Area Info* diagram represents a simplified preview of the defined tolerance template.

Remote control –

Upper Limit Line The table *Upper Limit Line* defines the upper limits line for the measured burst power. To this end, the normal burst is divided into 5 areas; within each area, the upper limit is defined by a constant line.

The individual columns in the table section *Upper Limit Line* have the following meaning:

Area	Area number as in Fig. 4-6, Area No. 1 to 5
Level rel. [dB]	Level in the area in units relative to the carrier. This means that the reference level (0-dB line) is the carrier power averaged over the useful part of the burst.
Enable	Valid (enabled) or invalid limit line. In an invalid area, the limit check is disabled as well.

The ranges for the upper limit lines, i.e. of the quantity *Level rel.* vary according to the area numbers. The default values for all limit lines can be set by means of the *Default* switch.

Remote control

```
CONFigure:Power[:NBURst][:DQPSk]:LIMit[:LINE]
     [:ASYMmetrical]:UPPer:AREA<nr>:ENABle  ON | OFF
```

```
CONFigure:Power[:NBURst][:DQPSk]:LIMit[:LINE]
     [:ASYMmetrical]:UPPer:AREA<nr>  <LevelRel>,<Enable_Area>
```

Lower Limit Line The table *Lower Limit Line* defines the lower limits lines for the measured burst power. According to the specifications of the standard, the lower limit line for the normal burst consists of only one area with constant limit value.

The individual columns in the table section *Lower Limit Line* have the following meaning:

Area F	Area number as in Fig. 4-6.
Level rel. [dB]	Level in the area in units relative to the carrier. This means that the reference level (0-dB line) is the carrier power averaged over the useful part of the burst.
Enable	Valid (enabled) or invalid limit line. In an invalid area, the limit check is disabled as well.

The range for the lower limit lines, i.e. of the quantity *Level rel.* varies according to the areas. The default values for all limit lines can be set by means of the *Default* switch.

Remote control

```
CONFigure:Power[:NBURst][:DQPSk]:LIMit[:LINE]
     [:ASYMmetrical]:LOWer:AREA1:ENABle  ON | OFF
```

```
CONFigure:Power[:NBURst][:DQPSk]:LIMit[:LINE]
     [:ASYMmetrical]:LOWer:AREA1  <LevelRel>,<Enable_Area>
```

Leakage Power The entry *Leakage Power* specifies an upper limit for the effective transmit power of the mobile station during the carrier-off state.

The leakage power is indicated in the info box of the *Power* measurement menu *(Leak. Power (RMS))*. If it exceeds the specified limit, the output field turns red with a white triangle pointing upwards.

For large maximum expected input levels, the dynamic range of the tester may not be sufficient to cover the power range below –60 dBm relevant for leakage power measurements (see Fig. 4-6). To overcome this difficulty, the CMU switches to a 2-shot mode as soon as the maximum input level (set via the *RF Max. Level* hotkey) exceeds +10 dBm:

1. The power vs. time measurement is performed under normal conditions. The power ramp is measured; no valid leakage power results are indicated ('---').
2. The tester is overdriven, i.e. the mixer level is enhanced by +25 dB, with a corresponding increase of the signal-to noise ratio (for comparison, see the *Low Noise* option described in section *Table-Oriented Version* on p. 4.49 ff.). In this test mode, the leakage power can be measured for maximum input levels ranging from +10 dBm to the maximum allowed input level of all three RF input connectors.

The 2-shot mode is not available in repetition mode *Continuous*. In repetition mode *Single Shot*, it is automatically deactivated for maximum input levels below +10 dBm where the burst power and leakage power can be measured simultaneously.

Remote control

```
CONFigure:Power[:NBURst][:DQPSk]:LIMit:POInt
  [:ASYMmetrical]:LPOWer  <Limit>
```

Modulation Measurements

The menu group *Modulation* comprises the functions for measurement of the modulation parameters described below and matching of the respective tolerance limits. The measurement results are displayed in the graphical measurement menu *Modulation,* the popup menu *Modulation Configuration* is used for configuration of the measurements.

Quantities characterizing the modulation accuracy are determined as follows:

The actual modulation vector of the received signal from the mobile station is measured over the complete burst and stored. From a comparison of this measured modulation vector with the (computed) ideal signal vector, three non-redundant quantities are calculated (see Fig. 4-7):

Phase error	Difference in phase between the measured and the ideal signal vector.
Magnitude error	Difference between the magnitudes of the measured and the ideal signal vector.
Error vector magnitude	Magnitude of the vector connecting the measured and the ideal signal vector. In contrast to the previous quantities, the error vector magnitude cannot be negative.

These three quantities are calculated as a function of time and displayed over the whole useful part of the burst (symbol 6 to symbol 162), each of them in a separate graphical measurement menu. In addition, the peak and RMS values of all three quantities are calculated (over the whole display range or over the first ten symbols only) and displayed.

Finally, the *Modulation* measurement provides the following scalar quantities:

Origin offset	Origin offset in the I/Q constellation diagram reflecting a DC offset in the baseband. The origin offset corresponds to an RF carrier feedthrough.
I/Q imbalance	Amplitude difference between the in-phase (I) to the quadrature (Q) components of the measured signal, normalized and logarithmized. The I/Q imbalance corresponds to an unwanted signal in the opposite sideband.
Frequency error	Difference of the measured frequency from the expected frequency.
Amplitude droop	Variation of the signal level between the first (symbol no. 6) and the last valid symbol (symbol no. 162) in the burst in dB.

For the **tolerance check** all three phase error curves can be fitted into a tolerance template and checked.

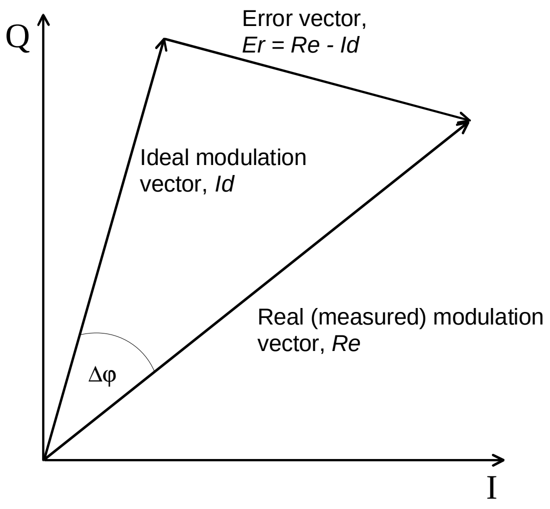


Fig. 4-7 Modulation errors in the I/Q vector diagram

The I/Q vector diagram shows the following quantities measured in the *Modulation* menu:

Δφ	Phase error
| *Re* | - | *Id* |	Magnitude error
| *Er* | = | *Re* – *Id* |	Error vector magnitude (EVM)

Note: *The test functionality of the CMU is beyond the requirements of the standard where nothing regarding the phase error and magnitude error is specified.*

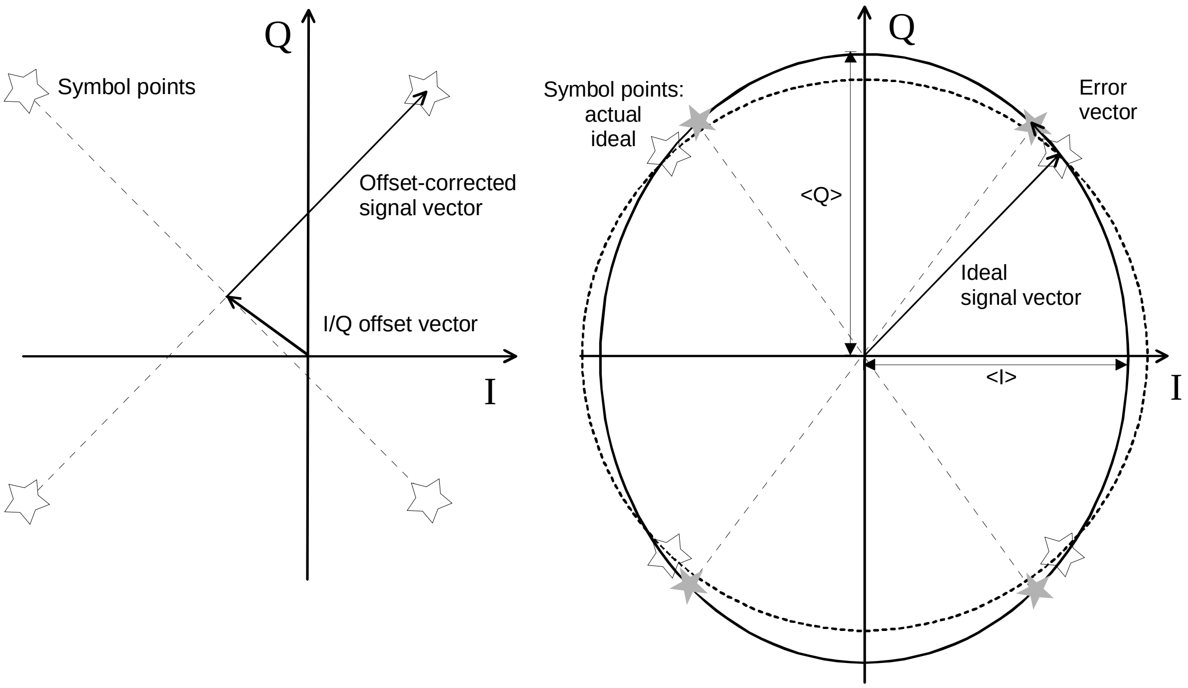


Fig. 4-8 Modulation errors in the I/Q constellation diagram

The I/Q offset in dB is the logarithmic ratio of the I/Q offset vector (i.e. the estimated DC-offset of the measured signal) to the offset-corrected signal vector:

$$\text{Origin Offset} = 20\log\frac{|\text{I/Q offset vector}|}{|\text{Offset-corrected signal vector}|}$$

The I/Q imbalance in dB is equal to the difference between the estimated I and Q amplitudes of the measured signals, which are normalized and logarithmized as follows:

$$\text{I/Q Imbalance} = 20\log\frac{|<\text{I}> - <\text{Q}>|}{|<\text{I}> + <\text{Q}>|}$$

Measurement Menu (Modulation)

The graphical measurement menu *Modulation* displays the measurement results:

- The measurement control softkey *Overview DQPSK* (which changes to *Phase Error DQPSK, Magn. Error DQPSK,* or *EVM DQPSK* if the corresponding application is selected) controls the measurement, indicates its status *(RUN* **|** *HLT* **|** *OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to the measurement control softkey define the scope of the *Modulation* measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Test Settings* on p. 4.5 ff.

The measurement menu *Modulation* can be accessed from any other measurement menu of function group *IS 136 800 Non Signalling* using the *Menus – Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

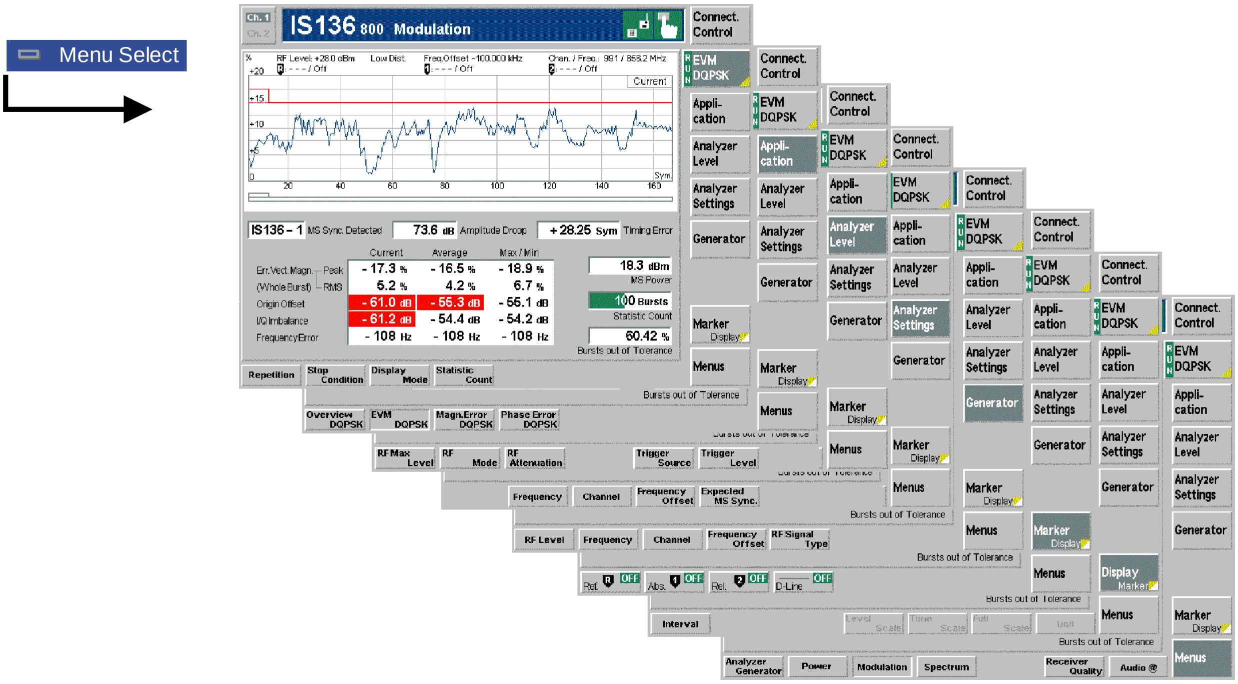


Fig. 4-9 Measurement menu Modulation – EVM DQPSK

Test Settings

The *Analyzer Level, Analyzer Settings, Generator, Marker/Display,* and *Menus* test settings are identical with those in the *Power* menu (see section *Test Settings* on p. 4.5 ff.). The following softkeys and hotkeys differ from the *Power* measurement:

EVM DQPSK

The *EVM DQPSK* measurement control softkey controls the measurement of the EVM and indicates the measurement status *(RUN | HLT | OFF)*. This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. It can be set independently for all *Modulation* applications.

The labeling of the measurement control softkey is changed upon switchover to another application. The active application generally suspends the other applications. On switchover between different applications, the selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

Remote control

```
INITiate:MODulation:EVMagnitude[:DQPSk]
ABORt:MODulation:EVMagnitude[:DQPSk]
STOP:MODulation:EVMagnitude[:DQPSk]
CONTinue:MODulation:EVMagnitude[:DQPSk]
```

Measurement configuration

Pressing the *EVM DQPSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.26 ff). Besides, the hotkeys *Repetition, Stop Condition, Display Mode,* and *Statistic Count* defining the scope of the measurement are associated to the *EVM DQPSK* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test Settings* on p. 4.5 ff.); they are identical with the parameters set in the *Control* tab of the *Modulation Configuration* menu (see page 4.26 ff).

Application

The *Application* softkey selects the measurement application.

The four applications of the *Modulation* menu correspond to four different sets of measured quantities displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup-menu (see p. 4.26 ff).

Overview DQPSK

The *Overview DQPSK* hotkey selects all scalar modulation results to be displayed.

For a list of measured quantities see explanation at the beginning of this section (p. 4.18).

Remote control

No explicit switchover command. All *Overview DQPSK* measurements are identified by the 2nd/3rd level keywords `...MODulation[:OVERview]...`

EVM DQPSK

The *EVM DQPSK* hotkey selects the magnitude of the error vector to be displayed. The error vector connects the measured signal from the mobile station and the ideal signal vector at the symbol points, see explanation at the beginning of this section (p. 4.18). The diagram shows the relative magnitude (in percent), i.e. the ratio of the magnitude of the error vector to the magnitude of the ideal signal vector.

Remote control

No explicit switchover command. All *EVM DQPSK* measurements are identified by the 2nd/3rd level keywords `...MODulation:EVMagnitude...`

Phase Error DQPSK

The *Phase Error DQPSK* hotkey selects the phase error of the modulation vector to be displayed. The phase error is the difference in phase between the measured signal from the mobile station and an ideal signal waveform at the symbol points, see explanation at the beginning of this section (p. 4.18).

Remote control

No explicit switchover command. All *Phase Error DQPSK* measurements are identified by the 2nd/3rd level keywords `...MODulation:PERRor...`

Magn. Error DQPSK

The *Magnitude Error DQPSK* hotkey selects the magnitude error of the modulation vector to be displayed. The magnitude error is the difference in magnitude between the measured signal from the mobile station and an ideal signal waveform at the symbol points, see explanation at the beginning of this section (p. 4.18). The diagram shows the relative magnitude error (in percent), i.e. the ratio of the absolute magnitude error to the magnitude of the ideal signal vector.

Remote control

No explicit switchover command. All *Magn. Error DQPSK* measurements are identified by the 2nd/3rd level keywords `...MODulation:MERRor...`

Display

The *Display* softkey provides settings referring to the time axis.

Interval

The *Interval* hotkey defines an evaluation time for peak and effective results.

1st 10 Symbols	Peak and effective errors are calculated over the first ten valid symbols (symbols no. 6 to 15) of the burst.
Whole Burst	Peak and effective errors are calculated over all valid symbols (symbols no. 6 to 162) of the burst.

The standard specifies a limit for the normalized error vector magnitude during the 1st ten symbols. The CMU allows to specify different limits for all measured quantities in both time intervals, see section *Tolerance Values (Modulation Configuration – Limits)* on page 4.27.

Remote control No explicit switchover command. The evaluation time is identified by the keywords `[:WBURst]|FTSYmbols`.

Menus

The *Menus* softkey displays the hotkey bar for switching over to the other measurement menus.

Measurement Results

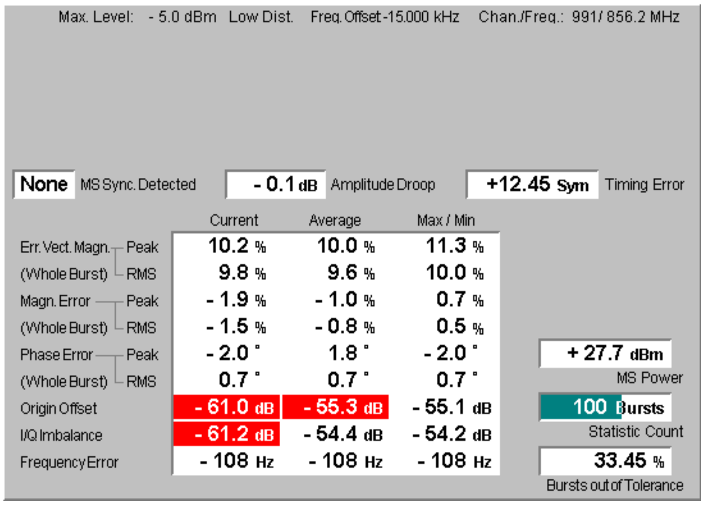
The values shown in the *Modulation* measurement menus can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (traces plotted as a function of time)

The measurement menu for the *Overview* application shows all scalar results but no trace. The measurement menus for the remaining three applications are analogous and show the phase error, the (relative) magnitude error or the (relative) error vector magnitude as a function of time and the corresponding peak and effective values. The range and unit of the y-axis is adjusted to the measured quantity.

a) Scalar Results (Overview)

The measurement menu for the application *Overview DQPSK* shows all scalar results. Most of the values are indicated in tabular form:



Parameter line

Output fields

Output table
and additional fields

Max. Level: - 5.0 dBm Low Dist. Freq. Offset -15.000 kHz Chan./Freq.: 991/ 856.2 MHz

None MS Sync. Detected

- 0.1 dB Amplitude Droop

+12.45 Sym Timing Error

		Current	Average	Max / Min
Err. Vect. Magn.	Peak	10.2 %	10.0 %	11.3 %
(Whole Burst)	RMS	9.8 %	9.6 %	10.0 %
Magn. Error	Peak	- 1.9 %	- 1.0 %	0.7 %
(Whole Burst)	RMS	- 1.5 %	- 0.8 %	0.5 %
Phase Error	Peak	- 2.0 °	1.8 °	- 2.0 °
(Whole Burst)	RMS	0.7 °	0.7 °	0.7 °
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

+ 27.7 dBm MS Power

100 Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-10 Display of results (Modulation – Overview)

Parameter line The parameter line contains the following settings:

Max. Level	Maximum expected input level as set in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.49 ff.)
Attenuation	Setting for the external attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

Remote control The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output fields In the three output field in the center of the menu, the following results are displayed:

MS Sync. Det.	Detected synchronization pattern of the current burst received from the mobile station *(IS 136 1* to *6* or *None)*, see section *Table-Oriented Version* on p. 4.49 ff.
Amplitude Droop	Difference of the signal power between the first valid symbol (symbol 6) in the current burst and the last valid symbol (symbol 162)
Timing Error	Time offset (in symbol periods) between the external trigger timing and the measured timing (symbol 0) of the current burst. This result is available with *External* trigger setting only; see section *Table-Oriented Version* on p. 4.49 ff.

Output table The scalar values in the output table are explained at the beginning of this section on page 4.18. They are first calculated for the current burst. From the current results the average over a statistics cycle (*Average*) and the extreme value over all bursts measured during the ongoing measurement *(Max/Min)* is calculated. Peak and RMS[2] values are either taken over the whole useful part of the burst or over the first ten valid symbols, depending on the *Interval* setting (see p. 4.21).

Error Vect. Magn.	Peak and effective (RMS averaged) value of the error vector magnitude
Magn. Error	Peak and RMS magnitude error
Phase Error	Peak and RMS phase error
Origin Offset	Origin offset in the I/Q constellation diagram
I/Q Imbalance	Amplitude difference between the I and Q components of the measured signal
Frequency Error	Difference between measured and expected signal frequency

Additional fields Three output fields to the right of output table indicate the following results and settings:

MS Power	Average power of current burst (irrespective of the display mode selected and of the current trace). This result is obtained with a matched filter, i.e. a root-raised cosine filer specified in the standard, and therefore differs from the *MS Power* in the *Power* measurement.
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle.
Bursts out of Tolerance	Percentage of bursts that exceed the tolerance limits

---

[2] To keep the results comparable, RMS averaging is chosen for both positive quantities and quantities with alternating sign.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see p. 4.27.

Remote control

The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

```
READ[:SCALar]:MODulation[:OVERview][:DQPSk]
              [:RESult][:WBURst]?
CALCulate[:SCALar]:MODulation[:OVERview][:DQPSk]
              [:RESult]MATCHing:LIMit[:WBURst]?
```

b) Test Diagrams (EVM, Phase Error, Magn. Error)

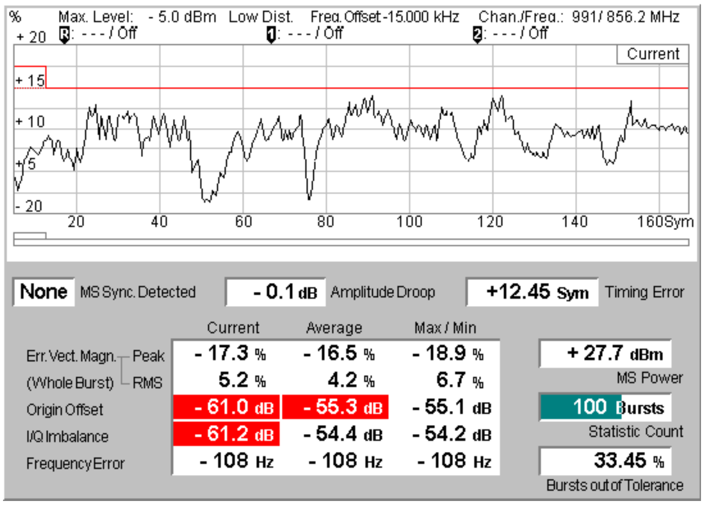
The graphical measurement menus for the three applications *EVM DQPSK*, *Magn. Error DQPSK*, and *Phase Error DQPSK* are analogous. The results are indicated in a parameter line, the test diagram and a tabular overview below:

Parameter line

Test diagram

Output fields

and table



% Max. Level: - 5.0 dBm Low Dist. Freq.Offset -15.000 kHz Chan./Freq.: 991/ 856.2 MHz

R: - - - / Off 1: - - - / Off 2: - - - / Off

None MS Sync. Detected

- 0.1 dB Amplitude Droop

+12.45 Sym Timing Error

		Current	Average	Max / Min
Err. Vect. Magn.	Peak	- 17.3 %	- 16.5 %	- 18.9 %
(Whole Burst)	RMS	5.2 %	4.2 %	6.7 %
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

+ 27.7 dBm MS Power

100 Bursts Statistic Count

33.45 % Bursts out of Tolerance

Fig. 4-11 Display of results (Modulation – EVM / Phase Error / Magn. Error)

Settings/ Scalar results

Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

Parameter line

The first parameter line contains the following settings:

Max. Level	Maximum input level as set in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.49 ff.)
Attenuation	Setting for the external attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

Remote control

The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output fields

Below the diagram, the following results are displayed:

MS Sync. Det.	Detected synchronization pattern of the mobile station *(IS 136 1* to *6* or *None)*, see section *Table-Oriented Version* on p. 4.49 ff.
Amplitude Droop	Difference of the signal power between the first valid symbol

	(symbol 6) in the active slot and the last valid symbol (symbol 162)
Timing Error	Time offset (in symbol periods) between the external trigger timing and the measured timing (symbol 0) of the current burst. This result is available with *External* trigger setting only; see section *Table-Oriented Version* on p. 4.49 ff.

Output table

The output table contains the following scalar values that:

MS Power	Average power of current burst (irrespective of the display mode selected and of the current trace)
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle
Bursts out of Tolerance	Percentage of bursts that exceed the tolerance limits

The following scalar values are calculated for the current burst first. From the current results the average over a statistics cycle (*Average*) and the extreme value over all bursts measured so far *(Max/Min)* is calculated:

Phase Error (Peak)	Maximum phase error
Phase Error (RMS)	Effective phase error (RMS-averaged over the burst)
Origin Offset	Origin offset in the I/Q constellation diagram
I/Q Imbalance	Amplitude difference between the I and Q components of the measured signal
Frequency Error	Difference between measured and expected signal frequency

Peak and RMS values refer to the current application *(Phase Error, Magnitude Error* or *Error Vector Magnitude)*. For an explanation of all quantities measured refer to the beginning of this section on page 4.18.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation Configuration* menu, see p. 4.27.

Remote control

```
READ[:SCALar]:MODulation:<Applic>[:DQPSk][:RESult][:WBURst]?
```

etc.

```
CALCulate[:SCALar]:MODulation:<Applic>[:DQPSk][:RESult]
  :MATChing:LIMit[:WBURst]?
```

Traces (arrays)

The continuous trace in the test diagram shows the measured quantity as a function of time (in symbols). The display mode *(Current, Max./Min., Average)* for the trace is indicated in the upper right corner of the diagram.

The trace comprises the whole useful part of the normal burst (symbol 6 to 162). The y-axis range is fixed for any of the three measured quantities (applications):

–20 deg to +20 deg	for the phase error
–20 % to +20 %	for the magnitude error
0 % to +20 %	for the error vector magnitude

The two colored, horizontal lines in the test diagram mark the selected tolerance range of the phase error.

Limit Check

A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see p. 4.27.

Remote control

```
READ:ARRay:MODulation:<Applic>[:DQPSk]:CURRent[:RESult]?
```

etc.

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration* contains two tabs to determine the parameters of the *Modulation* measurement including the error tolerances.

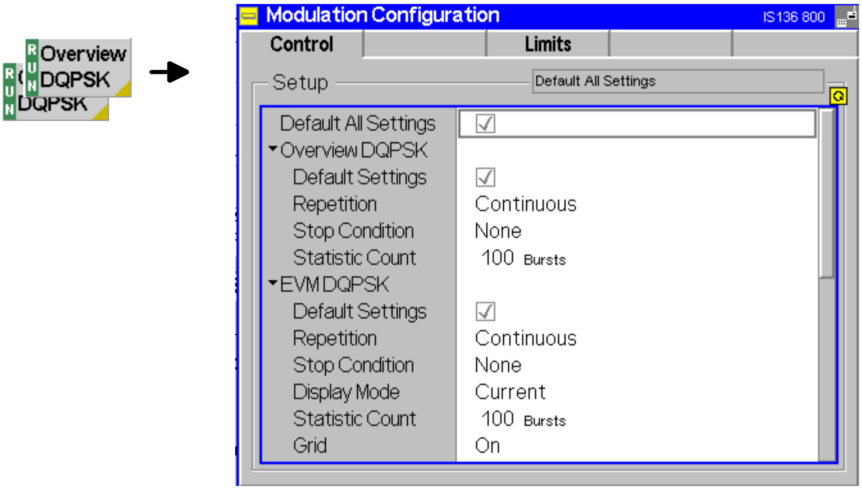
The popup menu *Modulation Configuration* is activated by pressing the measurement control softkey in the top right of the graphical measurement menu *Modulation* (this softkey reads *Overview, Phase Error, Magnitude Error* or *Err. Vector Magnitude*, depending on the selected application) twice. By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Modulation Configuration – Control)

The *Control* tab controls the *Modulation* measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The measurement curve displayed *(Display Mode*, not for application *Overview DQPSK)*
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*,

Besides, it influences the measurement diagrams by adding a *Grid* or not.



Default All Settings	☑
Overview DQPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	100 Bursts
EVM DQPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Grid	On

Fig. 4-12 Modulation Configuration – Control

The settings can be defined separately for the different applications of the *Modulation* measurement group. Most functions comply with those of the menu *Control* in the menu group *Power* (see page 4.13). In the remote-control commands, the keywords `POWer:<Applic>` are to be replaced by `MODulation:<Applic>`. The following parameters are specific to the *Modulation* measurement:

Default Settings	The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control

```
CONFigure:MODulation:XPERror[:GMSK]:CONTrol:DEFault ON | OFF
etc.
```

Display Mode	The *Display Mode* field defines which of the measured and calculated measurement curves is displayed. The measurement curves differ in the way the measured quantity at a fixed point in time *t* is calculated if the measurement extends over several bursts

Current	Measured value for the current burst
Max./Min.	Extreme value over a number of bursts
Average	Average value over a number of bursts

The number of bursts for the calculation of the statistic values *Minimum/Maximum* and *Average* – and thus the result – depends on the repetition mode set (see section *Measurement Control (Power Configuration – Control)* on page 4.13). In detail, this implies:

Single shot	Display of minimum, maximum and average value from the performed statistics cycle
Continuous	Display of minimum and maximum from all bursts already measured. The **average value**, however, is calculated according to the averaging prescription in Chapter 3, section *General Settings*.

In a power measurement absolute values are determined, whereas the measured phase error can have both positive or negative sign. To assess the phase error only the magnitude (and not the sign) is of importance so that extreme values are output in the menu *Modulation* instead of maxima and minima.

Remote control

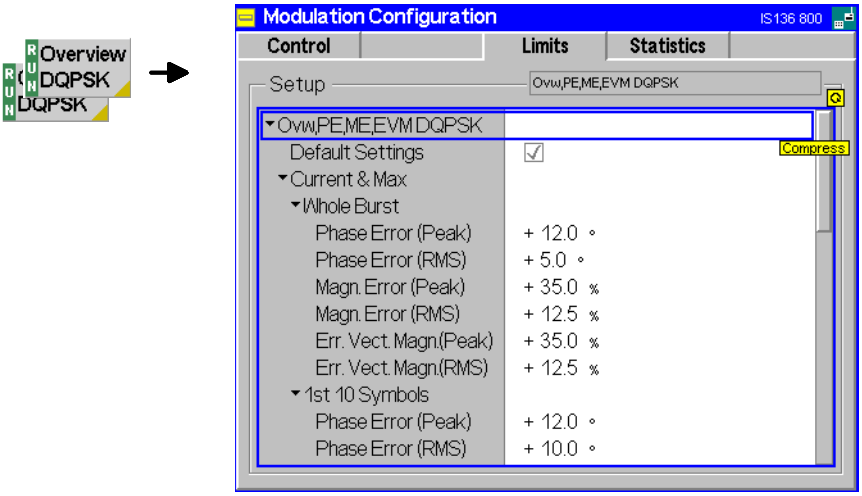
No display mode set explicitly, the three traces are accessible via

```
FETCh:ARRAy:MODulation:<Applic>[:DQPSk]:CURRent[:RESult]?
FETCh:ARRAy:MODulation:<Applic>[:DQPSk]:MMAX[:RESult]?
FETCh:ARRAy:MODulation:<Applic>[:DQPSk]:AVERage[:RESult]? etc.
```

Scalar output lists contain the results for all three display modes.

Tolerance Values (Modulation Configuration – Limits)

The *Limits* tab defines upper and lower error limits for the results obtained in the *Modulation* measurement. All relevant quantities are explained at the beginning of section *Modulation Measurements* on page 4.18.



Setup: Ovw,PE,ME,EVM DQPSK

- Ovw,PE,ME,EVM DQPSK
  - Default Settings ☑
  - Current & Max
    - Whole Burst
      - Phase Error (Peak) + 12.0 °
      - Phase Error (RMS) + 5.0 °
      - Magn. Error (Peak) + 35.0 %
      - Magn. Error (RMS) + 12.5 %
      - Err. Vect. Magn.(Peak) + 35.0 %
      - Err. Vect. Magn.(RMS) + 12.5 %
    - 1st 10 Symbols
      - Phase Error (Peak) + 12.0 °
      - Phase Error (RMS) + 10.0 °

Fig. 4-13 Modulation Configuration – Limits

Ovw., EVM, ME, PE, DQPSK

The *Ovw., EVM, ME, PE, DQPSK* table section defines all limits for π/4 DQPSK-modulated signals. The limits are set independently for the display modes *Current* and *Max./Min.* on one hand, *Average* on the other hand; see section *Measurement Control (Modulation Configuration – Control)* on page 4.26 ff. Furthermore, the peak and RMS values of the arrays *Error Vector Magnitude*, *Magnitude Error* and *Phase Error* can be assessed in a time interval comprising the first 10 valid symbols (symbols 6 to 15) or over the whole useful part of the burst (symbols 6 to 162).

Default Settings	Overwrites all *DQPSK settings* with their default values (see command description in Chapter 6)
Error Vector Magn.	Upper limits for the (peak or RMS-averaged[3]) error vector magnitude (EVM). Both entries are positive.
Magnitude Error	Upper limits for the absolute value of the (peak or RMS) magnitude error. Both entries are positive; the limits for the peak magnitude error define a tolerance mask symmetric to the origin.
Phase Error	Upper limits for the absolute value of the (peak or RMS) phase error. Both entries are positive; the limits for the peak phase error define a tolerance mask symmetric to the origin.
Origin Offset	Upper limit for the origin offset in the I/Q constellation diagram.
I/Q Imbalance	Upper limit for the amplitude difference between the in-phase and quadrature components of the signal.
Frequency Error	Upper limit for the difference between the measured and the expected frequency of the signal.

For an explanation of all measured quantities refer to the beginning of this section on page 4.18.

Remote control

```
CONFigure:MODulation:OEMP[:DQPSk]:CMMax:LIMit[:WBURst]...
CONFigure:MODulation:OEMP[:DQPSk]:CMMax:LIMit:FTSYmbols...
CONFigure:MODulation:OEMP[:DQPSk]:AVERage:LIMit[:WBURst]...
CONFigure:MODulation:OEMP[:DQPSk]:AVERage:LIMit:FTSYmbols...
```

---

[3] To keep the results comparable, RMS averaging is chosen for both positive quantities and quantities with alternating sign.

Adjacent Channel Power Measurements

The menu group *Spectrum* comprises the functions for measurement of the adjacent channel power (ACP) which can be measured and plotted either in the frequency or in the time domain. The measurement results are displayed in the graphical measurement menu *Spectrum,* the popup menu *Spectrum Configuration* is used for configuration of the measurements.

The adjacent channel measurement serves to measure the amount of energy that spills outside the designated radio channel. According to the prescription of the standard, the measurement is made at ±30 kHz from the nominal frequency of the designated channel (adjacent channels), at ±60 kHz (1st alternate channels), and at ±90 kHz (2nd alternate channels, see Fig. 4-14). The CMU uses a passband filter (described in the standard) to eliminate interference from unwanted sources.

There are two different types radiation to be covered by the ACP measurement:

- The out-of-band power originating from the modulation and noise can be assessed by the average off-carrier power. The average power measurement is made using 50% of the symbol periods in one time slot of the active channel.
- The out-of-band power originating from the switching transients (caused by the ramping-on and ramping-off of the transmitter) can be assessed by the measured peak power values.

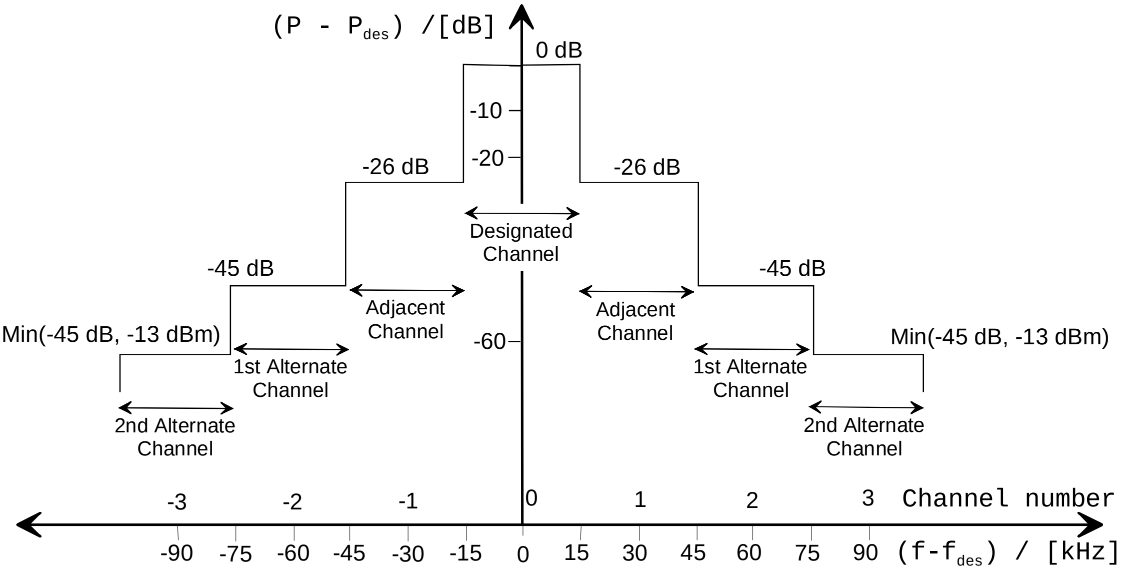


Fig. 4-14 IS 136 RF spectral mask centered on the frequency of the designated channel f_{des}

The spectral mask shown in Fig. 4-14 applies to both the peak power and average power measurement. A typical example of a waveform due to a burst as seen in a 60 kHz offset from the carrier (1st alternate channel) is given below (Fig. 4-15):

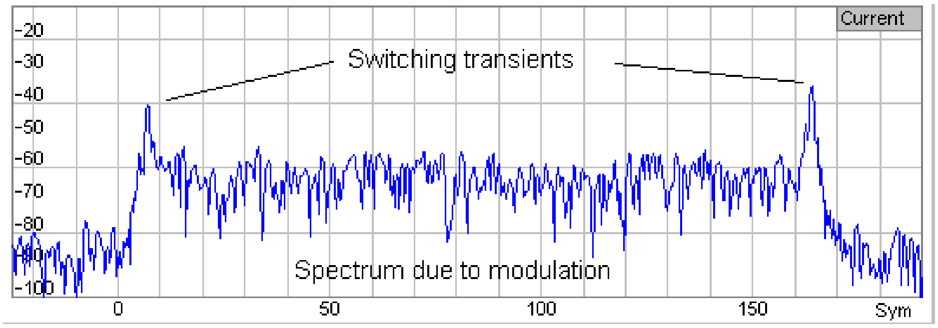


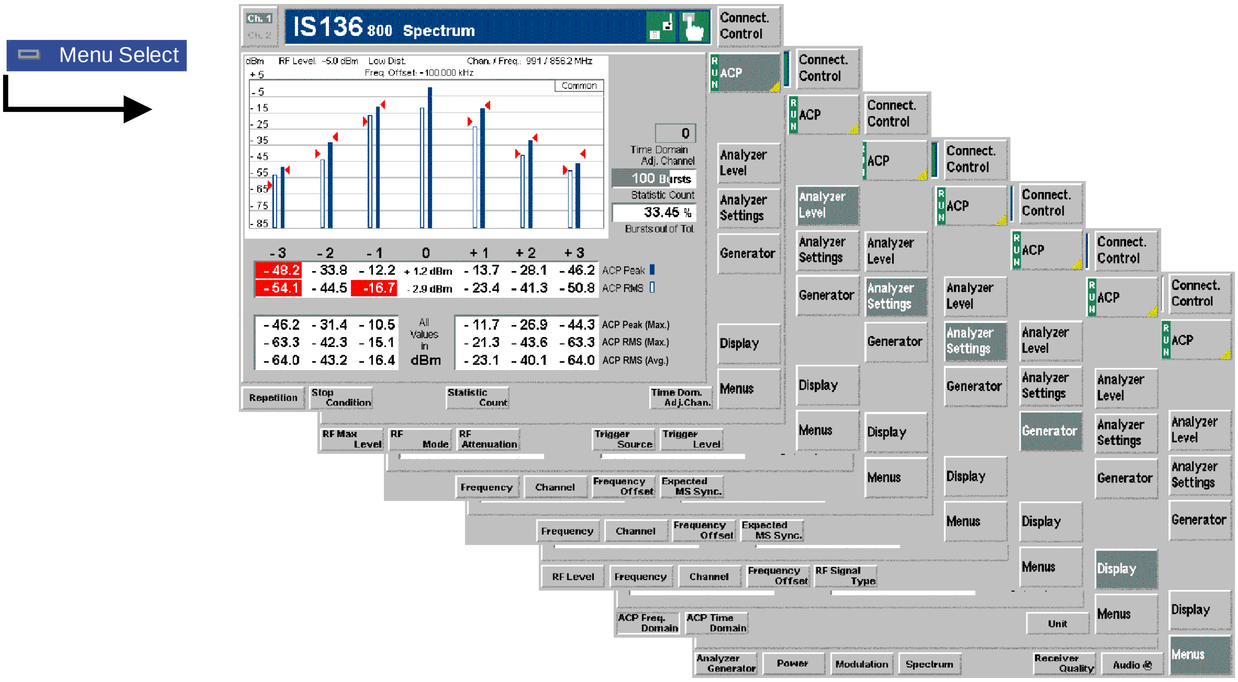
Fig. 4-15 Spectrum due to modulation and switching transients in time domain representation

Measurement Menu (Spectrum)

The graphical measurement menu *Spectrum* displays the results of the adjacent channel power measurement.

- The measurement control softkey *ACP Freq. Domain* (which changes to *ACP Time Domain* if that application is selected) controls the measurement, indicates its status *(RUN* | *HLT* | *OFF)* and opens the configuration menu *Spectrum Configuration.* The hotkeys associated to the measurement control softkey define the scope of the *Spectrum* measurement.
- The remaining softkeys to the right of the test diagram are combined with various hotkeys. If a softkey is selected and an associated hotkey pressed, a popup window will appear, which indicates a setting or enables an entry. The entry of values is described in section *Measurement Menu (Power)* on page 4.4.

The measurement menu *Spectrum* can be accessed from any other measurement menu of function group *IS 136 800 Non Signalling* using the *Menus – Spectrum* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).



RF Level: -5.0 dBm Low Dist.
Chan. / Freq.: 991 / 856.2 MHz
Freq. Offset: -100.000 kHz

0
Time Domain Adj. Channel
100 Bursts
Statistic Count
33.45 %
Bursts out of Tol.

- 3	- 2	- 1	0	+ 1	+ 2	+ 3	
- 48.2	- 33.8	- 12.2	+ 1.2 dBm	- 13.7	- 28.1	- 46.2	ACP Peak
- 54.1	- 44.5	-16.7	- 2.9 dBm	- 23.4	- 41.3	- 50.8	ACP RMS
- 46.2	- 31.4	- 10.5	All Values in dBm	- 11.7	- 26.9	- 44.3	ACP Peak (Max.)
- 63.3	- 42.3	- 15.1		- 21.3	- 43.6	- 63.3	ACP RMS (Max.)
- 64.0	- 43.2	- 16.4		- 23.1	- 40.1	- 64.0	ACP RMS (Avg.)

Fig. 4-16 Measurement menu Spectrum

Test Settings

The *Analyzer Level, Analyzer Settings, Generator, Marker* (for time-domain representation), and *Menu* settings are identical with those in menu *Power* (see section *Test Settings* on page 4.5, no display mode can be set for frequency-domain representation). The following softkeys and hotkeys differ from the *Power* measurement:

ACP

The *ACP* softkey controls the measurement and indicates its status *(RUN | HLT | OFF)*. This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. It can be set independently for all *Spectrum* applications.

The active application generally suspends the other applications. On switchover between different applications, the selected measurement status of each application is stored and will be put into effect as soon as the application is activated. In particular, an application in the status *RUN* is restarted each time it is activated.

Remote control

```
INITiate:SPECtrum:MODulation[:GMSK]
ABORt:SPECtrum:MODulation[:GMSK]
STOP:SPECtrum:MODulation[:GMSK]
CONTinue:SPECtrum:MODulation[:GMSK]
FETCh:SPECtrum:MODulation[:GMSK]:STATus?
```

Measurement configuration

Pressing the *ACP* softkey twice opens the popup menu *Spectrum Configuration* (see page 4.26 ff). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement are associated to the *ACP* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test settings* on page 4.5); they are identical with the parameters set in the *Control* tab of the *Spectrum Configuration* menu (see page 4.26 ff). The following hotkey is specific to the *Spectrum* measurement:

Time Dom. Adj. Chan

The *Time Domain Adj. Chan.* hotkey defines the channel for the time-domain ACP measurement. Numbers –3 to +3 may be selected, corresponding to the designated channel, the adjacent channels, and the first and second alternate channels (see Fig. 4-14).

Remote control

```
CONFigure:SPECtrum[:ACPower]:CONTrol:ACHannel <Channel>
```

Appli-cation

The Application softkey selects the adjacent channel power representation. The two alternative diagrams (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for both applications, however, are listed in a common popup-menu (see p. 4.26 ff).

ACP Freq. Domain

The *ACP Freq. Domain* hotkey selects the frequency-domain measurement where the ACP is displayed as a function of the frequency. In this mode, the peak and average power of the traffic channel, the adjacent channel and the first and second alternate channel (p. 4.18) are plotted in a single bar graph.

Remote control
No explicit switchover command. All *ACP Freq. Domain* measurements are identified by the 2nd/3rd/4th level keywords `...SPECtrum[:ACPower][:FDOMain]...`

ACP Time Domain

The *ACP Time Domain* hotkey selects the time-domain measurement where the ACP of a particular adjacent or alternate channel is displayed as a function of time.

Remote control
No explicit switchover command. All *ACP Time Domain* measurements are identified by the 2nd/3rd/4th level keywords `...SPECtrum[:ACPower]:TDOMain...`

Display Marker

The *Display/Marker* softkey re-scales the graphical display. It is selected by pressing the *Marker/Display* softkey twice. If pressed once again, the selected *Display/Marker* softkey changes back to the *Marker/Display* softkey (for time-domain representation only).

Level Scale

The *Level Scale* hotkey shifts the reference level in the ACP time domain diagram (0-dB line) by a definite value. The total y-axis display range of the measurement diagram is not affected; the entire diagram is simply shifted in vertical direction.

This hotkey is disabled (grayed) in the *ACP Freq. Domain* application.

Remote control
No command, screen configuration only.

Unit

The *Unit* hotkey sets the display unit for scalar results. It is possible to select absolute (dBm) or relative units (dBc). The units refer to the scalar measurement results displayed in the two tables below the diagram; the measurement diagram itself is not affected.

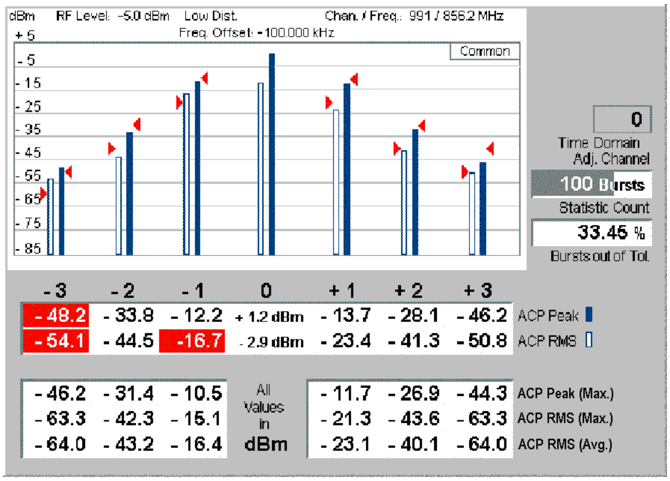
Remote control
No command, screen configuration only.

Measurement Results

The *Spectrum* menu group contains two separate measurement menus corresponding to the two applications *ACP Freq. Domain* and *ACP Time Domain*. These menus show different test diagrams and measured quantities.

a) ACP Frequency Domain Measurement

In the *ACP Freq. Domain* measurement, the (peak and effective) burst power in the designated channel, the adjacent channels, 1st and 2nd alternate channels is displayed. These results and the corresponding measurement settings are indicated in two parameter lines, the test diagram (bar graph) and a tabular overview below:



Parameter lines

Bar graph and

Output fields

Output tables

RF Level: -5.0 dBm Low Dist. Chan. / Freq.: 991 / 856.2 MHz
Freq. Offset: -100.000 kHz

0
Time Domain Adj. Channel

100 Bursts
Statistic Count

33.45 %
Bursts out of Tol.

- 3	- 2	- 1	0	+ 1	+ 2	+ 3	
- 48.2	- 33.8	- 12.2	+ 1.2 dBm	- 13.7	- 28.1	- 46.2	ACP Peak
- 54.1	- 44.5	-16.7	- 2.9 dBm	- 23.4	- 41.3	- 50.8	ACP RMS

- 46.2	- 31.4	- 10.5	All Values in dBm	- 11.7	- 26.9	- 44.3	ACP Peak (Max.)
- 63.3	- 42.3	- 15.1		- 21.3	- 43.6	- 63.3	ACP RMS (Max.)
- 64.0	- 43.2	- 16.4		- 23.1	- 40.1	- 64.0	ACP RMS (Avg.)

Fig. 4-17 Display of results (ACP frequency domain)

Parameter lines The first parameter line contains the following settings:

Max. Level	Maximum input level as set in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.49 ff.)
Attenuation	Setting for the external attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Chan./Freq.	RF channel and associated frequency

Output fields To the right of the diagram, the following settings are displayed:

Time Domain Adj. Channel	Channel selected for application *ACP Time Domain* (see Fig. 4-14). This setting has no influence on the frequency-domain diagram.
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle
Bursts out of Tolerance	Percentage of bursts that exceed the tolerance limits

Remote control The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Bar graph The bar graph shows the current *ACP Peak* (solid bars, switching transients) and *ACP RMS* values (contour bars, modulation contributions) in channels no. –3 to +3 (see output table below). The red triangles indicate the upper limits for both quantities as set in the *Spectrum Configuration – Limits* menu (see p. 4.38).

Output table

The upper output table contains the following scalar values:

ACP Peak/RMS	Maximum/effective power of current burst (irrespective of the display mode selected and of the current bar graph) in channels no. –3 to +3. The carrier power is always displayed as an absolute value (in dBm). The adjacent channel results can be expressed either in absolute (dBm) or in relative units (dBc); see *Display – Unit* hotkey. Relative *ACP Peak (ACP RMS)* powers in the adjacent channels are referenced to the current peak (RMS) power in the designated channel (channel 0).

The *ACP Peak* and *ACP RMS* values are calculated and stored for all bursts measured. From these values the average over a statistics cycle *(RMS)* and the peak value over all bursts measured so far *(Peak)* is calculated:

ACP Peak (Max.)	Maximum of all *ACP Peak* values in the measurement (=maximum power ever measured)
ACP RMS (Max.)	Maximum of all *ACP RMS* values in the measurement
ACP RMS (Avg.)	Average of all *ACP RMS* values referenced to the last statistics cycle

These statistical results can be expressed either in absolute (dBm) or in relative units (dBc); see *Display – Unit* hotkey. The relative values are calculated in analogy to the relative values in the upper output table:

- *ACP Peak (Max.)* is referenced to the current peak power in channel 0.
- *ACP RMS (Max.)* and *ACP RMS (Avg.)* is referenced to the current RMS power in channel 0.

Limit Check

A red output field and an arrow pointing upwards/downwards indicates that the measurement result exceeds the upper/lower limit set in the *Limits* tab of the *Spectrum* configuration menu, see p. 4.38.

Remote control

```
READ[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?
FETCh[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?
SAMPle[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?
CALCulate[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]
                               :MATChing:LIMit?
```

b) ACP Time Domain Measurement

In the ACP Frequency domain measurement, the burst power in a particular (adjacent) channel is plotted as a function of time. The values shown in the *Spectrum* measurement menu can be divided into three groups:

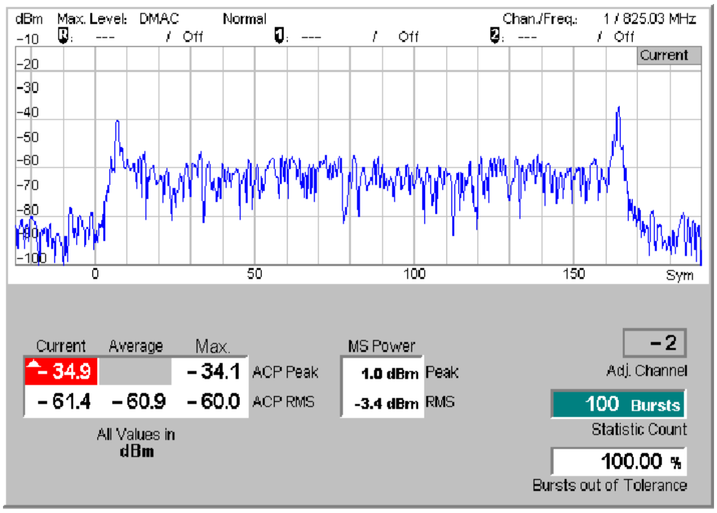
- Setting values
- Scalar measurement results (single values)
- Arrays (trace representing the burst power as a function of time)

They are indicated in two parameter lines, the test diagram and a tabular overview below.

Parameter lines

Test diagram

Output fields


dBm Max. Level: DMAC Normal Chan./Freq.: 1 / 825.03 MHz
-10 R: --- / Off 1: --- / Off 2: --- / Off

	Current	Average	Max.		MS Power	
	- 34.9		- 34.1	ACP Peak	1.0 dBm	Peak
	- 61.4	- 60.9	- 60.0	ACP RMS	-3.4 dBm	RMS

All Values in dBm

- 2 Adj. Channel
100 Bursts Statistic Count
100.00 % Bursts out of Tolerance

Fig. 4-18 Display of results (ACP time domain)

Settings/ Results

Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

1st Parameter line

The first parameter line contains the following settings:

Max. Level	Maximum input level as set in the *Analyzer* tab of the *Connection Control* menu (see section *Table-Oriented Version* on p. 4.49 ff.)
Attenuation	Setting for the external attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal channel frequency
Chan./Freq.	RF channel and associated frequency

2nd parameter line

The second parameter line contains the following marker values:

R	Level and time of reference marker
1	Level and time of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Level and time of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Output fields

Below the diagram, the following settings are displayed:

Adj. Channel	Current adjacent channel number according to Fig. 4-14.
Statistic Count	Length of statistics cycle in bursts. The colored bar indicates the relative measurement progress in the statistics cycle.
Bursts out of Tolerance	Percentage of bursts measured that exceed the tolerance limits.

Remote control

The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output table

The maximum and effective burst power (*ACP Peak* and *ACP RMS)* is calculated and stored for all bursts measured. The output table shows the results for the current burst, the average over a statistics cycle (*Average*) and the peak value over all bursts measured so far *(Peak)*:

Current	Maximum and average burst power (*ACP Peak* and *ACP RMS)* of the current burst,
Average	Average of the *ACP RMS* values referenced to the last statistics

	cycle (see description of averaging procedures in chapter 3, section *General Settings)*
Max.	Maximum of all *ACP Peak* and *ACP RMS* values in the current measurement.

These statistical results can be expressed in absolute (dBm) or relative units (dBc), see *Display – Unit* hotkey. The relative values are calculated in analogy to the relative values in frequency-domain representation:

- All *ACP Peak* values are referenced to the current peak power in channel 0.
- All *ACP RMS* values are referenced to the current RMS power in channel 0.

The current peak and RMS power in the designated channel (channel 0) is indicated in dBm (output table *MS Power*).

Limit Check A limit is specified for the peak and effective values of the adjacent channel powers. The limit check is thus included in the limit check for the *ACP Time Domain* measurement.

Remote control `READ:ARRay:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?` etc.

Measurement Configurations (Spectrum)

The popup menu *Spectrum Configuration* contains two tabs to determine the parameters of the ACP power measurement including the error tolerances.

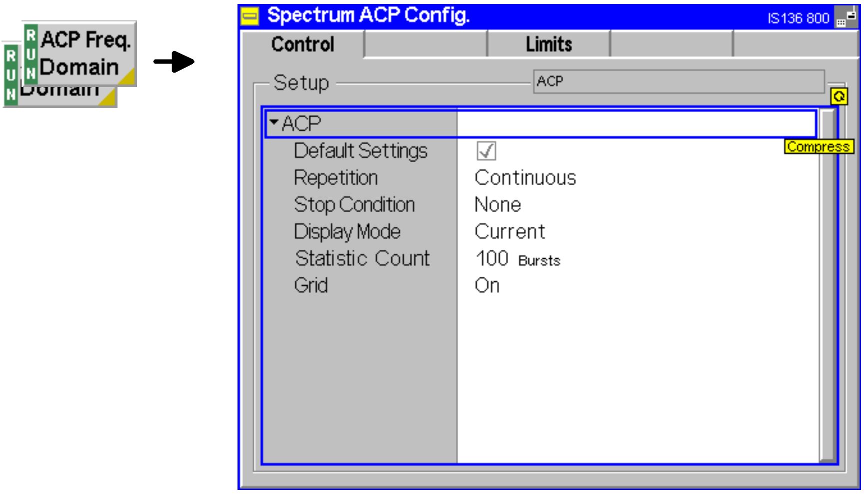
The popup menu *Spectrum Configuration* is called up by pressing the measurement control softkey in the top right of the graphical measurement menu *Spectrum* twice (this softkey reads *ACP Freq. Domain* or *ACP Time Domain*, depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Spectrum Configuration – Control)

The *Control* tab controls the ACP measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The measurement curve displayed *(Display Mode)*
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*

Besides, it influences the measurement diagram by adding a *Grid* or not.



Setup: ACP

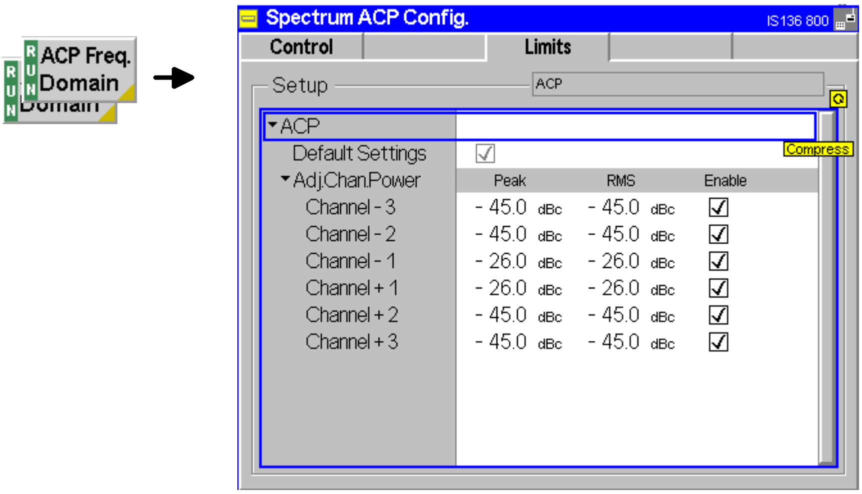
ACP
Default Settings ☑
Repetition Continuous
Stop Condition None
Display Mode Current
Statistic Count 100 Bursts
Grid On

Fig. 4-19 Spectrum Configuration – Control

All settings comply with those of the menu *Control* in the menu group *Power* (see page 4.13). In the remote-control commands, the keywords `POWer:<Applic>` are to be replaced by `SPECtrum:<Applic>`.

Tolerance Values (Spectrum Configuration – Limits)

The tab *Limits* defines upper limits for the maximum and effective power in the adjacent channels and in the first and second alternate channels (–3 to –1, 1 to 3, see Fig. 4-14).



ACP

Default Settings ☑

Adj.Chan.Power

	Peak		RMS		Enable
Channel - 3	- 45.0	dBc	- 45.0	dBc	☑
Channel - 2	- 45.0	dBc	- 45.0	dBc	☑
Channel - 1	- 26.0	dBc	- 26.0	dBc	☑
Channel + 1	- 26.0	dBc	- 26.0	dBc	☑
Channel + 2	- 45.0	dBc	- 45.0	dBc	☑
Channel + 3	- 45.0	dBc	- 45.0	dBc	☑

Fig. 4-20 Spectrum Configuration – Limits

Default Settings The *Default Settings* switch applies default power limits to all channels. The default values are quoted in the command description in chapter 6 of this manual.

Remote control `CONFigure:SPECtrum[:ACPower]:LIMit:DEFault ON | OFF`

Adj. Chan. Power The *Adj. Chan. Power* table section defines upper limits for the peak and RMS channel power:

Enable	Switches the limit check in the corresponding channel on and off
Peak	Upper limit for the maximum channel power
RMS	Upper limit for the effective channel power

Remote control

```
CONFigure:SPECtrum[:ACPower]:LIMit:CHN<nr> ON | OFF
CONFigure:SPECtrum[:ACPower]:LIMit:CHN<nr>
                              <LevPeak>, <LevRMS>, <Enable>
CONFigure:SPECtrum[:ACPower]:LIMit:CHP<nr> ON | OFF
CONFigure:SPECtrum[:ACPower]:LIMit:CHP<nr>
                              <LevPeak>, <LevRMS>, <Enable>
```

Receiver Quality Measurements

The menu group *Receiver Quality* measures parameters that describe the sensitivity of the mobile station receiver, in particular at low RF power levels.

The popup menu *Receiver Quality Configuration* is used for configuration of the measurements; the measurement results are indicated in the main menu *Receiver Quality*.

Note: *The evaluation of the receiver quality is based on the bit by bit comparison of the signal transmitted by the CMU with the signal received, decoded, and returned by the mobile station.*

Therefore, in Non Signalling *mode, the mobile phone must be manually set to the loop back mode where it returns the signal received from the CMU unchanged. If this is not done, the tests will measure large error rates.*

In addition, the RF generator must be set to generate a BER Test Signal, *see description of softkey* RF Signal Type *on page* 4.54*.*

Measured quantities The bit error rate *(BER)* is the ratio of bit errors to the total number of transferred bits in percent:

BER = bit errors / total number of bits * 100%
= bit errors / (bits per frame * frames transmitted)* 100%

The CMU evaluates "raw" data bits with no correction (i.e., before channel decoding). The basic evaluation period in the *Receiver Quality* measurement is the TDMA *frame* with a length of 40 ms and a data content of 520 bits (for a full-rate speech channel occupying 2 timeslots).

The *Receiver Quality* measurement is always performed in *Single Shot* mode and extends over a definite number of frames.

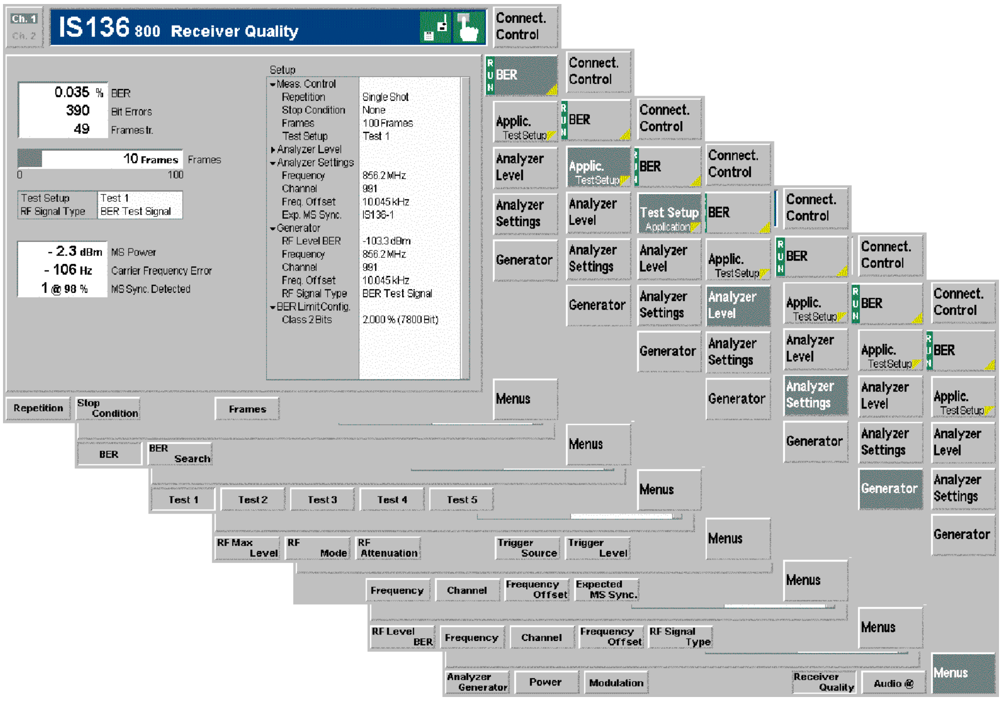
Measurement Menu (Receiver Quality)

The *Receiver Quality* menu shows the results and the most important parameters of the bit error rate test.

- The measurement control softkey *BER* controls the *Receiver Quality* measurement, indicates its status *(RUN* | *HLT* | *OFF)*, and (if pressed twice) opens the *Receiver Quality Configuration* menu. The hotkeys associated to the measurement control softkey define the scope of the measurement.
- The remaining softkeys on the right softkey bar are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Test Settings* on p. 4.5 ff.
- The measurement results and a progress bar are shown in the upper left part of the *Receiver Quality* menu.
- An additional table indicates the mobile transmitter characteristics.
- The test settings are displayed in a table in the lower part of the *Receiver Quality* menu.

The measurement menu *Receiver Quality* can be accessed from any other measurement menu of function group *IS 136 800 Non Signalling* using the *Menus – Receiver Quality* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

Menu Select



0.035 % BER
390 Bit Errors
49 Frames tr.

10 Frames Frames
0 100

Test Setup: Test 1
RF Signal Type: BER Test Signal

- 2.3 dBm MS Power
- 106 Hz Carrier Frequency Error
1 @ 98 % MS Sync. Detected

Setup
- Meas. Control
  - Repetition: Single Shot
  - Stop Condition: None
  - Frames: 100 Frames
  - Test Setup: Test 1
- Analyzer Level
- Analyzer Settings
  - Frequency: 856.2 MHz
  - Channel: 991
  - Freq. Offset: 10.045 kHz
  - Exp. MS Sync.: IS136-1
- Generator
  - RF Level BER: -103.3 dBm
  - Frequency: 856.2 MHz
  - Channel: 991
  - Freq. Offset: 10.045 kHz
  - RF Signal Type: BER Test Signal
- BER Limit Config.
  - Class 2 Bits: 2.000 % (7800 Bit)

Fig. 4-21 Main menu Receiver Quality

Test Settings

The *Analyzer Level, Analyzer Settings,* and *Menu* settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.5)*.* The following softkeys and hotkeys differ from the *Power* measurement:

BER

The *BER* softkey controls the receiver quality measurement in the BER application and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key.

Remote control
```
INITiate:RXQuality:BER
ABORt:RXQuality:BER
STOP:RXQuality:BER
CONTinue:RXQuality:BER
```

Measurement configuration

Pressing the *BER* softkey twice opens the popup menu *Receiver Quality Configuration* (see section *Measurement Configurations (Receiver Quality Configuration)* on page 4.43 ff.). Besides, the following hotkeys defining the scope of the measurement are associated to the *BER* softkey:

Repetition

The hotkey *Repetition* determines the repetition mode of the measurement *(Single Shot* or *Continuous* measurement). The difference in the *Receiver Quality* measurement compared to the transmitter tests is that the basic evaluation period is a speech frame instead of a single burst.

Remote control
```
CONFigure:RXQuality:BER:CONTrol:TSETup:REPetition
                                     <StopCondition>,<Stepmode>
```

Stop Condition

The *Stop Condition* hotkey sets a stop condition for the measurement *(None* or *1st Limit Exceeded* or *All Limits Exceeded;* see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.43)

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol:REPetition
                                  <StopCondition>,<Stepmode>
```

Frames

The hotkey *Frames* determines the number of frames to be sent in a *BER* measurement.

Remote control

```
CONFigure:RXQuality:BER<nr>:CONTrol  <Mode>,<FramesToSend>
```

Test Setup Application

The *Test Setup/Application* softkey selects the *test setup*. If pressed once again, the selected *Test Setup/Application* softkey changes to the *Application/Test Setup* softkey, see below.

Test 1

The *Test 1* to *Test 5* hotkeys select one of five test setups. Test setups are BER configuration files defined in the *Receiver Quality Configuration* menu (see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.43).

In the *Control* tab of the configuration menu, it is possible to customize the names of the five test setups. The labeling of the hotkeys is changed accordingly.

Remote control

```
CONFigure:RXQuality:BER:TSETup <TestSetup>
```

The test setup number is denoted by a numeric suffix in the BER commands (`...RXQuality:BER<nr>:...`).

Application Test Setup

The *Application/Test Setup* softkey selects the measurement application. At present, the *BER* test is the only application available. If pressed once again, the selected *Application/Test Setup* softkey changes to the *Test Setup/Application* softkey, see above.

BER

The *BER* hotkey selects the Bit Error Rate (BER) test. In this application the CMU evaluates the raw bit error rate; see explanations in section *Receiver Quality Measurements* on p. 4.39.

Remote control

No explicit switchover command. All single shot measurements are identified by the $2^{nd}/3^{rd}$ level keywords `...RXQuality:BER...`

Generator

The *Generator* softkey configures the generated RF signal. The following settings are specific to the *Receiver Quality* measurement:

BER Level

The *BER Level* hotkey sets the level of the CMU's RF signal to be used in the *Receiver Quality* measurement. The setting remains valid for the duration of the *Receiver Quality* measurement only, see section *Measurement Control (Receiver Quality Configuration – Control)* on page 4.43.

Remote control

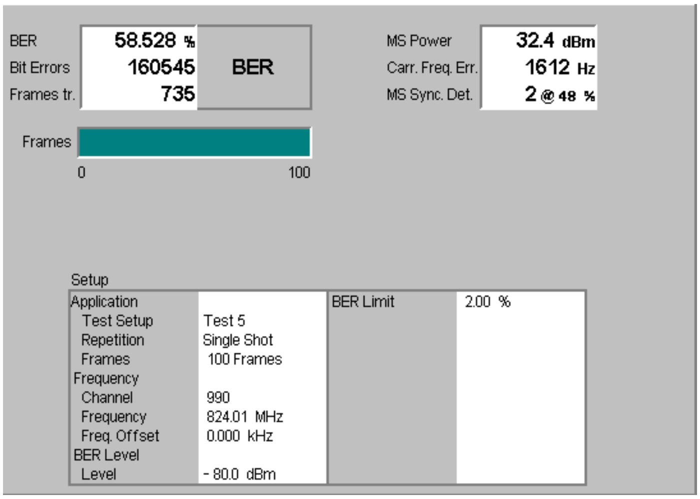
```
CONFigure:RXQuality:BER:CONTrol:TSETup[:DTC]:LEVel
```

Measurement Results

The values shown in the measurement menu *Receiver Quality* are divided into two groups:

- Measurement results and the progress of the measurement are displayed in the left half of the menu.
- The mobile transmitter characteristics are indicated in the right half.

The current test settings are shown in the *Setup* table below.



BER	58.528 %
Bit Errors	160545
Frames tr.	735

MS Power	32.4 dBm
Carr. Freq. Err.	1612 Hz
MS Sync. Det.	2 @ 48 %

Setup

Application		BER Limit	2.00 %
Test Setup	Test 5		
Repetition	Single Shot		
Frames	100 Frames		
Frequency			
Channel	990		
Frequency	824.01 MHz		
Freq. Offset	0.000 kHz		
BER Level			
Level	- 80.0 dBm		

Fig. 4-22 Display of measurement results (Receiver Quality)

Measurement results The results of the Receiver Quality measurement are shown in the two tables in the upper half of the measurement menu.

BER table The left-hand table contains the current measured bit error rate and the statistics of the measurement:

BER	Current bit error rate,
Bit Errors	Number of bit errors detected in the current measurement,
Frames tr.	Number of frames transmitted in the current measurement.

Mobile transmitter characteristics The right-hand table reports on parameters of the signal transmitted by the mobile phone:

MS Power	Absolute measured output power of the mobile phone,
Carr. Freq. Err.	Deviation of the measured mobile phone carrier frequency from the nominal channel frequency,
MS Sync. Det.	IS 136 standard synchronization pattern detected (see section *Table-Oriented Version* on p. 4.49 ff.). and percentage of bursts with this Sync. pattern.

Limit Check A red output field and an arrow pointing upwards indicates that the BER result exceeds the upper limit set by means of the *Limit* softkey.

Progress bar The progress bar below the *BER* table shows the measurement time relative to the total duration of the statistics cycle (number of frames indicated below the bar).

Remote control

```
READ[:SCALar]:RXQuality:BER[:RESult]? etc.
CALCulate[:SCALar]:RXQuality:BER[:RESult]:MATChing?
```

Setup

The *Setup* table in the lower half of the *Receiver Quality* menu gives an overview of the configuration of the current BER measurement. All parameters can be set via softkey/hotkey combinations (see section *Test Settings* on p. 4.40 ff.) or the configuration menus (see section *Measurement Configurations (Receiver Quality Configuration)* on p. 4.43 ff.) and are explained in detail in the corresponding sections:

Test setup	Test setup selected *(Test Setup 1* to *Test Setup 5)*
Frequency	Carrier frequency, channel, and offset relative to the nominal channel frequency
BER Level	Absolute BS signal level (in dBm) at which the bit error rate is measured
BER Limit	Upper limit for the bit error rate

Measurement Configurations (Receiver Quality Configuration)

The popup menu *Receiver Quality Configuration* contains two tabs to determine the parameters of the bit error rate test including the error tolerances.

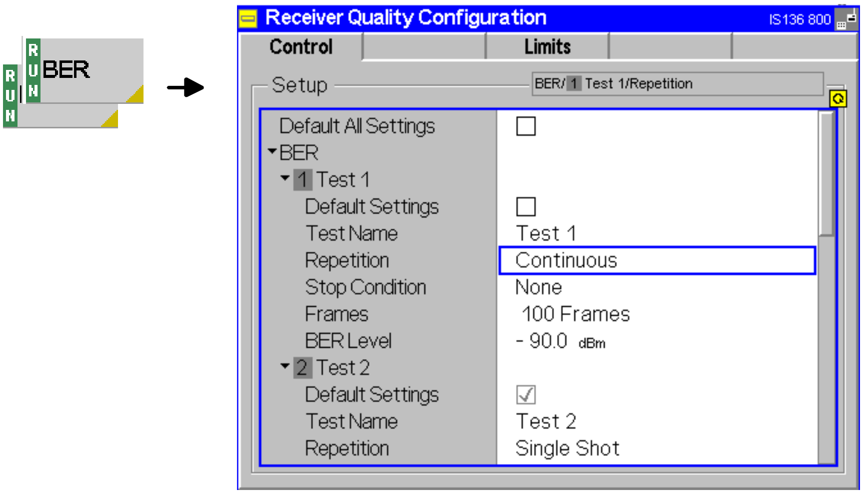
The popup menu *Receiver Quality Configuration* is called up by pressing the measurement control softkey in the top right of the in the *Receiver Quality* menu twice (this softkey reads *BER* or *BER Search*, depending on the application selected). It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Receiver Quality Configuration – Control)

The *Control* tab controls the BER measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The signal level at which the bit error rate is measured *(BER Level)*
- The number of evaluation periods forming a statistics cycle *(Frames)*

All parameters can be entered and stored independently for up to 5 test setups with variable name *(Test Name)*.



Default All Settings	☐
BER	
1 Test 1	
Default Settings	☐
Test Name	Test 1
Repetition	Continuous
Stop Condition	None
Frames	100 Frames
BER Level	- 90.0 dBm
2 Test 2	
Default Settings	☑
Test Name	Test 2
Repetition	Single Shot

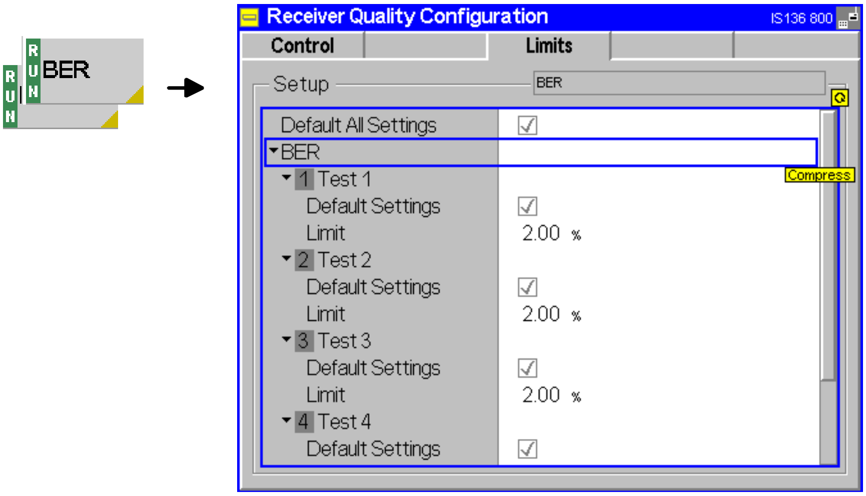
Fig. 4-23 Receiver Quality – Control

The *Repetition* and *Stop Condition* settings comply with those of the menu *Control* in the menu group *Power* (see page 4.13). In the remote-control commands, the keywords `POWer:<Applic>:CONTrol` are to be replaced by `RXQuality:BER:CONTrol:TSETup<nr>`.

Default All Settings	The *Default All Settings* switch sets all parameters of the *Control* tab to their default values. In addition, default switches for the individual test setups are provided. The default values are quoted in the command description in chapter 6 of this manual.
Remote control	`CONFigure:RXQuality:BER:CONTrol:DEFault  ON | OFF`
Test Name	The *Test Name* parameter indicates the name of the *BER* test setup. The default names *(Test Setup 1* to *5)* can be edited; the maximum length of a test name is 29 alphanumeric characters. The name of the test setup also appears in the left table column and on the hotkeys associated to the *Test Setup/Applic*. softkey.
Remote control	–
Frames	The *Frames* parameter sets the statistic count, i.e. the number of speech frames forming a statistics cycle. A statistics cycle is equal to the duration of a single shot measurement.
Remote control	`CONFigure:RXQuality:BER:CONTrol:TSETup<nr>:FRAMes`
BER Level	The *BER Level* parameter defines the absolute BS signal level (in dBm) at which the bit error rate is measured. The setting remains valid for the duration of the *Receiver Quality* measurement only; it is independent from the RF generator level used for transmitter tests. The permissible range of BER levels depends on the selected RF output of the CMU and the external attenuation set, see section *Control of Output Signals (Connection Control – Generator)* on page 4.52 ff.
Remote control	`CONFigure:RXQuality:BER:CONTrol:TSETup<nr>[:DTC]:LEVel`

Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)

The tab *Limits* defines an upper limit for the bit error rate test. This is done separately for the five individual test setups.



Default All Settings	☑
BER	
1 Test 1	
Default Settings	☑
Limit	2.00 %
2 Test 2	
Default Settings	☑
Limit	2.00 %
3 Test 3	
Default Settings	☑
Limit	2.00 %
4 Test 4	
Default Settings	☑

Fig. 4-24 Receiver Quality Configuration – Limits

Default All Settings The *Default All Settings* switch sets all parameters of the *Limits* tab to their default values. Further default switches refer to the settings for the individual test setups of the *Receiver Quality* measurement. The default values are quoted in the command description in chapter 6 of this manual.

Remote control `CONFigure:RXQuality:BER:LIMit:DEFault`

Limit The *Limit* parameter defines an upper limit (in percent) for the bit error rate in the corresponding test setup. The bit error rate measured is defined in section *Receiver Quality Measurements* on p. 4.39.

Remote control `CONFigure:RXQuality:BER:LIMit:TSETup<nr>:ABITs`

Connection Control

The popup menu *Connection Control* consists of four tabs which configure the inputs and outputs of the CMU and the respective signals in the function group *IS 136 800-MS Non Signalling.*

The menu is opened by pressing the softkey *Connect. Control* to the right of the header of each measurement menu. The individual popup menus *(Signal, RF* ⊙ and *Sync.)* can be accessed via the hotkeys at the lower edge of the screen.

Control of Input Signals (Connection Control – Analyzer)

The *Analyzer* tab determines the maximum input level *(Max. Level)* of the RF analyzer, defines the frequency *(RF Channel, Frequency Offset)* of the analyzed RF input signal and configures the RF input path. Besides it controls the wideband peak power measurement *(Power)* and indicates the result.

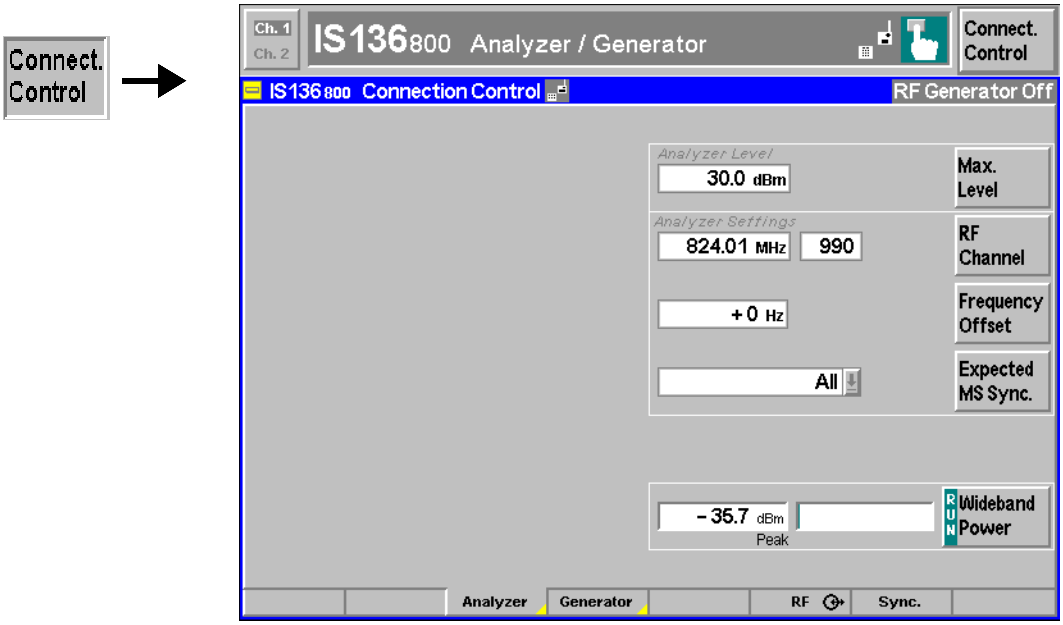
The CMU provides a softkey-oriented version of the *Analyzer* tab and a table-oriented version with extended functionality. The *Analyzer* hotkey toggles between the two versions if it is pressed repeatedly.

Softkey-Oriented Version

The softkey-oriented version of the *Analyzer* tab determines

- The maximum input level *(Max. Level)*
- Channel number *(RF Channel), Frequency Offset,* and synchronization pattern *(Expected MS Sync.)* of the signal analyzed by the CMU *(Analyzer Settings)*

Besides it controls the wideband peak power measurement *(Wideband Power)* and indicates the result. All setting values of this menu are also displayed in the main menu *Analyzer/Generator* (see page 4.2).



RF Generator Off

Analyzer Level: 30.0 dBm

Analyzer Settings: 824.01 MHz 990

+0 Hz

All

-35.7 dBm Peak

Fig. 4-25 Connection Control – Analyzer (softkey)

Max. Level

The *Max. Level* softkey sets the maximum expected input level (overload level). This level corresponds to the maximum RF level that the CMU is able to measure. The CMU allows for a typical crest factor for TDMA signals and an appropriate overdrive reserve. Input levels exceeding the *Max. Level* plus the crest factor plus the reserve overdrive the input path and cause invalid results ("– – –"). The CMU generates a message *Overload at Connector <Connector_no>.*

In the table-oriented version of the *Analyzer* tab, either manual or automatic setting of the input level can be selected. The behavior of the *Max. Level* softkey depends on the way the input level is set:

- In manual mode, the input level is indicated in the input field to the right of the softkey. This field can be activated and the level can be changed by pressing the *Max. Level* softkey. Note the remarks on external input attenuation on p. 4.50.
- If autoranging is selected, *Auto* is indicated in the input field to the right of the softkey. *Max. Level* is not active. To change the input level and mode, the table-oriented *Analyzer* tab must be opened by pressing the *Analyzer* hotkey again.

Remote control
`[SENSe:]LEVel:MAXimum <Level>`

RF Channel

The *RF Channel* softkey defines the channel number (if applicable) or frequency of the measured signal.

In *Non Signalling* mode, RF frequencies can be entered in multiples of 10 kHz. It can be modified by an additional *Frequency Offset* entered in the input field below. If the frequency entered does not correspond to a designated IS 136 channel number, "---" is indicated in the associated channel input field. On turning the rotary knob, the current frequency is incremented or decremented by 30 kHz.

In the two IS 136 hyperbands, the assignment of channel numbers and frequencies is specified for both signal directions. Therefore, inside the bands, it is sufficient to enter only one value (frequency **or** channel number), the other one is automatically determined by the CMU.

The following tables contain the channel assignment in the reverse path (i.e. from mobile to base station/CMU). Channel numbers which are not listed in the tables are not assigned.

Table 4-1 IS 136 channels in the reverse path (mobile phone transmit)

Channel structure
IS 136 800 hyperband

Center Frequency / [MHz]	Channel	Band
0.03 824.01	--- 990	not used
824.04 825	991 1023	A'' (1 MHz)
825.03 834.99	1 333	A (10 MHz)
835.02 844.98	334 666	B (10 MHz)
845.01 846.48	667 716	A' (1.5 MHz)
846.51 848.97	717 799	B' (2.5 MHz)
849 MHz 2700 MHz	--- ---	not used

Channel structure
IS 136 1900 hyperband

Center Frequency / [MHz]	Channel	Band[4]
0.03 1850.01	--- 1	not used
1850.04 1865.01	2 501	A (15 MHz)
1865.04 1869.99	502 667	D (5 MHz)
1870.02 1884.99	668 1167	B (15 MHz)
1885.02 1890.00	1168 1334	E (5 MHz)
1890.03 1895.01	1335 1501	F (5 MHz)
1895.04 1909.92	1502 1998	C (15 MHz)
1909.95 2700	1999 ---	not used

Remote control

```
[SENSe:]RFANalyzer:FREQuency:UNIT <Unit>
[SENSe:]RFANalyzer:FREQuency <Frequency>
```

Frequency Offset

The *Frequency Offset* softkey modifies the analyzer frequency set via *Voice Channel* by a positive or negative offset value.

This enables fine-tuning of the frequency measured by the CMU, e.g. in order to simulate a Doppler shift (caused by a relative movement between mobile and base station) or de-tuning of the mobile.

Remote control

```
[SENSe:]RFANalyzer:FREQuency:OFFSet <Offset>
```

---

[4] Simplified channel representation. The bands A to F in the 1900 MHz hyperband overlap such that channels 499 to 501 belong to both band A and D, channels 666 to 667 to band D and B, channels 1166 to 1167 to band B and E, channels 1333 to 1334 to band E and F, and channels 1499 to 1501 to band F and C.

Expected MS Sync.

The *Expected MS Sync.* softkey defines a synchronization pattern for the measured signal.

The synchronization pattern in the reverse channel TDMA burst identifies the slot number and provides timing information for the decoder. It is defined in the standard.

In IS 136-MS tests, the synchronization pattern is used to distinguish between different burst types and for fine tuning: If a particular synchronization pattern is specified, the CMU only searches for bursts with this pattern; other burst types are discarded. The following settings are possible:

IS 136 1 to 6	*IS 136* standard synchronization patterns
Off	Measurement without detection of the synchronization pattern
All	Signal checked for arbitrary Sync. pattern; the detected synchronization pattern is used for fine tuning of the measurement.

IS 136 Sync. patterns

The 6 Sync. patterns *IS 136 1 to IS 136 6* are specified in the standard and quoted in the command description in chapter 6 of this manual.

Remote control

```
[SENSe:]RFANalyzer:EMSSync <SyncPattern>
```

Wideband Power

The *Wideband Power* softkey controls the wideband power measurement and indicates its status *(RUN | HLT | OFF)*. The status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The measurement result in units of dBm. The analog bar to the right of the softkey shows the measured power relative to the RF input power range between *Max. Level*. *– 10 dB* and *Max. Level + 10 dB*.

The wideband power measurement is performed at the Front End of the CMU and yields the peak power of the input signal inside a wide frequency range. The main purpose of the wideband power measurement is to indicate whether an input signal is available and whether it is advisable to change the *Max Level* settings.

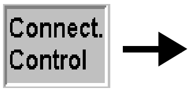
Remote control

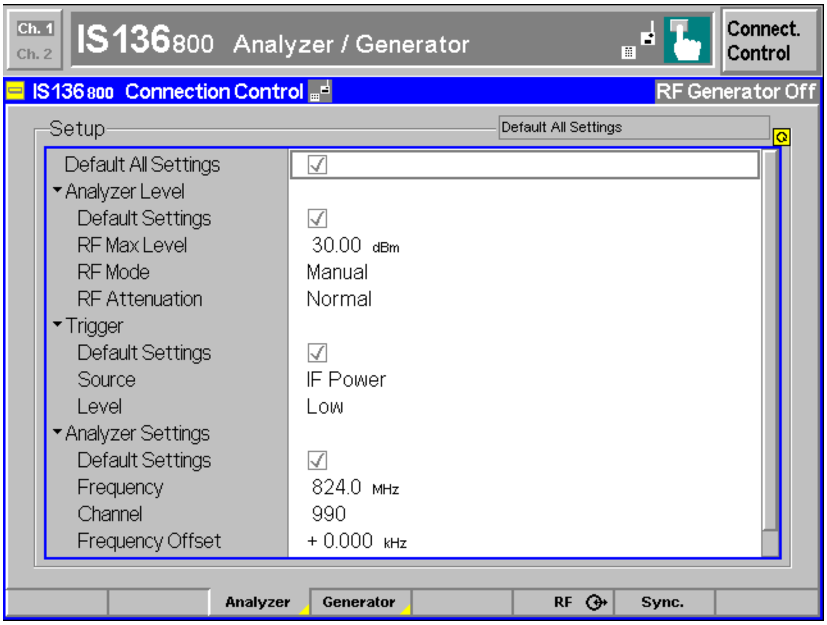
```
INITiate:WPOWer
FETCh:WPOWer:STATus?
READ[:SCALar]:WPOWer[:RESult]?
FETCh[:SCALar]:WPOWer[:RESult]?
SAMPle[:SCALar]:WPOWer[:RESult]?
```

Table-Oriented Version

The table-oriented version of the *Analyzer* tab controls:

- The maximum expected RF input level *(RF Max. Level)* and the way it is defined *(RF Mode)*
- An external input attenuation or gain *(RF Attenuation)*
- The *Trigger* settings
- All *Analyzer Settings* described in section *Softkey-Oriented Version* on p. 4.46 ff.





Default All Settings	☑
Analyzer Level	
Default Settings	☑
RF Max Level	30.00 dBm
RF Mode	Manual
RF Attenuation	Normal
Trigger	
Default Settings	☑
Source	IF Power
Level	Low
Analyzer Settings	
Default Settings	☑
Frequency	824.0 MHz
Channel	990
Frequency Offset	+ 0.000 kHz

Fig. 4-26 Connection Control – Analyzer (table)

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Analyzer* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, a default switch is provided for each of the individual table sections.

Remote control

`[SENSe:]LEVel:DEFault`
`CONFigure:TRIGger:DEFault ON | OFF`

RF Analyzer Level – RF Mode

The *Analyzer Level* table section sets the maximum input level which can be measured. The maximum input level is displayed next to the softkey *Max. Level* in the main menu *Analyzer/Generator* (see page 4.2).

Manual	Manual input of maximum input level
Auto	Automatic setting of maximum input level *(autoranging)* according to average burst power of applied signal

Remote control

`[SENSe:]LEVel:MODE MANual | AUTOmatic`

RF Analyzer Level – RF Max. Level

The maximum expected input level can be entered in the *RF Max. Level* input field. Input levels exceeding the *RF Max. Level* overdrive the input path and cause invalid results (“– – –“).

External attenuation

The range of values depends on the RF input used. If an external input attenuation is reported to the instrument (see section *RF Connectors (Connection Control – Connector/Ext. Att.)* on page 4.55), all levels measured are referenced to the output of the DUT and therefore shifted with respect to the actual level at the input connectors of the CMU. The level ranges for the input connectors are shifted as well.

Error messages

If the value determined for *Max. Level* is too high or too low, a window with the error message *"<Max_Level> is out of range. <permissible max. value> is limit."* and three fields will appear:

Accept	The permissible max. value is accepted as Max. Level

Re-edit	Max. Level is entered once again
Cancel	The last valid input value is maintained

When switching over to another input, the current value of *Max. Level* is automatically adapted, if required:

- Towards lower values to the maximum value of the new input
- Towards upper values to the minimum value of the new input

Note: *A maximum input level can be entered even if automatic level setting (autoranging) is selected. The entered level is used as a start value for the autoranging algorithm and is also important to ensure safe switchover to manual setting.*

Remote control `[SENSe:]LEVel:MAXimum <Level>`

Attenuation The *Attenuation* field defines how the RF analyzer of the CMU is tuned to meet the requirements of the current measurement type. In general, a compromise between the acceptable noise level in the displayed result and the contribution of internally generated distortion must be reached.

Normal	Mixer level in normal range,
Low noise	Mixer level enhanced by +10 dB (full dynamic range of CMU, therefore recommended for *Power* vs time and *Spectrum* measurements),
Low distortion	Mixer level reduced by –10 dB (high intermodulation spacing, therefore recommended for modulation measurements).

The *Attenuation* setting permits the CMU to be adapted to the requirements of the measurement. The advantages and disadvantages of the settings *Low noise* and *Low distortion* are listed in the following table.

	Advantages	**Disadvantages**
Low noise	Low noise high dynamic range	No RF overdrive reserve Risk of intermodulation
Low distortion	High intermodulation spacing	Lower dynamic range

Remote control `[SENSe:]LEVel:ATTenuation  NORMal | LNOise | LDIStortion`

Trigger – Source The *Trigger Source* field determines how the measurement is to be triggered:

Free Run	Trigger by incoming TDMA burst that is detected by the instrument software
RF Power	Trigger by the power (rising edge) of the incoming burst, broadband trigger
IF Power	Narrow-band IF power trigger
Extern	External trigger signal fed in via connector AUX3 (pin no. 8)

For the *RF Power* and *IF Power* parameters the signal to be measured must be a burst signal. The external trigger can be selected for *Non Signalling* measurements only. In contrast, *Signalling* measurements can be triggered by the signal from the CMU signalling unit.

Remote control

```
TRIGger[:SEQuence]:SOURce
                FRUN | RFPower | IFPower | EXTern
```

Trigger – Level	The *Trigger Level* field determines the trigger threshold if the measurement is triggered by the *RF Power* or *IF Power*.
	The trigger threshold is the level at which the trigger signal starts triggering. With free-run measurements or external trigger the *Trigger Level* field is disabled.

Low	Low trigger level, equal to the reference level – 26 dB
Medium	Medium trigger level, equal to the reference level – 16 dB
High	High trigger level, equal to the reference level – 6 dB

Remote control `TRIGger[:SEQuence]:THReshold LOW | MEDium | HIGH`

Control of Output Signals (Connection Control – Generator)

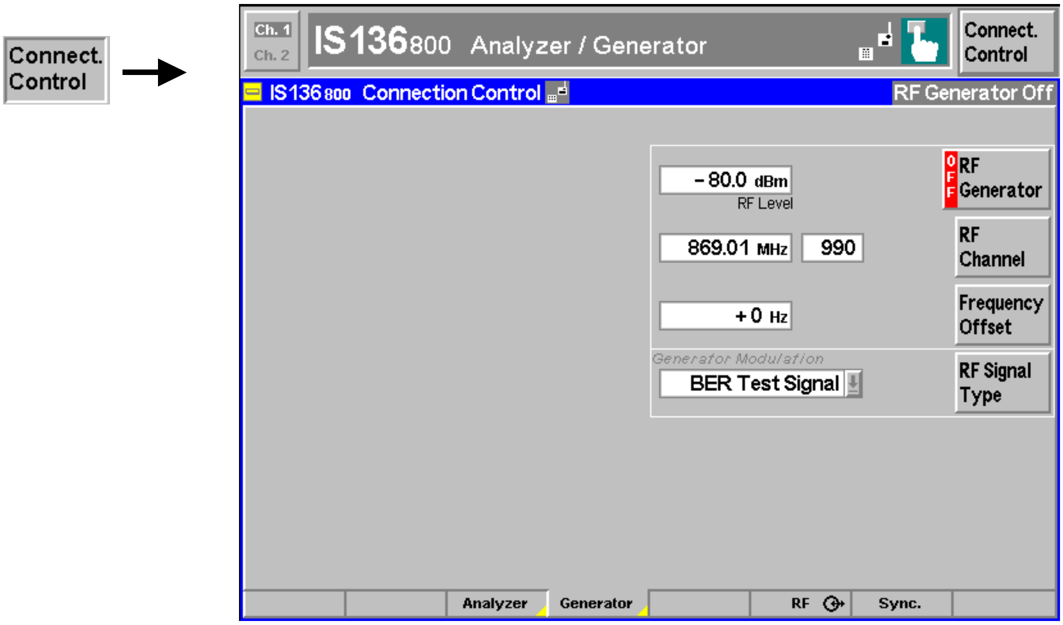
The *Generator* tab controls the RF, SAT, and ST generators and configures the generated signals. The CMU provides a softkey-oriented version of the *Generator* tab and a table-oriented version with extended functionality. The *Generator* hotkey toggles between the two versions if it is pressed repeatedly.

Softkey-Oriented Version

The softkey-oriented version of the *Generator* tab controls and configures the RF generator. It defines:

- Power *(RF Generator)* and frequency *(RF Channel, Frequency Offset)* of the generated RF signal
- A bit sequence to be modulated onto the RF carrier *(RF Signal Type).*

The RF generator settings are also available in the main menu *Analyzer/Generator* (see page 4.2).



RF Level: - 80.0 dBm

869.01 MHz 990

+ 0 Hz

Generator Modulation: BER Test Signal

Fig. 4-27 Connection Control – Generator (softkey)

RF Generator

The softkey *RF Generator* defines the generator level and indicates the operating status of the RF generator *(ON* **|** *OFF)*.

The level is entered in dBm. The value range depends on the selected RF output (RF 1, RF 2 or RF 3 OUT). The RF generator can be switched on or of after softkey selection (press once) using the *ON/OFF* key.

Remote control

```
INITiate:RFGenerator; ABORt:RFGenerator
FETCh:RFGenerator:STATus?
```

External attenuation

If an external gain or attenuation is used and reported to the instrument (see softkey *Ext. Att. Output*) the RF generator level is adjusted to maintain the commanded power after the attenuation or gain. As a consequence, all levels indicated are referenced to the input of the DUT and no longer correspond to the actual level at the output connectors of the CMU (see section *RF Connectors (Connection Control – Connector/Ext. Att.)* on page 4.55). The default value for the generator power is also shifted provided that the generator can output the required power, compensating for the external attenuation or gain.

Error messages

If the level defined for *RF Level* is too high or too low, a window will appear with the error message *"<RF_Level> is out of range. <Permissible max. value> is limit*." and three fields:

Accept	Permissible max. value is accepted as *Max. Level*
Re-edit	The *Max. Level* is entered once again
Cancel	The last valid input is maintained

When switching over to a different output, the current value of *Max. Level* is automatically adapted, if required:

- Towards lower values to the maximum permissible value of the new output
- Towards higher values to the minimum value of the new output

Remote control

```
SOURce:RFGenerator:LEVel <Level>
```

RF Channel

The *RF Channel* softkey defines the channel number (if applicable) or the frequency of the generated RF signal.

RF frequencies can be entered in multiples of 10 kHz. It can be modified by an additional *Frequency Offset* entered in the input field below. In the two IS 136 hyperbands, the assignment of channel numbers and frequencies is specified for both signal directions. Therefore, inside the bands, it is sufficient to enter only one value (frequency **or** channel number), the other one is automatically determined by the CMU.

In *Non Signalling* mode, the measurements may also be taken outside the IS 136 bands. If an out-of-band frequency is entered, the associated channel field indicates '---'.

The following tables contain the channel assignment in the forward channel (i.e. from the base station/CMU to the mobile phone). The channel frequencies are shifted by +45 MHz compared with the reverse path (duplex spacing, see above, *Panel Analyzer Settings*) in the 800 MHz hyperband and by 80.04 MHz in the 1900 MHz hyperband. Channel numbers which are not listed in the tables are not assigned.

Table 4-2 IS 136 channels in the forward path (base station transmit)

Channel structure
IS 136 800 hyperband

Center Frequency / [MHz]	Channel	Band
0.03 869.01	--- 990	not used
869.04 870	991 1023	A'' (1 MHz)
870.03 879.99	1 333	A (10 MHz)
880.02 889.98	334 666	B (10 MHz)
890.01 891.48	667 716	A' (1.5 MHz)
891.51 893.97	717 799	B' (2.5 MHz)
894 2700	--- ---	not used

Channel structure
IS 136 1900 hyperband

Center Frequency / [MHz]	Channel	Band[5]
0.03 1930.05	--- 1	not used
1930.08 1945.05	2 501	A (15 MHz)
1945.08 1950.03	502 667	D (5 MHz)
1950.06 1965.03	668 1167	B (15 MHz)
1965.06 1970.04	1168 1334	E (5 MHz)
1970.07 1975.05	1335 1501	F (5 MHz)
1975.08 1989.96	1502 1998	C (15 MHz)
1989.99 2700	1999 ---	not used

Remote control

```
SOURCe:RFGenerator:FREQuency:UNIT <Unit>
SOURCe:RFGenerator:FREQuency <Frequency>
```

Frequency Offset

The *Frequency Offset* softkey defines an offset for the frequency set under *RF Channel*.

This enables fine-tuning of the RF frequency generated by the CMU, for example for simulating a Doppler shift (due to a relative movement between mobile and base station) or de-tuning of the mobile.

Remote control

```
SOURCe:RFGenerator:FREQuency:OFFSet <FrequencyOffset>
```

RF Signal Type

The *RF Signal Type* softkey selects a bit modulation sequence for the generated RF signals.

The following options are available:

BER Test Signal	Fixed bit sequence used for bit error rate test
CW	No signal superimposed, "empty" carrier (continuous wave)
PRBS	Pseudo random bit sequence

Note: *The* RX Quality *measurement (see p. 4.39 ff.) will fail (i.e. yield unrealistically high bit error rates) unless the generator signal is configured as* BER Test Signal*.*

---

[5] Simplified channel representation. The bands A to F in the 1900 MHz hyperband overlap such that channels 499 to 501 belong to both band A and D, channels 666 to 667 to band D and B, channels 1166 to 1167 to band B and E, channels 1333 to 1334 to band E and F, and channels 1499 to 1501 to band F and C.

The BER test signal simulates three full-rate users with the following time-slot and Digital Verification Color Code (DVCC) configurations:

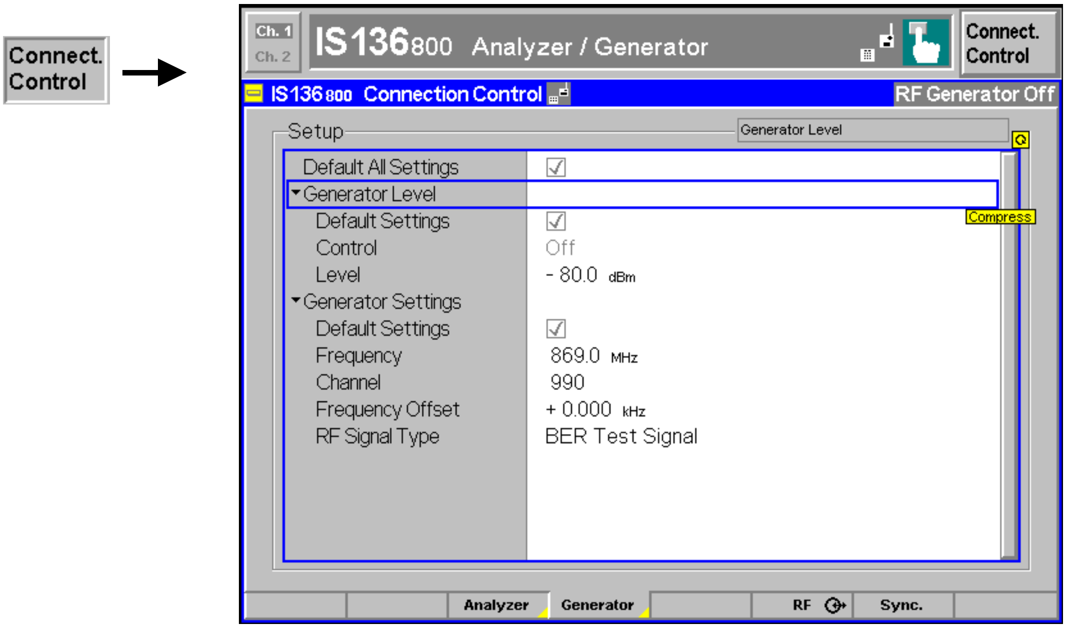
User	1	2	3
Timeslot	1 & 4	2 & 5	3 & 6
DVCC	1	2	3

The mobile station may need to be reconfigured accordingly, in order to attain the synchronization necessary to run the BER tests.

Remote control `SOURce:RFGenerator:MODulation:RFS:TYPE <Selection>`

Table-Oriented Version

The table-oriented version of the *Generator* tab contains all settings of the softkey-oriented version (see section *Softkey-Oriented Version* on p. 4.52 ff.). Besides, it provide switches to restore the default settings.



Default All Settings	☑
▾Generator Level	
Default Settings	☑
Control	Off
Level	- 80.0 dBm
▾Generator Settings	
Default Settings	☑
Frequency	869.0 MHz
Channel	990
Frequency Offset	+ 0.000 kHz
RF Signal Type	BER Test Signal

Fig. 4-28 Connection Control – Generator (table)

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Generator* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, a default switch is provided for each of the individual table sections.

Remote control –

RF Connectors (Connection Control – Connector/Ext. Att.)

The popup menu *RF* ⇴ configures the connectors for RF signals. This includes the setting of

- The RF input and output of the CMU *(RF Output, RF Input)*
- An external attenuation at the connectors *(Ext. Att. Output, Ext. Att. Input)*

Connect. Control →

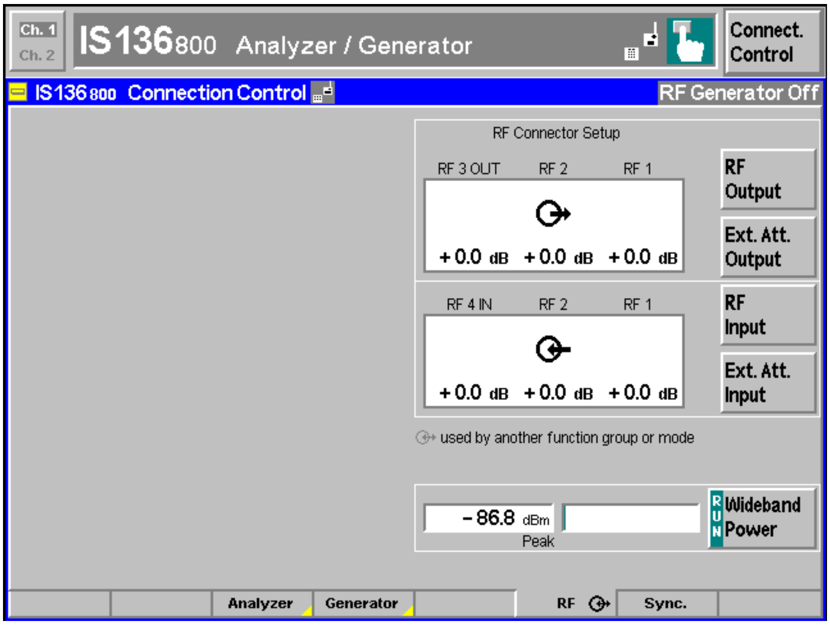


Fig. 4-29 Connection Control – RF connectors

The *Wideband Power* measurement is explained in the *Wideband Power* softkey description on page 4.49.

RF Output

The *RF Output* softkey defines which of the three connectors RF 1, RF 2 and RF 3 OUT is to be used as RF output connector.

The selected RF output is indicated by a ⇴ symbol.

Note: *Input and output connectors can be arbitrarily combined. The bidirectional connectors RF 1 and RF 2 can be selected as RF inputs and outputs at the same time.*

The LEDs on the front panel are only „on“ (light) if the generator is switched on.

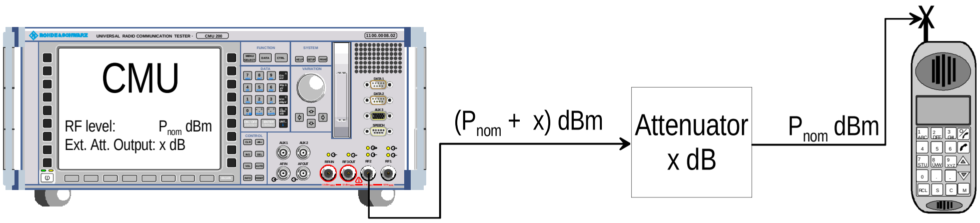
Remote control `OUTPut[:STATe] RF1 | RF2 | RF3`

Ext. Att. Output

The softkey *Ext. Att. Output* defines an external attenuation (or gain, if the value is negative) at the selected RF output.

Input of an external attenuation is suitable if, e.g., a path attenuation (cable) is included in the test setup, which is to be corrected by an increased signal level.

If an external attenuation is defined, the output signal level is referenced to the input of the DUT, the generator level is therefore shifted with respect to the actual level at the input connector of the CMU. The default value for the generator power and the level ranges for the RF outputs are also shifted provided that the generator can output the required power, compensating for the external attenuation or gain. Otherwise it is adapted to the level closest to the shifted default value.



Remote control

```
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]
```

RF Input

The *RF Input* softkey determines which of the three connectors RF 1, RF 2 and RF 4 IN is to be used as RF input connector.

The selected RF output is indicated by a ⊙ symbol. Input and output connectors can be arbitrarily combined.

Remote control

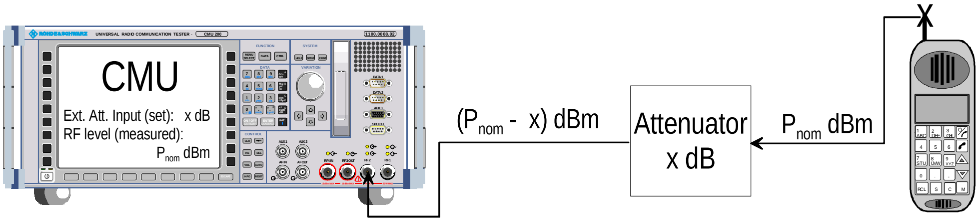
```
INPut[:STATe] RF1 | RF2 | RF4
```

Ext. Att. Input

The softkey *Ext. Att. Input* enters the value of the external attenuation (or gain) at the selected RF input.

Input of an external attenuation is required if, for example, external attenuator pads are used for protection of the sensitive RF inputs of the CMU or if a path attenuation is included in the test setup.

If an external input attenuation is reported to the instrument, all levels measured are referenced to the output of the DUT and therefore shifted with respect to the actual level at the input connectors of the CMU. The level ranges for the input connectors are shifted as well.



Note: *The LEDs on the front panel are only “on“ (light) if the measurement is active.*

Remote control

```
[SENSe:]CORRection:LOSS:INTPut<nr>[:MAGNitude]
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]
```

Reference Frequency (Connection Control – Sync.)

The popup menu *Sync.* defines the reference signals for synchronization. This includes

- The internal or external *Reference Frequency*
- The output mode for the network-specific system clock *(REF OUT 2)*

Connect. Control →

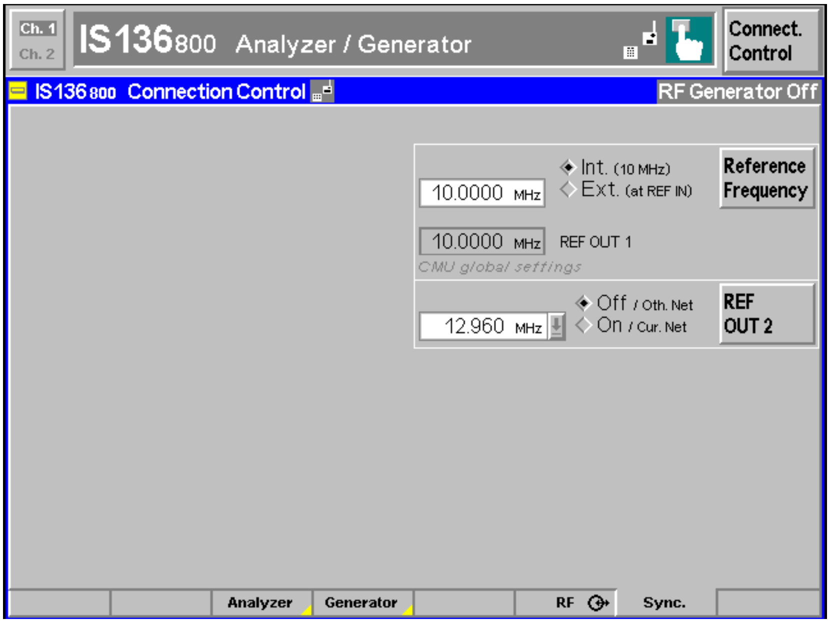


Fig. 4-30 Connection Control – Synchronization

Reference Frequency

The *Reference Frequency* softkey determines the source and the frequency of the reference signal.

The associated field permits to select between two alternatives:

Int. (10 MHz)	Internal synchronization with 10 MHz (TCXO or OCXO, CMU-B11/-B12) applied to output REF OUT 1 at the rear of the instrument.
Ext. (at REF IN)	External reference signal to be fed in via input *REF IN* and applied to output REF OUT 1 at the rear of the instrument.

The frequency of the external reference signal must be entered in the input field next to the *External* button.

The reference signal used is applied to output *REF OUT 1* so that it can be fed to other instruments as well. It can be used for synchronization to another instrument.

Notes:

1. *With external synchronization selected, the header cyclically displays a warning if no synchronization has been performed e.g. because of missing or faulty input signal.*
2. *In the case of external synchronization with squarewave signals (TTL) ensure correct signal matching to avoid reflections. Otherwise, resulting overshoots may cause trigger problems at the CMU input. A possible remedy is to use a lowpass filter or an attenuator pad directly at the CMU input. Correct synchronization may be checked by comparing the signal REF OUT 1 or REF OUT 2 with the input signal.*
3. *This configuration is valid in* ***all*** *CMU function groups.*

Remote control

The commands for the reference frequency are part of the CMU base system (see CMU200/300 operating manual):

```
CONFigure:SYNChronize:FREQuency:REFerence:MODE
             INTernal | EXTernal
CONFigure:SYNChronize:FREQuency:REFerence <Frequency>
```

REF OUT 2

The softkey *REF OUT 2* configures a network-specific system clock REF OUT 2 to be fed to the output *REF OUT 2* at the rear of the instrument.

The associated field permits to select between two alternatives:

OFF (other network)	The clock frequency of the current function group is not fed to the output *REF OUT 2*. With this setting the system clock of another active function group (e.g. the 1900 MHz hyperband while the current hyperband is 800 MHz) is still applied to *REF OUT 2* provided that the output *REF OUT 2* is switched on in the other function group. However, if *REF OUT 2* is explicitly switched over from *On* to *Off* the clock signal is definitely removed.
On (current network)	The network-specific system clock of the current function group is fed to output REF OUT 2. The system clock of any other function group applied to REF OUT 2 before is replaced.

The following clock frequencies may be selected:

38.88 MHz, 19.44 MHz, 12.96 MHz, 9.72 MHz

(The values are calculated according to the formula $F_{out} = 38.88\ MHz / n$ where $n = 1, ..., 4$)

The clock frequency can be used to synchronize other instruments.

Remote control

```
SOURce:DM:CLOCk:STATe ON | OFF
SOURce:DM:CLOCk:FREQuency <Frequency>
```

TDMA Mobile Tests (Signalling Mode)

This section provides detailed information on the measurement and configuration menus defined in function group *IS 136 800-MS Signalling*. It is organized like a typical measurement session including the following stages:

1. Call setup to the mobile station *(Connection Control – Connection)*
2. Overview of measurements and general settings *(Overview)*
3. Measurement menus *(Power, Modulation, Spectrum, Receiver Quality):* control of the measurements, output of measurement results, specific measurement configurations
4. Global configurations *(Connection Control)*

The most important menus of the function group *IS 136 800/1900-MS Signalling* are shown in an overview at the end of chapter 3 in the present manual.

A lot of menus and controls are similar or identical in the two operating modes for *IS 136 800/1900-MS* with and without signalling. These menus will only be presented with a summary explanation; the detailed description is found in section *IS 136 800/1900-MS Non Signalling*.

Call Setup
(Connection Control – Signalling)

The popup menu *Connection Control* controls signalling (call setup and release, services, signalling parameters) and configures the inputs and outputs with the external attenuation values and the reference frequency.

The purpose of the *Signalling* test mode is to perform transmitter and receiver test with an existing connection to the mobile station. Therefore the tabs controlling the call setup (*Connection Control – Connection)* appear immediately after selection of the function group *IS 136 800/1900-MS Signalling* in the *Menu Select* menu*.* Alternatively, the *Connection Control* menu can be called up by pressing the softkey *Connect. Control* at the top right in every measurement menu; the individual tabs can be accessed via the hotkey bar at the lower edge of the screen. By pressing the *Escape* key, the *Connection Control* menu is closed and the CMU changes to the measurement mode.

In the following the first two tabs *Connection Control – Connection* displayed immediately after activation of the function group are described. A description of the other tabs of the *Connection Control* menu is relegated to the end of this chapter (see section *Connection Control in the Registered State* on page 4.84).

The term signalling denotes all procedures that are necessary for call setup and release as well as for control of a connection in the mobile radio network. In the case of IS 136 mobile station tests, a distinction is made between five different signalling states:

Signal Off	CMU transmits no signal
Signal On	CMU outputs a IS 136 control channel signal to which a mobile station can synchronize
Registered	Registration of the mobile station completed
Alerting	Mobile is being called by the CMU (after registration or without registration)
Call Established	Call connection to mobile station established, mobile picked up

A number of control commands which can be initiated both by the CMU *(Call to MS)* and by the mobile station *(Call from MS)* switch between these states (in Fig. 4-31 below; processes initiated by the mobile station are indicated by dashed lines).

A lot of applications within the function group *IS 136 800/1900-MS Signalling* are only possible or useful in a particular signalling state (for example, a handoff between various networks requires an existing connection between CMU and mobile station, i.e. it is only possible in the *Call Established* state). Accordingly, the *Connection Control* menus may vary depending on the signalling state.

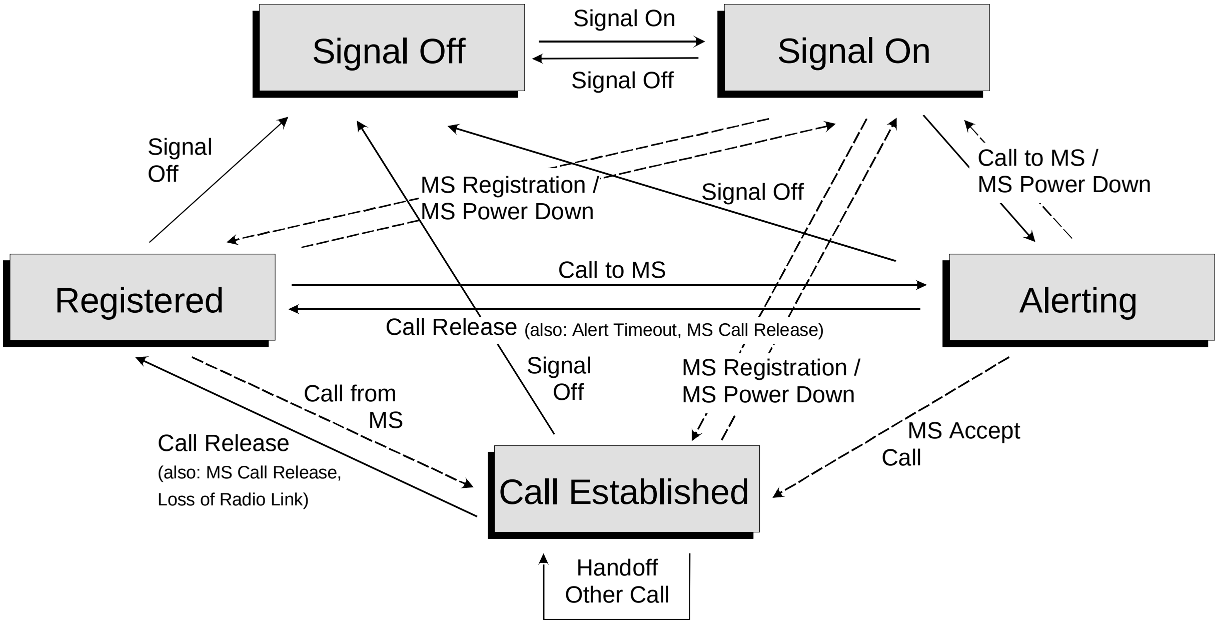


Fig. 4-31 Signalling states of the CMU

Corresponding to the five possible signalling states, five different *Connection* menus are available. When a signalling state is reached, the corresponding menu is opened automatically (exception: see softkey *Open Pop. autom.*).

Note: *For a complete overview of signalling states including the Handoff process see Fig. 6.1 in chapter 6 of this manual.*

Connection Control with "Signal Off"

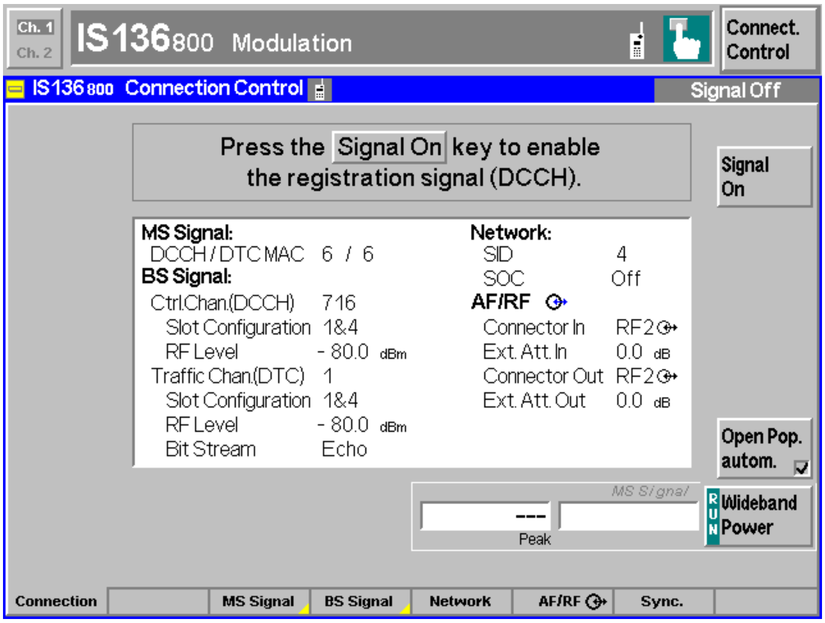
The popup menu *Connection (Signal Off)* provides information on:

- Mobile Attenuation Codes set at the mobile *(MS Signal)*
- The most important parameters concerning the frequency and level of the signal that the CMU will transmit in the state *Signal On (BS Signal)*
- Important *Network* parameters
- Selected RF connectors and external attenuation *(RF ⊙→)*
- Status and result of the wide-band peak-power measurement *(Wideband Power)*

Besides, it activates the control channel signal for the call setup to the mobile station *(Signal On).*

The popup menu *Connection (Signal Off)* is opened when the function group *IS 136 MS Signalling* is selected, or if the DCCH signal is switched off *(Signal Off* softkey*)* while the system is in another signalling state. It is replaced by the *Connection (Signal On)* menu after the DCCH signal on the CMU is switched on (Softkey *Signal On,* see Fig. 4-31).

Connect. Control →



Press the Signal On key to enable the registration signal (DCCH).

MS Signal:
DCCH / DTC MAC 6 / 6
BS Signal:
Ctrl.Chan.(DCCH) 716
Slot Configuration 1&4
RF Level - 80.0 dBm
Traffic Chan.(DTC) 1
Slot Configuration 1&4
RF Level - 80.0 dBm
Bit Stream Echo

Network:
SID 4
SOC Off
AF/RF ⊙→
Connector In RF2⊙→
Ext. Att. In 0.0 dB
Connector Out RF2⊙→
Ext. Att. Out 0.0 dB

MS Signal

Peak

Fig. 4-32 Connection Control – Connection (Signal Off)

MS Signal The table *MS Signal* indicates the Mobile Attenuation Codes set at the mobile. These parameters are set in the tab *MS Signal* and explained in more detail there (see section *Signals of the Mobile Phone (Connection Control – MS Signal)* on page 4.96 ff.).

Remote control `CONFigure:BSSignal...`

BS Signal The table *BS Signal* indicates the most important parameters concerning the frequency and level of the control and traffic channel signals transmitted by the CMU in the state *Signal On*. These parameters are set in the tab *BS Signal* and explained in more detail there (see section *Signals of the CMU (Connection Control – BS Signal)* on page 4.99 ff.).

Remote control `CONFigure:BSSignal...`

Network The table *Network* indicates the System Identitiy *(SID)* and the System Operator Code *(SOC).* The codes are set in the tab *Network* and explained there in more detail (see section *Network Parameters (Connection Control – Network)* on page 4.102 ff.).

Remote control `CONFigure:NETWork...`

RF ⊙→ The table *RF* ⊙→ indicates the RF connectors and external attenuation settings. These parameters are set in the tab *RF* ⊙→ and are explained in more detail there (see section *RF Connectors (Connection Control – RF/AF Connector)* on page 4.56).

Remote control `[SENSe:]CORRection:LOSS...?`

Wideband Power The *Wideband Power* softkey controls the wide-band power measurement and indicates its state *(RUN | HLT | OFF)*.

In the associated fields, the peak power of the received signal is indicated as absolute numerical value and relative to the effective radiated power (ERP) of the mobile (analog bar). The analog bar views the RF input power range between *ERP – 10 dB* and *ERP + 10 dB*. The ERP depends on the DTC MAC set in the

Overview menu and on the power class of the mobile; see Table 4-3 on page 4.71.

The result of the wide-band power measurement is usually slightly higher than the result of the *Power vs Time* measurement which is obtained with a matched filter according to the standard.

Remote control

```
INITiate:WPOWer
FETCh:WPOWer:STATus?
READ[:SCALar]:WPOWer[:RESult]?
FETCh[:SCALar]:WPOWer[:RESult]?
SAMPle[:SCALar]:WPOWer[:RESult]?
```

Signal On

The *Signal On* softkey switches on a control channel signal (DCCH) to which the mobile station can synchronize.

By switching on the signal, the CMU changes to the signalling state *Signal On*. A user prompt below the menu header indicates the function of this softkey.

Remote control

```
PROCedure:Signalling:ACTion SON
```

Open Pop. autom. ☐

The *Open Pop. autom.* softkey contains a field which activates or suppresses display of the popup menu *Connection (Signal Off)*.

- In the default setting (*Open Pop. autom.* on), the popup menu is displayed each time the *Signal Off* state is reached (due to a change of the signalling state or function group).
- In the alternative setting (*Open Pop. autom.* off), the popup-menu is suppressed. Signalling may still be controlled, e.g., via the mobile. Moreover, the popup menu *Connection (Signal Off)* can also be opened explicitly by pressing the corresponding hotkey in the menu group *Connection Control*.

Remote control –

Connection Control with "Signal On"

The popup menu *Connection (Signal On)* provides information on

- Mobile Attenuation Codes set at the mobile *(MS Signal)*
- The signals transmitted by the CMU *(BS Signal)*
- The network parameters *(Network)*
- The RF connectors *(RF ⊙)*
- The status and result of the peak power measurement *(Wideband Power)*

Besides, it contains softkeys which lead to other signalling states:

- Deactivating the control channel signal for establishing the first connection to the mobile station *(Signal Off)*
- Setting up a call to the mobile station (*Call to MS* -> state *Alerting)*

The popup menu *Connection (Signal On)* is opened after the DCCH signal on the CMU is switched on (Softkey *Signal On* in the popup menu *Connection (Signal Off)*). It is replaced by the *Connection (Registered)* menu after the mobile station initializes a registration by itself. It is replaced by the *Connection (Call Established)* menu if the mobile station sets up a call to the CMU. It is replaced by the *Connection (Alerting)* menu if a mobile is called via the *Call to MS* softkey (see Fig. 4-31).

Connect. Control →

Waiting for mobile registration
or call from the mobile.

MS Signal:
DCCH / DTC MAC 6 / 6
BS Signal:
Ctrl.Chan.(DCCH) 716
Slot Configuration 1&4
RF Level - 80.0 dBm
Traffic Chan.(DTC) 1
Slot Configuration 1&4
RF Level - 80.0 dBm
Bit Stream Echo

Network:
SID 4
SOC Off
AF/RF
Connector In RF2
Ext. Att. In 0.0 dB
Connector Out RF2
Ext. Att. Out 0.0 dB

Fig. 4-33 Connection Control – Connection (Signal On)

The entries of the *BS Signal, Network,* and *RF* ⊙→ table sections and the *Power* softkey is described in section *Connection Control with "Signal Off* on page 4.61.

Signal Off

The *Signal Off* softkey switches off the CMU's control channel signal to which the mobile station can synchronize.

By switching off the signal the CMU changes to the signalling state *Signal Off*.

Remote control `PROCedure:Signalling:ACTion SOFF`

Call to MS

The *Call to MS* softkey sets up a call to the mobile station.

A user prompt below the header indicates that the mobile station must synchronize to the CMU signal first. After successful synchronization, the message *Paging in progress ...* is displayed below the header; the CMU changes to the signalling state *Alerting*. As soon as the mobile is picked up the CMU changes to the signalling state *Call Established*.

Note: *To set up a call, the CMU transmits fife page messages at maximum. If the* Call to MS *procedure still fails (e.g. because the mobile was not properly connected), the message* Call to mobile was not successful ! *is displayed in a message window. The message window is closed after a while or after it is confirmed by pressing the* ENTER *key.*

Remote control `PROCedure:Signalling:ACTion CTM`

Open Pop. autom. ☐

The softkey *Open Pop. autom.* contains a field which activates or suppresses the display of the popup menu *Connection (Signal On)*.

- In the default setting (*Open Pop. autom.* on), the popup menu is displayed each time the *Signal On* state is reached (due to a change of the signalling state or function group).
- In the alternative setting (*Open Pop. autom.* off), the popup-menu is suppressed. Signalling may still be controlled, e.g., via the mobile. Moreover, the popup menu *Connection (Signal On)* can also be opened explicitly by pressing the corresponding hotkey in the menu group *Connection Control*.

Overview of the Function Group

The main menu *Overview* gives an overview of the function group *IS 136 800/1900-MS Signalling* including the most important settings and measurement results.

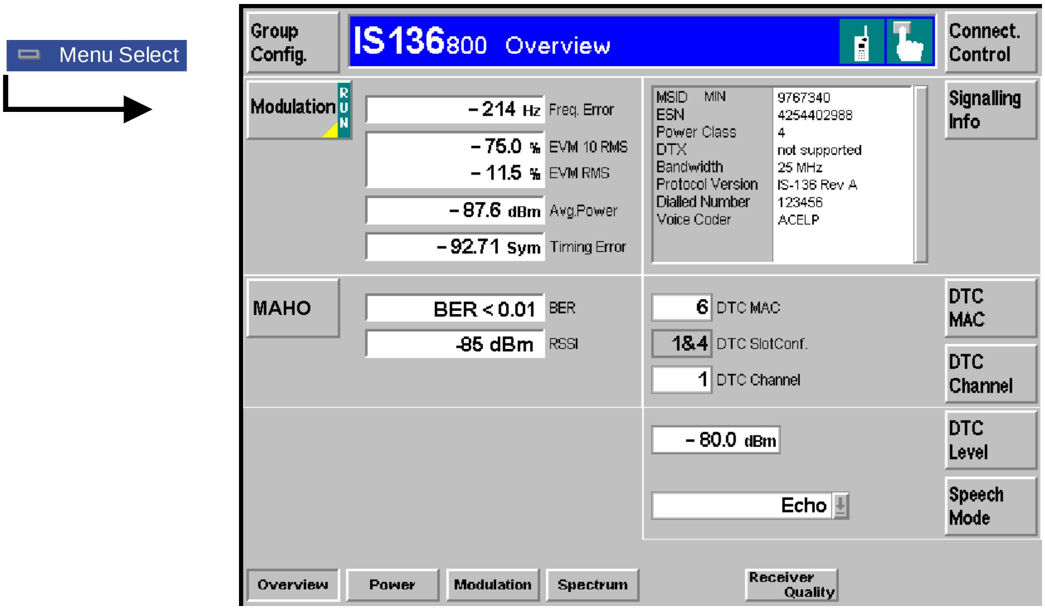
The panels on the left side report the following basic measurement results:

- The main softkey *Modulation* in the upper part controls the modulation measurement and informs on its current status (*RUN* | *HALT* | *OFF). The* individual measurement results displayed are discussed under the measurement menu Modulation on page 4.72 ff.
- In the panel *MAHO,* the *BER* level and received signal strength *(RSSI)* of the current traffic channel as reported by the mobile station is displayed (see section *Receiver Quality Measurements* on page 4.76).

The panels on the right side display signalling information and provide settings concerning the mobile station and the traffic channel signal of the CMU:

Table *Signalling Info*	Parameters of the mobile station	See page 4.96 ff.
Softkeys *DTC.../Speech Mode*	Traffic channel settings[1]	See page 4.85 ff.

The main menu *Overview* is opened from the main menu *Menu Select* (with associated key at the front of the instrument) and after closing the configuration menu *Connection Control - Signalling* (using the *Escape* key or automatically after establishing a call connection). From the *Overview* menu, the remaining measurement menus of the function group *(Power, Modulation, Spectrum,* and *Receiver Quality)* can be accessed via hotkeys.



-214 Hz Freq. Error
-75.0 % EVM 10 RMS
-11.5 % EVM RMS
-87.6 dBm Avg.Power
-92.71 Sym Timing Error

MSID MIN	9767340
ESN	4254402988
Power Class	4
DTX	not supported
Bandwidth	25 MHz
Protocol Version	IS-136 Rev A
Dialled Number	123456
Voice Coder	ACELP

BER < 0.01 BER
-85 dBm RSSI

6 DTC MAC
1&4 DTC SlotConf.
1 DTC Channel
-80.0 dBm
Echo

Fig. 4-34 Function overview – main menu Overview

Important note: current vs. default values

Some parameters of the CMU assume two independent values: The default value *is used to set up a call; it can be modified in the signalling states* Signal Off, Signal On *and* Registered. *The* current value *during the call (signalling state* Call Established) *can still be changed, however, modifying this current value does not alter the default value. An example for such a double parameter in IS 136 800/1900-MS is the* DTC Level.

In remote control, default values are set with a `CONFigure ...` *command, current values are set with the corresponding* `PROCedure ...` *command.*

---

[1] The DTC MAC and DTC Channel values represent the default settings if the CMU is in the *Signal Off, Signal Off, Registered*, or *Alerting* states. The default values are superseded by measurement results once the CMU is in the Call Established state.

Power vs. Time Measurements

The menu group *Power* comprises the functions for measuring the RF power of the received burst signal as a function of time. The measurement results are displayed in the graphical measurement menu *Power,* the popup menu *Power Configuration* is used for configuration of the measurements.

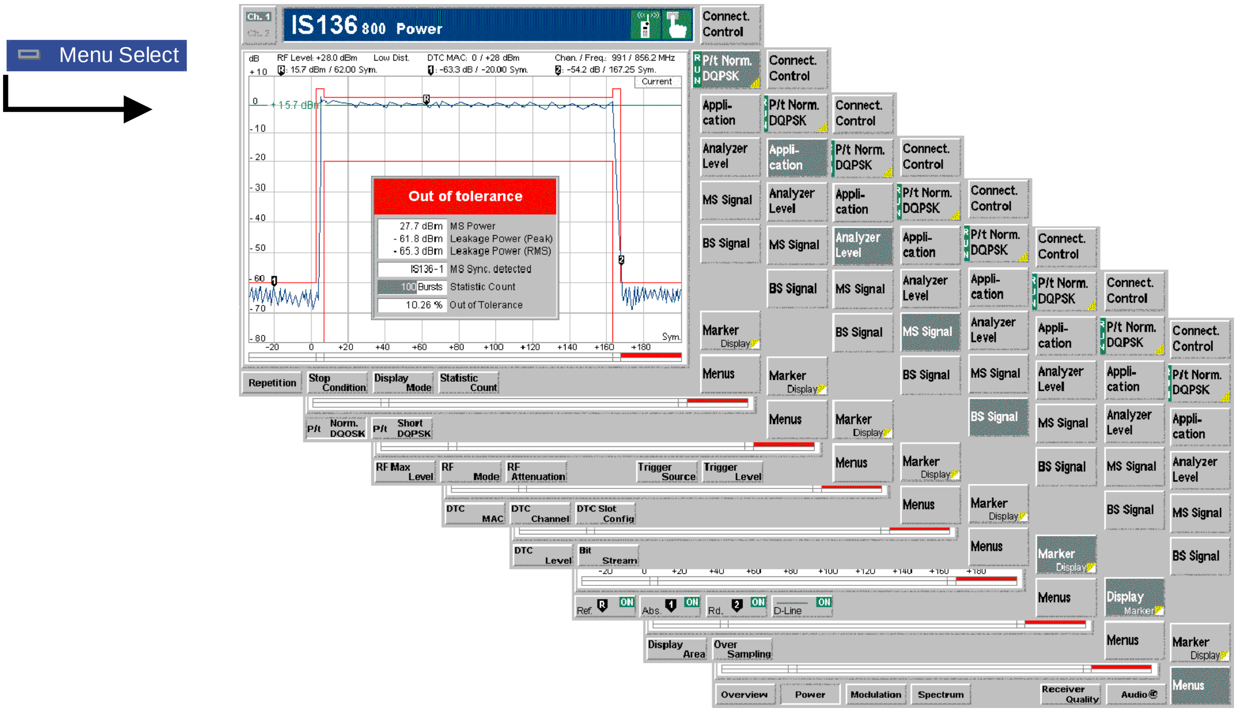
Most settings and functions of this menu do not depend on the signalling state and correspond to those of the menu *Power* in the operating mode *IS 136 800/1900-MS Non Signalling* (for a detailed description se p. 4.4 ff.).

Measurement Menu (Power)

The graphical measurement menu *Power* displays the results of the power measurement (burst analysis).

- The main softkey *P/t Norm. DQPSK* (which changes to *P/t Short. DQPSK* if that application is selected) indicates the status of the power measurement *(RUN | HALT | OFF)* and opens the configuration menu *Power Configuration*.
- The other softkeys to the right of the test diagram are combined with various hotkeys*.* The softkey/hotkey combinations provide test settings and switch over between different measurements.

The measurement menu *Power* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or using the *Menus – Power* hotkey. The hotkeys associated to the *Menus* softkey switch over between the *Power* menu and the remaining measurement menus of function group *IS 136 800/1900 Signalling*.



27.7 dBm	MS Power
- 61.8 dBm	Leakage Power (Peak)
- 65.3 dBm	Leakage Power (RMS)
IS136-1	MS Sync. detected
100 Bursts	Statistic Count
10.26 %	Out of Tolerance

Fig. 4-35 Measurement menu Power

Test Settings

The measurement control softkey *P/t Norm. DQPSK* and the associated hotkeys, the *Marker/Display,* and *Menus* test settings are identical with those in *Non Signalling* mode (see section *Test Settings* on p. 4.5 ff.). The following softkeys and hotkeys differ from the *Power* measurement:

Application

The *Application* softkey activates the selection of the DTC *(digital traffic channel)* burst type for the power measurement (see section *Limit Lines* on page 4.15 ff.).

P/t Normal Burst

The *P/t Normal Burst* hotkey selects a normal burst (162 symbols).

Remote control

No explicit switchover command. All *Normal Burst* measurements are identified by the 2nd/3rd level keywords ...`POWer[:NBURst]`...

P/t Short. Burst

The *P/T Short. Burst* hotkey selects an shortened burst (142 symbols).

Remote control

No explicit switchover command. All *Short. Burst* measurements are identified by the 2nd/3rd level keywords ...`POWer:SBURst`...

Analyzer Level

The *Analyzer Level* softkey controls the level in the RF input signal path and provides the trigger settings for the *Power* measurement. See also section *Signals of the Mobile Phone (Connection Control – MS Signal)* on p. 4.96 ff.

Difference from *Non Signalling* mode (see p. 4.5 ff.):

- In *Signalling* mode, the measurement is triggered by the signal from the signalling unit or the mobile phone. Use of an external trigger signal is not possible.
- In *Signalling* mode, the maximum input level *(RF Max. Level)* can be set automatically according to the Mobile Attenuation Code of the mobile phone *(RF Mode* hotkey, setting *DMAC)*.

MS Signal

The *MS Signal* softkey controls the traffic channel transmitter output signal of the mobile phone. The MS output signal parameters are indicated in the *Overview* menu (see p. 4.65).

DTC MAC

The *DTC MAC* hotkey sets the mobile attenuation code. The mobile attenuation code determines the effective radiated power of the mobile, see section *Limit Values for Average Burst Power (Power Configuration – Limits)* on page 4.71.

Remote control

```
PROCedure:SIGNalling[:DTC]:MAC  0 ... 31
```

BS Signal

The *BS Signal* softkey controls the traffic channel signal of the CMU. The BS signal parameters are indicated in the *Overview* menu (see p. 4.65). They are described in detail in section *Connection Control with Call Established* on p. 4.89 ff.

DTC Channel

The *DTC Channel* hotkey sets the number of the digital traffic channel.

Remote control

```
PROCedure:SIGNalling[:DTC]:CHANnel <CH_Number>
CONFigure:BSSignal[:DTC]:CHANnel <CH_Number>
```

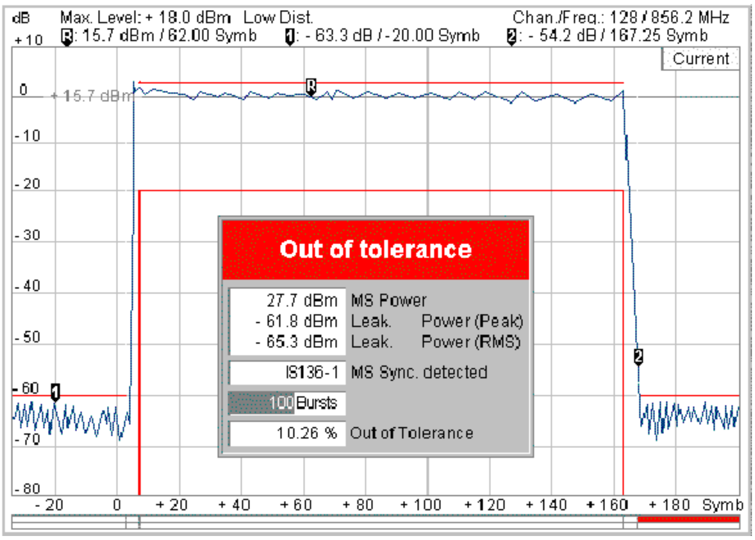
DTC Slot Config.	The *DTC Slot Config.* hotkey selects the two timeslots of a TDMA frame which are paired to form a full-rate traffic channel.
Remote control	`PROCedure:SIGNalling[:DTC]:SLOTconfig C14 | C25 | C36`
DTC Level	The *DTC Level* hotkey sets the signal level of the digital traffic channel.
Remote control	`CONFigure:BSSignal[:DTC]:LEVel <Level>` `PROCedure:BSSignal[:DTC]:LEVel <Level>`
Speech Mode	The *Speech Mode* hotkey determines how the CMU returns the data received from the mobile.
Remote control	`CONFigure:BSSignal:SPEech ECHO | LOOP | HSET`

Measurement Results

The values represented in the measurement menu *Power* can be divided into three groups:

- Settings
- Scalar measurement results (single values),
- Arrays (the trace plotted as a function of time).

The measurement results are indicated in two parameter lines, the test diagram and an info box:



Parameter line 1 / 2

Test diagram

Info box

Max. Level: + 18.0 dBm Low Dist. Chan./Freq.: 128 / 856.2 MHz
R: 15.7 dBm / 62.00 Symb 1: - 63.3 dB / -20.00 Symb 2: - 54.2 dB / 167.25 Symb

Out of tolerance

27.7 dBm	MS Power
- 61.8 dBm	Leak. Power (Peak)
- 65.3 dBm	Leak. Power (RMS)
IS136-1	MS Sync. detected
100	Bursts
10.26 %	Out of Tolerance

Fig. 4-36 Display of measurement results (Power menu)

Settings/ scalar results	Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the info box, a popup window in the middle of the graphical screen *Power*.
1st parameter line	The first parameter line contains the following settings:

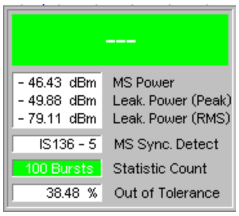
Max. Level	Maximum input level as set in *RF Input Level – Max. Level* (see Fig. 4-53 on p. 4.97 ff.)
Attenuation	Setting for the attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Chan./Freq	RF channel and associated frequency

2nd parameter line

The second parameter line contains the following marker values:

R	Level and time of reference marker
1	Level and time of delta marker 1 (setting *absolute*) and/or difference from reference marker (setting *relative*)
2	Level and time of delta marker 2 (setting *absolute*) and/or difference from reference marker (setting *relative*)

Info box



- 46.43 dBm	MS Power
- 49.88 dBm	Leak. Power (Peak)
- 79.11 dBm	Leak. Power (RMS)
IS136 - 5	MS Sync. Detect
100 Bursts	Statistic Count
38.48 %	Out of Tolerance

The info box contains the following settings:

Statistic count	Number of bursts per statistics cycle and relative progress of the measurement within the cycle (colored bar)

In addition, the following scalar results are indicated:

MS Power	Average power of current burst (irrespective of the display mode selected and of the current trace)
Leakage Power	Mobile station transmit power during the carrier-off state; both the peak (Peak) and effective (RMS) value is indicated
MS Sync. detected	Standard synchronization pattern detected (see section *Control of Input Signals (Connection Control – Analyzer)* on page 4.46 ff.), or *Off*, if no synchronization pattern was found.
Burst Matching	Message if the displayed burst is out of tolerance. This message depends on the selected display mode.

Remote control

Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

For scalar measurement results:

```
READ[:SCALar]:POWer:<Applic>[:DQPSk][:RESult]
FETCh[:SCALar]:POWer:<Applic>[:DQPSk][:RESult]?
SAMPle[:SCALar]:POWer:<Applic>[:DQPSk][:RESult]?

CALCulate[:SCALar]:POWer:<Applic>[:DQPSk]:CURRent
  [:RESult]:MATChing?
```

Traces (arrays)

The trace is displayed as a continuous curve in the test diagram together with the limit lines, markers and the D-line, if defined.

The trace in the *Power* measurement menu shows the measured burst power (in dB) as a function of time (in symbols). The displayed result depends on the test settings. The scale of the time axis is adapted to the burst type (application *Normal Burst* or *Short Burst*) selected. The display mode for the trace *(Minimum, Maximum, Average, Current)* is indicated in the upper right corner of the diagram.

Remote control

```
READ:ARRay:POWer:<Applic>[:DQPSk]:CURRent[:RESult]?
FETCh:ARRay:POWer:<Applic>[:DQPSk]:CURRent[:RESult]?
SAMPle:ARRay:POWer:<Applic>[:DQPSk]:CURRent[:RESult]? etc.
CALCulate:POWer:<Applic>[:DQPSk]:CURRent[:RESult]
  :MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?  etc.
```

Measurement Configurations (Power Configuration)

The popup menu *Power Configuration* contains two tabs to determine the parameters of power measurement and provide graphical tools for evaluation of the measurement results.

The popup menu *Power Configuration* is activated by pressing the softkey *Power* at the top right in the graphical measurement menu *Power*. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Power Configuration – Control)

The tab *Control* controls the power measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The type of measurement curve displayed *(Display Mode)*
- The number of bursts/evaluation periods forming a statistics cycle *(Statistic Count)*

Besides, it influences the power display by adding or removing the *Grid.* All settings can be defined separately for the two applications *Normal Burst* and *Short. Burst*. They are described in section *IS 136 800/1900 Non Signalling* on page 4.13 ff.

Limit Lines (Power Configuration – Limit Lines)

The tab *Limit Lines* defines the limit lines for the burst analysis. Limit lines are a graphical tool for defining and monitoring tolerance values. The tab enables

- A preview of the defined limit lines *(Area Info)*
- Definition of the limit lines for the current application (normal or shortened burst) section by section *(Limit Line Definition)*

Burst structure in IS 136 radio network

In the IS 136 radio network, all radio channels are divided into TDMA frames with 6 timeslots, each with a duration of 40/6 ms ≈ 6.67 ms. In this time mask, the mobile station can transmit bursts with different length and bit patterns. The CMU is able to measure the following burst types transmitted by IS 136 mobile phones:

Normal burst	Data and Signalling information transmission in the digital traffic channel (DTC) and in the digital control channels (DCCH) except RACH. A normal burst contains 162 symbols (324 bits).
Shortened burst	Traffic channel burst used to adjust the mobile phone's timing (dynamic time alignment). The shortened burst contains 120 symbols plus a guard time of 22 symbols.

Symbol structure

`Mobile to base station, DCCH, normal burst`

GP	R	PRE	SYNC	DATA	SYNC +	DATA
3	3	8	14	61	12	61

`Mobile to base station, DTC, normal burst`

GP	R	DATA	SYNC	DATA	SACCH	D	DATA
3	3	8	14	61	6	6	61

`Mobile to base station, DTC, shortened burst`

GP	R	S	D	4x0	S	D	8x0	S	D	12x0	S	D	16x0	S	AG
3	3	14	6	2	14	6	4	14	6	6	14	6	8	14	22

GP	Guard period; transmission-free time	R	Ramp time
PRE	Preamble	DATA	user information
SYNC, S	Synchronization	SYNC+	Additional synchronization
D	Coded digital verification color code		

Fig. 4-37 Burst structure of the TDMA reverse channel bursts

Burst power

As a function of time, the bursts can be divided into different areas. These areas are used as a basis for the definition of the limit lines and are shown in the following diagram (Fig. 4-38).

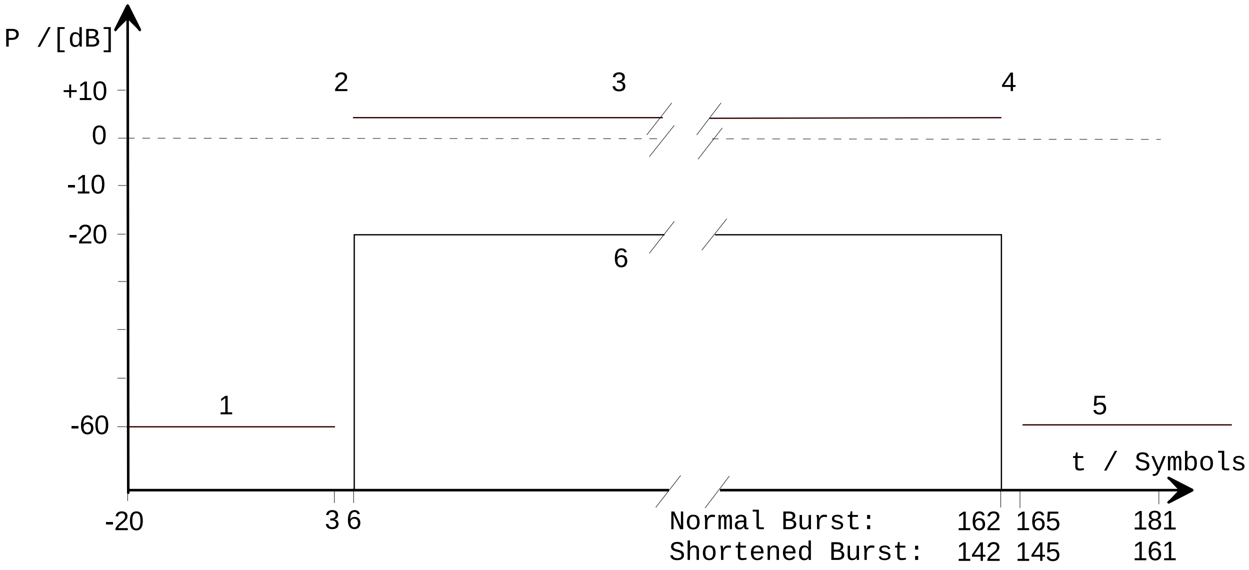


Fig. 4-38 Tolerance mask (limit lines) for normal and shortened bursts

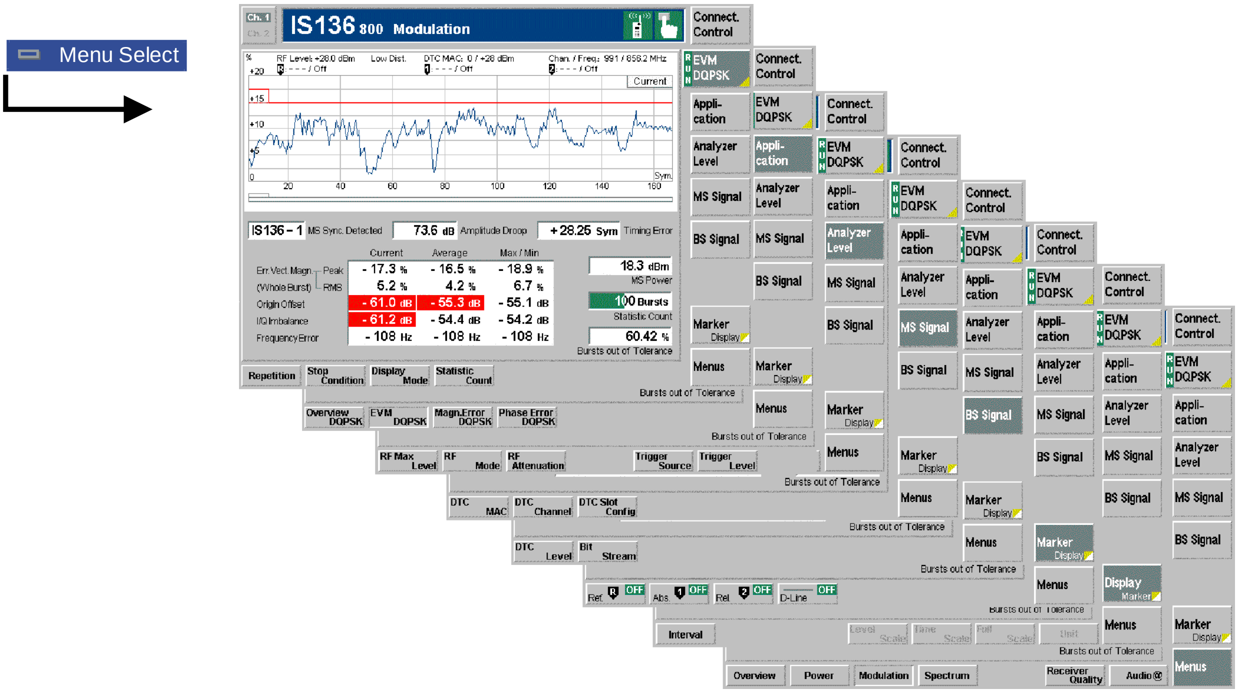
All settings can be defined separately for the two applications *Normal Burst* and *Short. Burst*. They are described in section *IS 136 800/1900 Non Signalling* on page 4.15 ff.

Modulation Measurements

The menu group *Modulation* provides the functions for measurement of the modulation parameters, i.e. the frequency and phase error in the burst and matching of the respective tolerance limits. The popup menu *Modulation Configuration* is used for configuration of the measurements; the measurement results are displayed in the graphical measurement menu *Modulation*.

With the following exceptions (which also apply to the menu *Power)*, the menu group *Modulation* does not differ from the same menu group in the measurement mode *IS 136 800/1900-MS Non Signalling* (see p. 4.18 ff.):

1. The mobile attenuation code (MAC) can be set with the *DTC Mac* and *DTC Channel* softkeys and can be used to define the input level *Analyzer Level* softkey).
2. The trigger settings *Signalling, Free Run, RF Power* and *IF Power* are available. The measurement can be triggered by the CMU's signalling unit. Triggering by an additional external signal, however, is not possible.



RF Level: +28.0 dBm   Low Dist.   DTC MAC: 0 / +28 dBm   Chan. / Freq.: 991 / 856.2 MHz

R: - - - / Off   1: - - - / Off   2: - - - / Off

IS136 – 1 MS Sync. Detected   73.6 dB Amplitude Droop   + 28.25 Sym Timing Error

		Current	Average	Max / Min
Err.Vect.Magn. (Whole Burst)	Peak	- 17.3 %	- 16.5 %	- 18.9 %
	RMS	5.2 %	4.2 %	6.7 %
Origin Offset		- 61.0 dB	- 55.3 dB	- 55.1 dB
I/Q Imbalance		- 61.2 dB	- 54.4 dB	- 54.2 dB
Frequency Error		- 108 Hz	- 108 Hz	- 108 Hz

18.3 dBm MS Power

100 Bursts Statistic Count

60.42 % Bursts out of Tolerance

Fig. 4-40 Measurement menu Modulation

Test Settings

The selections and test settings provided by the *Application* and *Display/Marker* softkeys are identical with those in the *Non Signalling* mode (see section *Test Settings* on page 4.20 ff.). The remaining softkeys are equal to the softkeys of the same name in the *Power* menu (see page 4.67 ff.).

Measurement Results

The values shown in the measurement menu *Modulation* can be divided into three groups:

- Setting values
- Scalar measurement results (single values),
- Arrays (traces plotted as a function of time).

The measurement menu for the *Overview* application shows all scalar results but no trace. The measurement menus for the remaining three applications are analogous and show the phase error, the (relative) magnitude error or the (relative) error vector magnitude as a function of time and the corresponding peak and effective values. The range and unit of the y-axis is adjusted to the measured quantity. In contrast to the *Non Signalling* mode (see p. 4.22 ff.) the first parameter line contains also the MAC of the mobile station, and the *Timing Error* is indicated. Besides the display and interpretation of the results are identical.

Timing Error The *Timing Error* output field, which is displayed in the right-hand output field of the *Modulation* measurement menu, indicates the time offset (in symbol periods) between the expected and the measured timing of the current burst. The expected timing results from the timing of the BS signal and the (known) timing advance of the mobile station.

The *Timing Error* can be determined with trigger mode *Signalling* only; see section *Signals of the Mobile Phone (Connection Control – MS Signal)* on page 4.96 ff.

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration* contains two tabs to define the parameters of the phase and frequency error measurement including the error tolerances.

The popup menu *Modulation Configuration* is activated by pressing the main softkey in the top right of the graphical measurement menu *Modulation* (this softkey reads *Phase Error, Magnitude Error* or *Err. Vector Magnitude*, depending on the selected application) twice. By pressing the associated hotkeys, it is possible to change between the tabs.

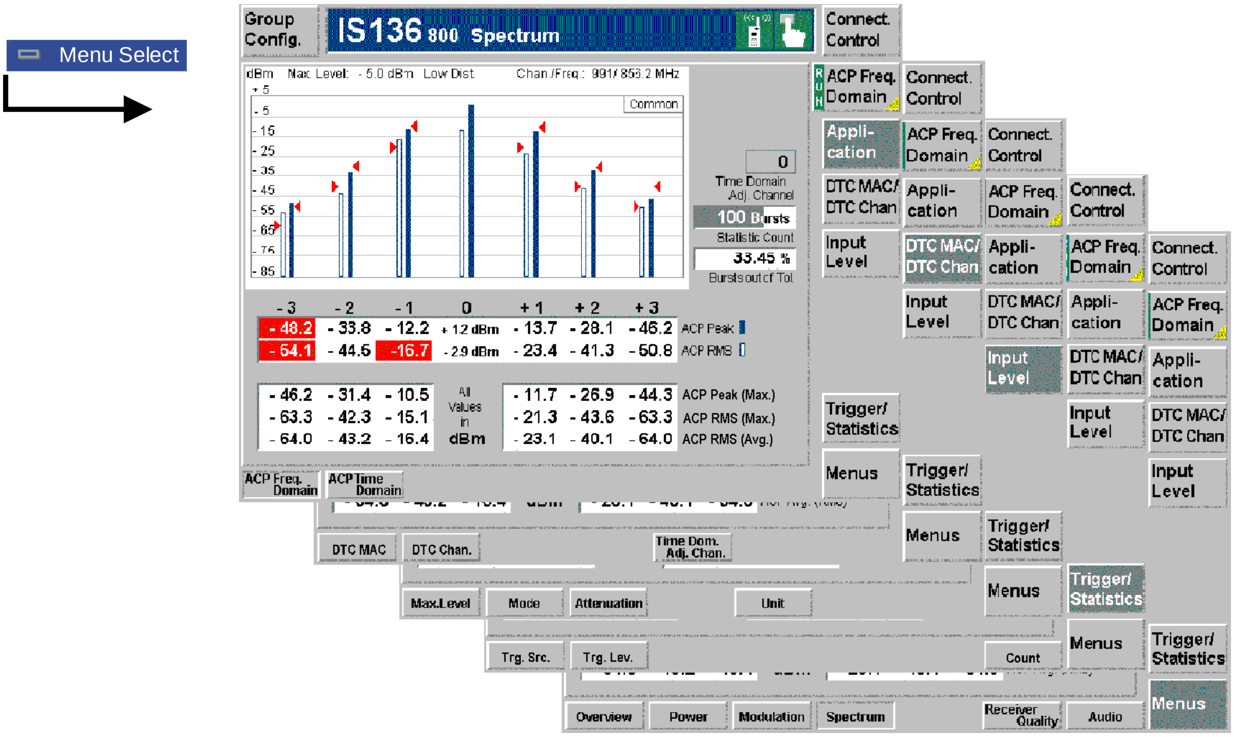
The functions of the *Modulation Configuration* menus are described in section *IS 136 800/1900-MS Non Signalling*, see p. 4.26 ff.

Adjacent Channel Power Measurements

The menu group *Spectrum* comprises the functions for measurement of the adjacent channel power (ACP) which can be measured and plotted either in the frequency or in the time domain. The measurement results are displayed in the graphical measurement menu *Spectrum,* the popup menu *Spectrum Configuration* is used for configuration of the measurements.

Apart from few exceptions (which also apply to the menu *Power*), the menu group *Spectrum* does not differ from the same menu group in the measurement mode *IS 136 800/1900-MS Non Signalling* (see p. 4.29 ff.):

1. The mobile attenuation code (MAC) can be set with the *DTC Mac/DTC Chan.* softkey and can be used to define the input level *(Analyzer Level* softkey).
2. The trigger settings *Signalling, Free Run, RF Power* and *IF Power* are available. The measurement can be triggered by the CMU's signalling unit. Triggering by an additional external signal, however, is not possible.



- 3	- 2	- 1	0	+ 1	+ 2	+ 3	
- 48.2	- 33.8	- 12.2	+ 1.2 dBm	- 13.7	- 28.1	- 46.2	ACP Peak
- 54.1	- 44.5	-16.7	- 2.9 dBm	- 23.4	- 41.3	- 50.8	ACP RMS
- 46.2	- 31.4	- 10.5	All Values in dBm	- 11.7	- 26.9	- 44.3	ACP Peak (Max.)
- 63.3	- 42.3	- 15.1		- 21.3	- 43.6	- 63.3	ACP RMS (Max.)
- 64.0	- 43.2	- 16.4		- 23.1	- 40.1	- 64.0	ACP RMS (Avg.)

Fig. 4-41 Measurement menu Spectrum

Test Settings

The selections and test settings provided by the *Application and Display/Marker* softkeys are identical with those in the *Non Signalling* mode (see section *Test Settings* on page 4.30 ff.). The remaining softkeys are equal to the softkeys of the same name in the *Power* menu (see page 4.67 ff.).

Measurement Results

The *Spectrum* measurement menu and the results depend on the selected display range (application, i.e. *ACP Frequency Domain* or *ACP Time Domain)*. The range and unit of the y-axis is adjusted to the measured quantity.

In contrast to the *Non Signalling* mode (see p. 4.33 ff.) the first parameter line contains also the MAC of the mobile station. Besides the display and interpretation of the results is identical.

Spectrum Configurations (Spectrum Configuration)

The popup menu *Spectrum Configuration* contains two tabs to define the parameters of the spectrum measurement including the error tolerances.

The popup menu *Spectrum Configuration* is activated by pressing the main softkey in the top right of the graphical measurement menu *Spectrum* twice (this softkey reads *ACP Frequency Domain* or *ACP Time Domain*, depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

The functions of the *Spectrum Configuration* menu are described in section *IS 136 800/1900-MS Non Signalling*, see p. 4.37 ff.

Receiver Quality Measurements

The menu group *Receiver Quality* assesses the sensitivity of the mobile station receiver via a bit error rate test. The measurement results are displayed in the graphical measurement menu *Receiver Quality,* the popup menu *Receiver Quality Configuration* is used for configuration of the measurements. Instead of the application *BER* (bit error rate tests) provided in the measurement mode *IS 136 800/1900-MS Non Signalling* (see p. 4.39 ff.), the mobile-assisted handoff report (MAHO) is available in *Signalling* measurements.

Mobile assisted handoff (MAHO) is a process in which a mobile operating on a DTC measures the received signal strength (RSS) and BER on the current forward DTC and the RSS on up to 24 neighbor cell channels and reports this information to the network. The MAHO channels that the network sends to the mobile for measurement are typically the channels on which the DCCHs of neighboring cells and sectors are located.

The network uses the MAHO report to decide whether the mobile should be handed off to another cell. For the CMU, the contents of the MAHO report are automatically provided by the mobile phone and do not represent real measured quantities.

The standard specifies a MAHO and an extended MAHO measurement to be performed by IS 136 mobile phones:

MAHO	The mobile measures the signal strength (RSSI) and 3-bit Bit Error Rate (BER) on the current traffic channel. In addition, it determines the RSSI in a definite number of neighbor channels.
Extended MAHO	The mobile measures the signal strength (RSSI) and 4-bit Bit Error Rate (BER) plus one of the quantities CIR or WER on the current traffic channel. In addition, it determines the RSSI in a definite number of neighbor channels.

Prerequisites The MAHO test can be performed while a call connection between the CMU and the MS under test is established (signalling state *Call Established)*. Measurement configurations such as the selection of neighbor channels can be performed in any signalling state (including *Call Established)*.

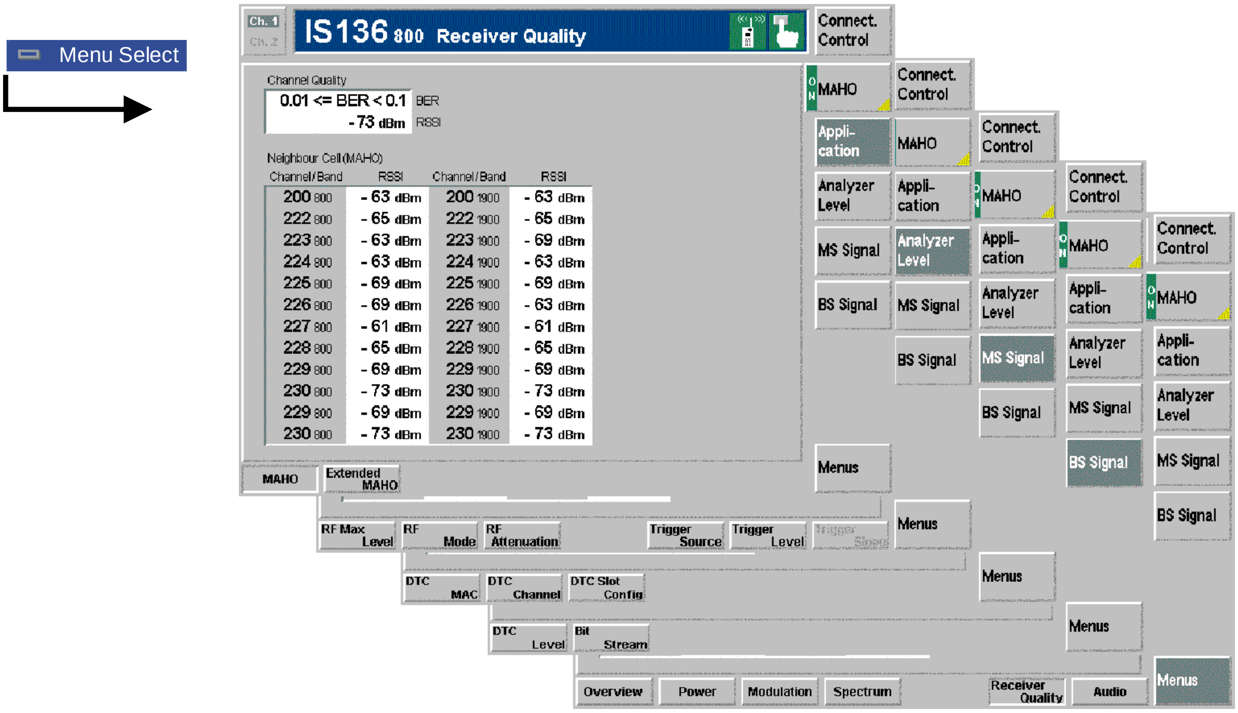
Extended MAHO tests require a mobile with protocol version TIA/EIA 136 PV2 or later. For mobile phones with earlier protocol versions, the *Extended MAHO* parameters in the configuration menu can still be set. However, the *Application – Extended MAHO* hotkey is grayed so that it is not possible to activate the application.

Measurement Menu (Receiver Quality)

The *Receiver Quality* menu shows the results and the most important parameters of the MAHO test.

- The measurement control softkey *MAHO* (which changes to *Extended MAHO* if that application is selected) controls the MAHO test, indicates its status *(RUN* | *HLT* | *OFF)*, and (if pressed twice) opens the *Receiver Quality Configuration* menu.
- The remaining softkeys on the right softkey bar are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Test Settings* on p. 4.5 ff.
- The measurement results are shown in two tables.

The measurement menu *Receiver Quality* can be accessed from any other measurement menu of function group *IS 136 800 Non Signalling* using the *Menus – Receiver Quality* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).



Channel Quality
0.01 <= BER < 0.1 BER
-73 dBm RSSI

Neighbour Cell (MAHO)

Channel/Band	RSSI	Channel/Band	RSSI
200 800	-63 dBm	200 1900	-63 dBm
222 800	-65 dBm	222 1900	-65 dBm
223 800	-63 dBm	223 1900	-69 dBm
224 800	-63 dBm	224 1900	-63 dBm
225 800	-69 dBm	225 1900	-69 dBm
226 800	-69 dBm	226 1900	-63 dBm
227 800	-61 dBm	227 1900	-61 dBm
228 800	-65 dBm	228 1900	-65 dBm
229 800	-69 dBm	229 1900	-69 dBm
230 800	-73 dBm	230 1900	-73 dBm
229 800	-69 dBm	229 1900	-69 dBm
230 800	-73 dBm	230 1900	-73 dBm

Fig. 4-42 Measurement menu Receiver Quality (application MAHO)

Test Settings

The *Analyzer Level, MS Signal, BS Signal,* and *Menu* settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.67 ff.)*.* The following softkeys and hotkeys differ from the *Power* measurement:

Appli-cation

The *Application* softkey selects the measurement application. The two alternative applications *MAHO* and *Extended MAHO* are displayed in separate measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for both applications, however, are listed in a common popup-menu (see section *Receiver Quality Configurations (Receiver Quality Configuration)* on page 4.82 ff.).

MAHO

The *MAHO* hotkey selects the (basic) MAHO test. In this application the CMU displays the BER and the RSSI in the current traffic channel plus the RSSI in up to 24 neighbor channels; see explanations in section *Measurement Results* on p. 4.78 ff.

Remote control
No explicit switchover command. All single shot measurements are identified by the 2nd/3rd level keywords `...RXQuality:MAHO...`

Extended MAHO

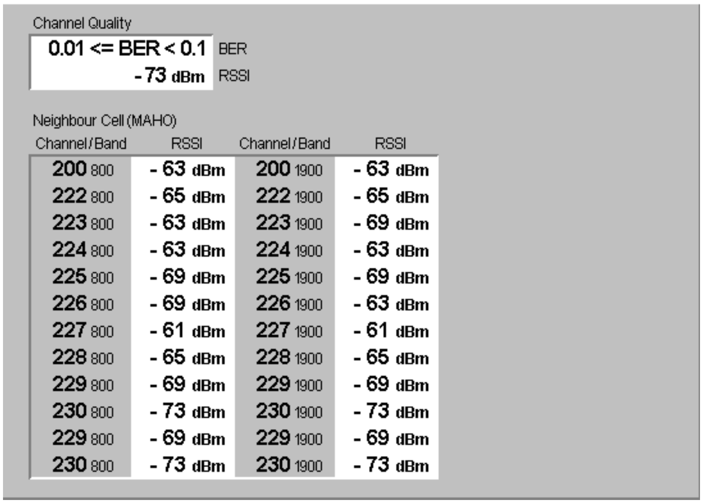
The *Extended MAHO* hotkey selects the extended MAHO test. In this application the CMU displays the BER and the RSSI in the current traffic channel plus the RSSI in up to 22 neighbor channels. Compared to the MAHO application, the BER is coded with a higher resolution and the RSSI scale contains ten additional levels; see Table 4-5 on p. 4.80 and Table 4-6 on p. 4.80. In addition, either the CIR or the WER in the current traffic channel is returned; see explanations in section *Measurement Results* on p. 4.78 ff.

This hotkey is disabled (grayed) if the mobile under test is not capable of providing an extended MAHO report (see also *Prerequisites* in section Receiver Quality Measurements on p. 4.76 ff.).

Remote control
No explicit switchover command. All single shot measurements are identified by the 2nd/3rd level keywords `...RXQuality:EMAHo...`

Measurement Results

In the *MAHO* application the BER and the RSSI in the current traffic channel plus the RSSI in up to 24 neighbor channels are displayed in two tables.



Channel Quality
0.01 <= BER < 0.1 BER
-73 dBm RSSI

Neighbour Cell (MAHO)

Channel/Band	RSSI	Channel/Band	RSSI
200 800	- 63 dBm	200 1900	- 63 dBm
222 800	- 65 dBm	222 1900	- 65 dBm
223 800	- 63 dBm	223 1900	- 69 dBm
224 800	- 63 dBm	224 1900	- 63 dBm
225 800	- 69 dBm	225 1900	- 69 dBm
226 800	- 69 dBm	226 1900	- 63 dBm
227 800	- 61 dBm	227 1900	- 61 dBm
228 800	- 65 dBm	228 1900	- 65 dBm
229 800	- 69 dBm	229 1900	- 69 dBm
230 800	- 73 dBm	230 1900	- 73 dBm
229 800	- 69 dBm	229 1900	- 69 dBm
230 800	- 73 dBm	230 1900	- 73 dBm

Fig. 4-43 Display of results (Receiver Quality – MAHO)

BER The *BER* output field indicates the channel quality (measured raw *BER* level reported by the mobile phone) in the current traffic channel.

According to the standard, the traffic channel quality is coded in terms of $2^3 = 8$ dimensionless levels. A high quality level implies a high bit error rate and thus a **poor** received signal quality. The CMU returns the actual BER range (right column of Table 4-3).

Table 4-3 Definition of BER Levels (MAHO)

Channel quality level	Bit error rate
0	0% ≤ BER < 0.01%
1	0.01% ≤ BER < 0.1%
2	0.1% ≤ BER < 0.5%
3	0.5% ≤ BER < 1%
4	1% ≤ BER < 2%
5	2% ≤ BER < 4%
6	4% ≤ BER < 8%
7	8% ≤ BER ≤ 100%

Remote control `[SENSe:]RXQuality:CQUality:BER?`

RSSI The *RSSI* output field indicates the received signal strength *(RSSI* reported by the mobile phone) in the current traffic channel. According to the standard, the RSSI information is coded in terms of $2^5 = 32$ dimensionless levels depending linearly on the absolute measured power. A large RSSI corresponds to a high received signal input power. The CMU returns the actual signal strength (right column of Table 4-4).

Table 4-4 Definition of RSSI levels (MAHO)

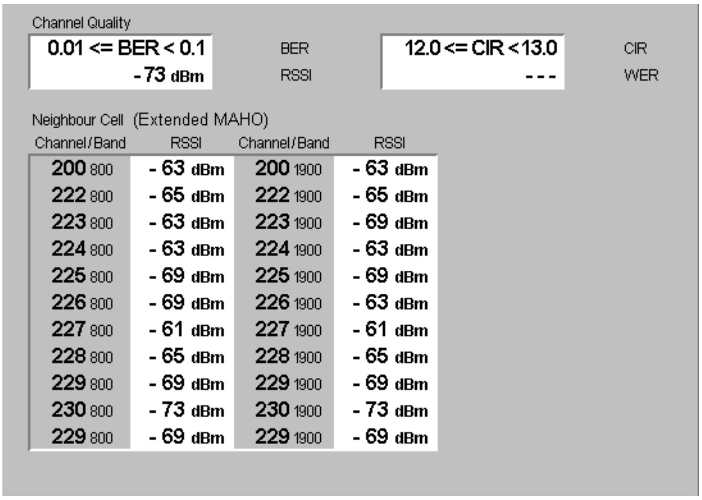
RSSI value	Signal strength
31	≥ –51 dBm
30	–53 dBm
29	–55 dBm
...	...
2	–109 dBm
1	–111 dBm
0	≤ –113 dBm

Remote control `[SENSe:]RXQuality:CQUality:RSSI?`

MAHO Table The *Neighbor Cell (MAHO)* table contains the channel numbers and RSSI (reported by the mobile phone) in up to 24 neighbor *channels (Neighbor Cell (MAHO)).* To obtain a non-empty table, the list of neighbor channels must be defined in the configuration menu; see section *Receiver Quality Configurations (Receiver Quality Configuration)* on p. 4.82 ff.

Remote control
```
[SENSe:]RXQuality:MAHO:NCELls?
[SENSe:]RXQuality:MAHO:NCELl<nr>?
```

In the *Extended MAHO* application the BER and the RSSI in the current traffic channel plus the RSSI in up to 22 neighbor channels are displayed in two tables. A third table contains either the CIR or the WER in the current traffic channel.



Channel Quality

0.01 <= BER < 0.1	BER	12.0 <= CIR < 13.0	CIR
-73 dBm	RSSI	---	WER

Neighbour Cell (Extended MAHO)

Channel/Band	RSSI	Channel/Band	RSSI
200 800	- 63 dBm	200 1900	- 63 dBm
222 800	- 65 dBm	222 1900	- 65 dBm
223 800	- 63 dBm	223 1900	- 69 dBm
224 800	- 63 dBm	224 1900	- 63 dBm
225 800	- 69 dBm	225 1900	- 69 dBm
226 800	- 69 dBm	226 1900	- 63 dBm
227 800	- 61 dBm	227 1900	- 61 dBm
228 800	- 65 dBm	228 1900	- 65 dBm
229 800	- 69 dBm	229 1900	- 69 dBm
230 800	- 73 dBm	230 1900	- 73 dBm
229 800	- 69 dBm	229 1900	- 69 dBm

Fig. 4-44 Display of results (Receiver Quality – Extended MAHO)

BER / RSSI The *BER* and *RSSI* output fields indicate the channel quality (measured raw *BER* level reported by the mobile phone) and the RSSI the current traffic channel. Compared to the MAHO application, the BER is coded with a higher resolution and the RSSI scale contains ten additional levels:

Table 4-5 Definition of BER Levels (Extended MAHO)

Channel quality level	Bit error rate
0	0% ≤ BER < 0.01%
1	0.01% ≤ BER < 0.1%
2	0.1% ≤ BER < 0.5%
3	0.5% ≤ BER < 1%
4	1% ≤ BER < 1.5%
5	1.5% ≤ BER < 2%
6	2% ≤ BER < 2.5%
7	2.5% ≤ BER < 3.0%
8	3.0 ≤ BER < 3.5%
9	3.5 ≤ BER < 4.0%
10	4.0 ≤ BER < 4.5%
11	4.5 ≤ BER < 5.0%
12	5.0 ≤ BER < 6.0%
13	6.0 ≤ BER < 7.0%
14	7.0 ≤ BER < 8.0%
15	8% ≤ BER ≤ 100%

Table 4-6 Definition of RSSI levels (Extended MAHO)

RSSI value	Signal strength
41	≥ –31 dBm
40	–33 dBm
39	–35 dBm
...	...
2	–110 dBm
1	–111 dBm
0	≤ –113 dBm

Remote control

```
[SENSe:]RXQuality:EMAHo:BER?
[SENSe:]RXQuality:EMAHo:RSSI?
```

MAHO Table The *Neighbor Cell (MAHO)* table contains the channel numbers and RSSI (reported by the mobile phone) in up to 23 neighbor *channels (Neighbor Cell (MAHO)).* To obtain a non-empty table, the list of neighbor channels must be defined in the configuration menu; see section *Receiver Quality Configurations (Receiver Quality Configuration)* on p. 4.82 ff.

Remote control

```
[SENSe:]RXQuality:EMAHo:NCELls?
[SENSe:]RXQuality:EMAHo:NCELls:CELL<nr>?
```

The quantities CIR and WER are measured alternatively, depending of the *Report Selection* parameter setting in the configuration menu. This is in accordance with the specification for the extended MAHO measurement given in the standard.

CIR The *CIR* output field indicates the Carrier to Interference Ratio of the forward DTC. This quantity equals to the ratio of (average received signal level) to (average interference plus noise) or an appropriate approximation evaluated by the mobile phone.

Table 4-7 Definition of CIR Levels

Channel quality level	Carrier to Interference Ratio (CIR)
0	CIR < 8.0 dB
1	8.0 ≤ CIR < 9.0 dB
2	9.0 ≤ CIR < 10.0 dB
3	10.0 ≤ CIR < 11.0 dB
4	11.0 ≤ CIR < 12.0 dB
5	12.0 ≤ CIR < 13.0 dB
6	13.0 ≤ CIR < 14.0 dB
7	14.0 ≤ CIR < 15.0 dB
8	15.0 ≤ CIR < 16.0 dB
9	16.0 ≤ CIR < 17.0 dB
10	17.0 ≤ CIR < 18.0 dB
11	18.0 ≤ CIR < 19.0 dB
12	19.0 ≤ CIR < 20.0 dB
13	20.0 ≤ CIR < 21.0 dB
14	21.0 <= CIR < 22.0 dB
15	CIR ≥ 22.0 dB

Remote control `[SENSe:]RXQuality:EMAHo:CIR?`

WER The *WER* output field indicates the Word Error Rate (WER) which equals the ratio of (number of incorrect received words) to (total number of transmitted words). A word is equal to a Layer 2 frame. Incorrect words are defined as having a CRC check that fails.

According to the standard, the control channel quality is expressed in terms of $2^4 = 16$ dimensionless WER levels. A high quality level implies a high WER and thus a **poor** received signal quality. The CMU returns the actual WER range (see Table 4-8).

Table 4-8 Definition of WER Levels

Channel quality level	Word Error Rate (WER)
0	0%
1	0 < WER ≤ 2%
2	2 < WER ≤ 4%
3	4 < WER ≤ 6%
4	6 < WER ≤ 8%
5	8 < WER ≤ 10%
6	10 < WER ≤ 12%
7	12 < WER ≤ 14%
8	14 < WER ≤ 18%
9	18 < WER ≤ 20%
10	20 < WER ≤ 25%
11	25 < WER ≤ 30%
12	30 < WER ≤ 40%
13	40 < WER ≤ 50%
14	50 < WER ≤ 60%
15	WER > 60%

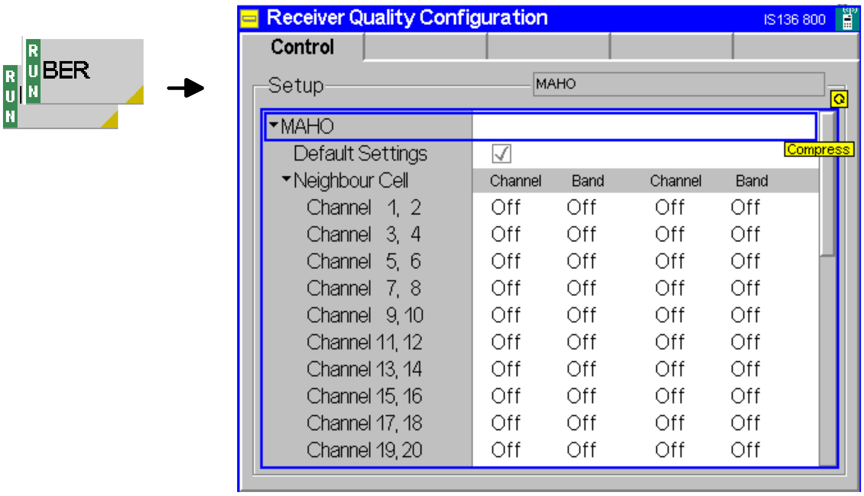
Remote control `[SENSe:]RXQuality:EMAHo:WER?`

Receiver Quality Configurations (Receiver Quality Configuration)

The popup menu *Receiver Quality Configuration* configures the *Receiver Quality* measurement. The popup menu *Receiver Quality Configuration* is called up by pressing the measurement control softkey in the top right of the in the *Receiver Quality* menu twice (this softkey reads MAHO or Extended MAHO, depending on the application selected).

The *Control* tab of the configuration menu determines:

- The list of traffic channel numbers in the neighbor cells *(Neighbor Cell)* for both the *MAHO* and the *Extended MAHO* application
- The additional measured quantity in the *Extended MAHO* application *(Report Selection)*



Receiver Quality Configuration IS136 800

Setup MAHO

MAHO

Default Settings ☑

Neighbour Cell

	Channel	Band	Channel	Band
Channel 1, 2	Off	Off	Off	Off
Channel 3, 4	Off	Off	Off	Off
Channel 5, 6	Off	Off	Off	Off
Channel 7, 8	Off	Off	Off	Off
Channel 9, 10	Off	Off	Off	Off
Channel 11, 12	Off	Off	Off	Off
Channel 13, 14	Off	Off	Off	Off
Channel 15, 16	Off	Off	Off	Off
Channel 17, 18	Off	Off	Off	Off
Channel 19, 20	Off	Off	Off	Off

Fig. 4-45 Receiver Quality – Control

Default Settings The *Default Settings* switches set all parameters of a given application to their default values. The default values are quoted in the command description in chapter 6 of this manual.

Remote control

```
CONFigure:RXQuality:MAHO:CONTrol:DEFault  ON | OFF
CONFigure:RXQuality:EMAHo:CONTrol:DEFault  ON | OFF
```

MAHO – Neighbor Cell The *Neighbor Cell* field defines a maximum of 24 forward traffic channel numbers in the neighbor cells. The mobile measures the RSSI on these neighbor channels and reports them to the tester (MAHO report, see section *Receiver Quality Measurements* on page 4.76 ff. If the *List Sorted* box is checked, the neighbor channel list is sorted according to the channel number.

IS 136 channel numbers between 1 and 799 and between 990 and 1023 are assigned in both the 800 MHz and the 1900 MHz hyperband (see Table 4-2 on p. 4.54). Therefore, to unambiguously determine the channels, the *Band* (800 or 1900) must be selected in addition. For unique 1900 MHz channels, the *Band* parameter is fixed to *1900*.

Remote control

```
CONFigure:RXQuality:MAHO:CONTrol:NCELls:CHANnel
CONFigure:RXQuality:MAHO:CONTrol:NCELls:BAND
CONFigure:RXQuality:MAHO:CONTrol:NCELls:CELL
CONFigure:RXQuality:MAHO:CONTrol:NCELls:LSORted
```

Extended MAHO – Report Selection

The *Report Selection* parameter determines which quantity is measured in addition to the BER (for traffic channels) and the RSSI.

CIR (disabled WER)	CIR measurement without WER measurement
WER (disabled CIR)	WER measurement without CIR measurement

Measurement of either the CIR or the WER is in accordance with the standard.

Remote control

```
CONFigure:RXQuality:EMAHo:CONTrol:RSELect
```

Extended MAHO – Neighbor Cell

The *Neighbor Cell* field defines a maximum of 22 forward traffic channel numbers in the neighbor cells. The mobile measures the RSSI on these neighbor channels and reports them to the tester (Extended MAHO report, see section *Receiver Quality Measurements* on page 4.76 ff. If the *List Sorted* box is checked, the neighbor channel list is sorted according to the channel number.

IS 136 channel numbers between 1 and 799 and between 990 and 1023 are assigned in both the 800 MHz and the 1900 MHz hyperband (see Table 4-2 on p. 4.54). Therefore, to unambiguously determine the channels, the *Band* (800 or 1900) must be selected in addition. For unique 1900 MHz channels, the *Band* parameter is fixed to *1900*.

Remote control

```
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CHANnel
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:BAND
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CELL
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:LSORted
```

Connection Control (Contd.)

The popup menu *Connection Control* controls the Signalling procedures (call setup and release, services, signalling parameters) and determines the inputs and outputs with the external attenuation values and the reference frequency.

The purpose of the *Signalling* test mode is to perform measurements with an existing call connection to the mobile station. Therefore the first two tabs for setting up the call (*Connection Control – Connection)* appear immediately after selection of the function group *IS 136 800/1900-MS Signalling* in the *Menu Select* menu*.* Alternatively, the *Connection Control* menu can be called up by pressing the softkey *Connect. Control* at the top right in every measurement menu; the individual tabs can be accessed via the hotkey bar at the lower edge of the screen. By pressing the *Escape* key, the *Connection Control* menu is closed and the CMU changes to the measurement mode.

The two tabs *Connection Control – Connection* displayed immediately after the function group *IS 136 800/1900-MS Signalling* is activated are described at the beginning of section *TDMA Mobile Tests (Signalling* on p. 4.60 ff. The remaining tabs of the *Connection Control – Connection* menu are described below.

Connection Control in the Registered State

The popup menu *Connection (Registered)* provides information on

- The current data of the mobile station *(Mobile registered)*,
- The status and result of the peak power measurement *(Wideband Power)*.

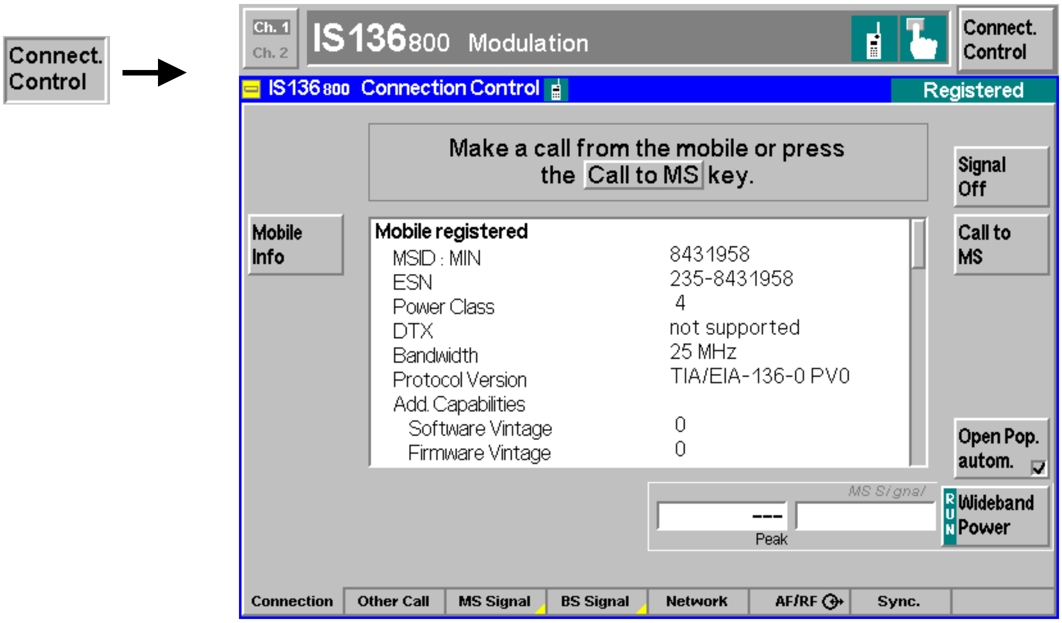
Besides, it contains softkeys which lead to other signalling states:

- Deactivation of the control channel signal for synchronization and call release to the mobile station *(Signal Off)*,
- Establishing a call to the mobile station (*Call to MS ->* state *Call Established),*

The popup menu *Connection (Registered)* is opened when a successful call (in which case the mobile is considered as being registered) is released *(Call Release* softkey in the *Alerting* or in the *Call Established* state, MS call release, loss of radio link) or when registration is initiated by the mobile phone. It is replaced by the *Connection (Alerting)* menu if the CMU initiates a call to the mobile phone (Softkey *Call to MS),* or by the *Connection (Call Established)* menu if the mobile phone initiates a call to the CMU, see Fig. 4-31.

Note: *If synchronization is lost during the operation (because of a low signal level etc.) the warning* Loss of radio link ! *will appear.*

At the same time, bit 2 is set in the STATus:OPERation register. The message window is closed after a while or after it is confirmed by pressing the ENTER *key.*



Make a call from the mobile or press the Call to MS key.

Mobile registered

MSID : MIN	8431958
ESN	235-8431958
Power Class	4
DTX	not supported
Bandwidth	25 MHz
Protocol Version	TIA/EIA-136-0 PV0
Add. Capabilities	
Software Vintage	0
Firmware Vintage	0

Fig. 4-46 Connection Control – Connection (Registered)

The function of the *Power* softkey is described in section *Connection Control with "Signal Off* on page 4.61, the softkey *Signal Off* in section *Connection Control with "Signal On* on page 4.63.

Mobile Info The table *Mobile Info* indicates the mobile parameters transferred to the CMU in the registration. A selection of the signalling parameters appears also when the call has been established (see section *Connection Control with Call Established* on page 4.89).

MSID	Type of code number used to identify the mobile phone. Depending on the mobile phone, one of the following four MSID types may be used: *TMSI 20* 20-bit Temporary Mobile Station Identity *TMSI 20* 24-bit Temporary Mobile Station Identity *MIN* 34-bit Mobile Station Identification Number *IMSI* 50-bit International Mobile Subscriber Id. Number Default values for all *MSID* types can be defined in the *Network* tab (see p. 4.102 ff.)
ESN	32-bit Electronic Serial Number, to be sent with every signalling message (only on request; if the ESN is switched off in the *Requested Mobile Data* section of the *Network* tab described on page 4.102 ff, it is not transmitted so the signalling process is speeded up)
Power Class	Power class of the mobile, see Table 4-9 on page 4.90
DTX	Discontinuous transmission mode capability
Bandwidth	Width of the whole RF band used (either 20 MHz or 25 MHz for both the 800 MHz and the 1900 MHz hyperband)
Protocol Version	Protocol standard of the mobile phone

If it is requested in the *Connection Control – Network* menu (see page 4.102 ff.), the *Capability Report* containing the following information on the mobile phone is displayed *(Add. Capabilities)*:

Software Vintage	Software version number
Firmware Vintage	Firmware version number
Model Number	Model number of mobile defined by the manufacturer

Manufacturer Code	Information element identifying the mobile station manufacturer
Max. Supp. PFC	Max. Paging Frame Class, interval between occurrences of a mobile's paging channel
SOC Support	Support of 12-bit System Operator Code used to identify a licensed service provider
BSMC Support	Support of 8-bit Base Station Manufacturer's Code used to identify the manufacturer of the network infrastructure
Async. Data Supp.	Support of asynchronous data service (digital circuit-switched data service)
G3 Fax Support	Support of group 3 fax service (digital circuit-switched data service)
SMS Broadcast S.	Support of broadcast short message service
Subaddressing S.	Support of subaddressing
Supported Freq. B.[2]	Support of the individual frequency bands listed in Table 4-2 on page 4.54 ff.
IRA Support	Support of IRA address encoding
User Group Support	Support of user groups
800 MHz Ana. Sup.[2]	Analog speech support in the 800 MHz band (AMPS)
DTC Supp.	Support of full-rate, half-rate, double or triple-rate digital traffic channels
STU-III Supp.	Support of STU-III Secure Terminal Unit
Voice Coder Map	List of voice coders supported by the mobile (not provided by all mobiles)
Complete Model No.	Complete 8-bit model number defined by the manufacturer
Alternate SOC S.	12-bit system operator code used to identify the system provider
Multilingual S. Map I.	Multilingual support of the mobile phone
FACCH/SACCH ARQ Map	Support of FACCH/SACCH ARQ mode on the DTCs (ARQ = Automatic Retransmission Response)
DADS Support Info	Support of DADS operation
Encryption and Privacy Map	Identification of the encryption and privacy modes supported by the mobile station
Advice Support	Support of ADVICE

The *Capability Report* is transmitted on request every time the mobile station is switched on. If the *Capability Report* is switched off in the *Requested Mobile Data* section of the *Network* tab, the mobile phone doesn't transmit the information so the signalling process is faster.

Note on Other Call / Handoff Procedures:

The information on the *Supported Frequency Bands* and the *800 MHz Analog Support* reported by the mobile is used to check – and possibly restrict – the default destination network list for *Other Call* and *Handoff* procedures (see p. 4.92 ff.). If the *Capability Report* is switched off, this information is only available after a call has been established.

Other Calls, which are always initiated in the *Registered* state, may fail if a destination network that is not supported by the mobile under test is selected. To exclude this, either the mobile station must be known or the capability report must be requested when the mobile is switched on (see *Requested Mobile Data* section

---

[2] See *Note on Other Call / Handoff Procedures* at the end of this paragraph.

of the *Network* tab).

Handoffs are always initiated in the *Call Established* state so that the destination network list displayed is correct. Moreover, the *Mobile Info* is stored and therefore available in the destination network, too.

Remote control `[SENSe:]MSSinfo:...?`

Call to MS

The softkey *Call to MS* sets up a call to the mobile station.

A user prompt below the header indicates the function of this softkey. On pressing it the message *Paging in progress ...* is displayed below the header. As soon as the mobile responds (rings), the CMU changes to the signalling state *Alerting.* When the mobile is picked up, the CMU changes to the signalling state *Call Established*.

Remote control `PROCedure:Signalling:ACTion CTM`

Open Pop. autom. ☐

The softkey *Open Pop. autom.* contains a field which activates or suppresses the display of the popup menu *Connection (Registered)*.

- In the default setting (*Open Pop. autom.* on), the popup menu is displayed each time the *Registered* state is reached (due to a change of the signalling state or function group).
- In the alternative setting (*Open Pop. autom.* off), the popup-menu is suppressed. Signalling may still be controlled, e.g., via the mobile. Moreover, the popup menu *Connection (Registered)* can also be opened explicitly by pressing the corresponding hotkey in the menu group *Connection Control*.

Remote control –

Connection Control in the Alerting State

The popup menu *Connection (Alerting)* provides information on

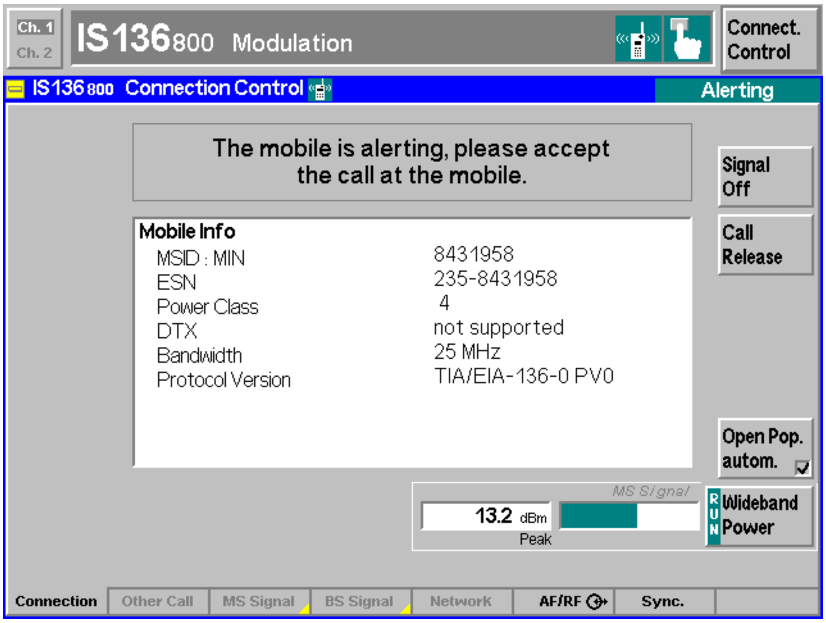
- The characteristics of the registered mobile station *(Mobile info)*
- The status and result of the peak power measurement *(Power)*

Besides, it contains softkeys which lead to other signalling states:

- Deactivation of the control channel signal for synchronization and call release *(Signal Off)*
- *Call Release* while keeping the control channel signal switched on (-> state *Registered)*

The popup menu *Connection (Alerting)* is opened while the mobile phone is ringing during a call setup *(Call to MS* softkey in the *Signal On* or in the *Registered* state). It is replaced by the *Connection (Call Established)* menu when the mobile phone accepts the call (is picked up*),* or by the *Connection (Registered)* menu if the call is released *(Call Release* softkey, MS call release, alert timeout after 5 page messages, loss of radio link), see Fig. 4-31.

Connect. Control →



The mobile is alerting, please accept the call at the mobile.

Mobile Info

MSID : MIN	8431958
ESN	235-8431958
Power Class	4
DTX	not supported
Bandwidth	25 MHz
Protocol Version	TIA/EIA-136-0 PV0

13.2 dBm

Fig. 4-47 Connection Control – Connection (Alerting)

The function of the *Power* softkey is described in section *Connection Control with "Signal Off* on page 4.61, the softkey *Signal Off* in section *Connection Control with "Signal On* on page 4.63.

Mobile Info The table *Mobile Info* indicates the characteristics of the called mobile station. All parameters are already displayed in the *Registered* state and described on page 4.84 ff.

Remote control `SENSe:MSSinfo:...?`

Call Release

The *Call Release* softkey releases the call connection to the mobile station. The CMU changes to the signalling state *Registered*.

Note: *Before the call is released from either the CMU or the mobile, the mobile stores the current control channel number. This control channel information can be used to attempt a subsequent call setup without scanning the whole IS 136 channel range. This not only speeds up consecutive call attempts between the CMU and the same mobile but also prevents the mobile from connecting to a real network competing with the tester.*

Remote control `PROCedure:Signalling:ACTion CRELease`

Close Pop. autom. ☐

The softkey *Close Pop. autom.* contains a button which can be used to close the menu *Connection (Alerting)* automatically when a call is set up.

- In the default setting (*Close Pop. autom.* on), the popup menu is closed as soon as the signalling state *Alerting* is reached or a handoff is performed.
- In the alternative setting (*Close Pop. autom.* off), the popup-menu must be closed explicitly (e.g. via the *Escape* key) to continue the measurement.

Remote control –

Connection Control with Call Established (Signalling State Call Established)

The popup menu *Connection (Call Established)* provides information on

- A selection of signalling parameters of the mobile station *(Mobile Info)*
- The status and result of the peak power measurement *(Wideband Power)*

It contains softkeys leading to other signalling states (see Fig. 4-31):

- Deactivation of the signal for synchronization and call release to the mobile station *(Signal Off)*
- Call release to mobile station (*Call Release* -> state *Registered)*

It permits the following network and signal parameters to be entered:

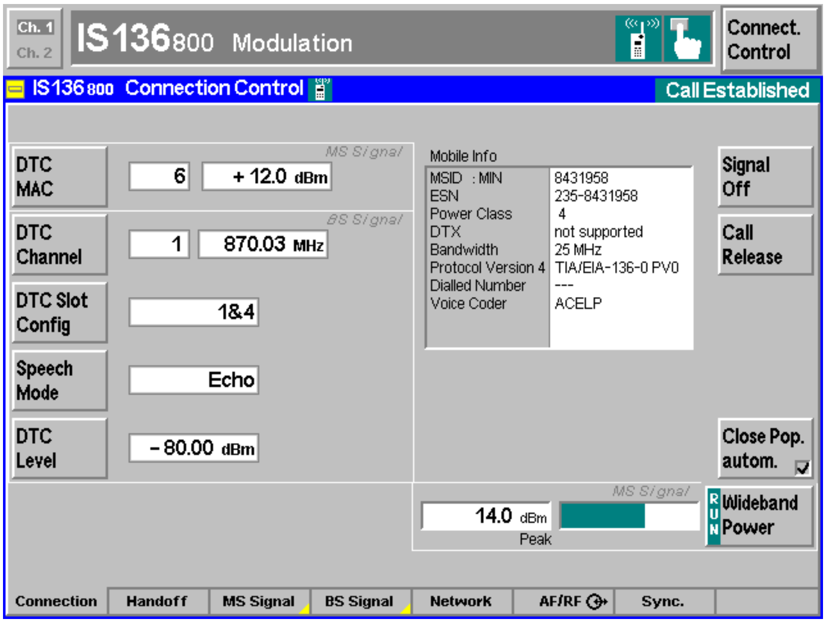
- Digital mobile attenuation code in the MS traffic channel *(DTC MAC)*
- Number and frequency of the BS traffic channel *(DTC Channel)*
- Time slot configuration in the BS traffic channel *(DTC Slot Config.)*
- Way of returning the data received from the mobile *(Speech Mode)*
- Level of the BS traffic channel *(DTC Level)*

The popup menu *Connection (Call Established)* is opened when a call is initiated by a mobile station which is already registered *(Signal On* or *Registered* state), or after a call initiated by the CMU is accepted by the mobile station. It is replaced by the *Connection (Signal Off)* menu when the DCCH signal is switched off *(Signal Off* softkey) or if the mobile is switched off, or by the *Connection (Registered)* menu if the call is released *(Call Release* softkey, MS call release, loss of radio link), see Fig. 4-31.

Note: *If the synchronization is lost during operation (because of a low signal level etc.) the warning* Loss of radio link ! *will appear.*

At the same time, bit 2 is set in the STATus:OPERation register. Prior to further operation, confirm the reception of the message by pressing the ENTER *key.*

Connect. Control →



DTC MAC: 6, + 12.0 dBm

DTC Channel: 1, 870.03 MHz

DTC Slot Config: 1&4

Speech Mode: Echo

DTC Level: – 80.00 dBm

Mobile Info

MSID : MIN	8431958
ESN	235-8431958
Power Class	4
DTX	not supported
Bandwidth	25 MHz
Protocol Version 4	TIA/EIA-136-0 PV0
Dialled Number	---
Voice Coder	ACELP

Peak: 14.0 dBm

Fig. 4-48 Connection Control – Connection (Call Established)

The function of the softkeys *Signal Off* and *Power* is described in section *Connection Control without Signal* on page 4.61. The softkeys Call Release and Close Pop. autom. are described in the previous section, *Connection Control in the Alerting State*.

The *MS Signal* panel contains the *DTC MAC* softkey.

DTC MAC

The *DTC MAC* softkey sets the mobile attenuation code.

The DTC MAC can be entered either as a dimensionless number or a maximum output power in dBm. For a definition of the MAC scale and the corresponding maximum output powers see Table 4-9 on page 4.90.

Remote control `PROCedure:SIGNalling[:DTC]:MAC  0 to 10`

IS 136 mobile phones are divided into different power classes according to their maximum output power: The nominal Effective Radiated Power *(ERP)* of a mobile (which is the average power of the mobile while in digital mode) depends on both its power class and the MAC. The ERP values and the tolerance limits in the following table are taken from the TIA/EIA standard.

Table 4-9: IS 136 Power classes and mobile attenuation codes (MAC)

MAC	ERP in dBm, IS 136 800				Tolerance in dB	ERP in dBm, IS 136 1900		Tolerance in dB
	Class I	Class II	Class III	Class IV		Class II	Class IV	
0	36	32	28	28	+2 / –4	30	28	+2 / –4
1	32	32	28	28	+2 / –4	30	28	+2 / –4
2	28	28	28	28	+2 / –4	28	28	+2 / –4
3	24	24	24	24	+2 / –4	24	24	+2 / –4
4	20	20	20	20	+2 / –4	20	20	+2 / –4
5	16	16	16	16	+2 / –4	16	16	+2 / –4
6	12	12	12	12	+2 / –4	12	12	+2 / –4
7	8	8	8	8	+2 / –4	8	8	+2 / –4
8	8	8	8	4 ± 3 dB	+2 / –6	4 ± 3 dB	4 ± 3 dB	+2 / –6
9	8	8	8	0 ± 6 dB	+2 / –6	0 ± 6 dB	0 ± 6 dB	+2 / –6
10	8	8	8	–4 ± 9 dB	+2 / –6	–4 ± 9 dB	–4 ± 9 dB	+2 / –6

Note: *The ERP requirements in Table 4-9 above must be satisfied by the complete mobile station transmitter consisting of the mobile station and the antenna system that includes any interconnecting cable (TIA/EIA-136-270, Sect. 1.3 C). If the mobile station uses an antenna system with known gain or loss that is to be connected to the Transceiver Unit RF output connector, the antenna gain or loss can be compensated for by setting an appropriate external input attenuation* (Ext. Att. Input) *at the CMU; see section* AF/RF Connectors (Connection Control – AF/RF) *on p. 4.105 ff.*

The panel *BS Signal* contains two softkeys which are used for configuration of the CMU's forward traffic channel signals. All these parameters can also be set in the *BS Signal* tab; see section *Signals of the CMU (Connection Control – BS Signal)* on p. 4.99 ff.

DTC Channel

The *DTC Channel* softkey determines the number of the forward digital traffic channel and the corresponding RF frequency.

It is sufficient to enter one value; the other one is automatically determined according to the IS 136 channel assignment. For an overview of IS 136 channels in the forward path see Table 4-2 on p. 4.54.

Remote control

```
PROCedure:SIGNalling[:DTC]:CHANnel  <Channel>
CONFigure:BSSignal[:DTC]:CHANnel  <Channel>
```

DTC Slot Config.

The *DTC Slot Config.* softkey specifies the two timeslots of a TDMA frame which are paired to form a full-rate traffic channel.

A full-rate traffic channel is composed of a timeslot pair separated by 20 ms so that the combinations 1&4, 2&5, and 3&6 are allowed.

Remote control

```
PROCedure:SIGNalling[:DTC]:SLOTconfig C14| C25 | C36
CONFigure:BSSignal[:DTC]:SLOTconfig C14| C25 | C36
```

Speech Mode

The *Speech Mode* softkey determines how the CMU returns the data received from the mobile. This parameter is relevant for testing the quality of a call.

Echo	Loop-back mode with delay. The CMU sends back all data received on the DTC after 25 TDMA frames, corresponding to 1 s (50 timeslots for full-rate channels). If the CMU does not receive speech data in this operating mode, a bit pattern is automatically sent, producing "silence" in the receiver of the mobile station.
Loop	Loop-back mode with minimum delay: The CMU sends back all data received on the DTC after 20 ms.
Handset	The CMU sends and receives speech frames that are routed to the internal speech codec (option CMU-B52). The speech codec converts digital speech signals into analog signals and vice versa. Analog AF output signals are provided via the SPEECH connector at the front panel of the instrument. The analog AF input signal at the SPEECH connector is amplified by 22.5 dB. This setting requires the CMU to operate with an ACELP voice coder. It can be used for separate forward and reverse audio application measurements, e.g. by setting up a voice connection between the CMU and the mobile via an R&S Handset.

Note: *Option CMU-B41, Audio Generator and Analyzer, provides an additional test functionality for audio signals. See section AF/RF Connectors (Connection Control – AF/RF) on p. 4.105 ff. and description of CMU-B41 in the CMU200/300 operating manual.*

Remote control

```
CONFigure:BSSignal:SPEech ECHO | LOOP |HSET
```

DTC Level

The *DTC Level* softkey defines the level in dBm of the forward traffic channel.

Remote control

```
PROCedure:BSSignal[:DTC]:LEVel
CONFigure:BSSignal[:DTC]:LEVel
```

Mobile Info

The table *Mobile Info* indicates the characteristics of the connected mobile station:

Dialed Number	Number dialed at the mobile station (Call from MS),
Voice Coder	Vocoder model of the mobile station.

The remaining parameters are already displayed in the *Registered* state and described on page 4.84 ff.

Remote control

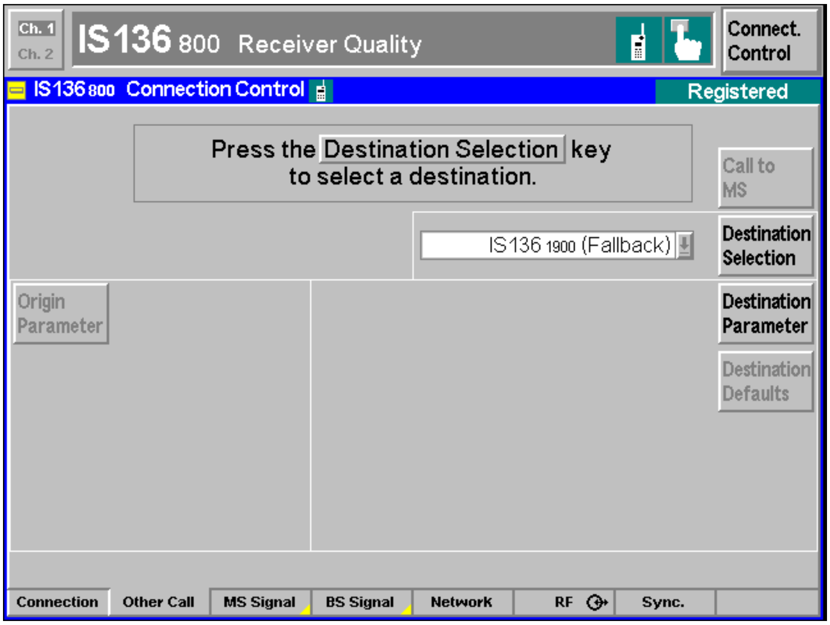
```
[SENSe:]MSSinfo...
```

Call to Another Network (Connection Control – Other Call)

The *Other Call* tab sets up a call from the current *(Origin)* to a different *(Destination)* network. While the call is still set up in the origin network (via DCC), the traffic channel is in the destination network (via DTC). Therefore, in contrast to a *Handoff* procedure (see p. 4.94), an *Other Call* is possible in the *Signal On* or *Registered* signalling states only. The call process includes:

- Selection of the target network *(Destination Selection)* and special parameters of this network *(Destination Parameter, Destination Defaults)*
- Start of the call procedure *(Call to MS)*
- Return to of the original network *(Origin Parameter)*

Connect. Control →



Press the Destination Selection key to select a destination.

IS136 1900 (Fallback)

Fig. 4-49 Connection Control – Other call (destination selection)

Destination Selection

The softkey *Destination Selection* selects the target network for the call.

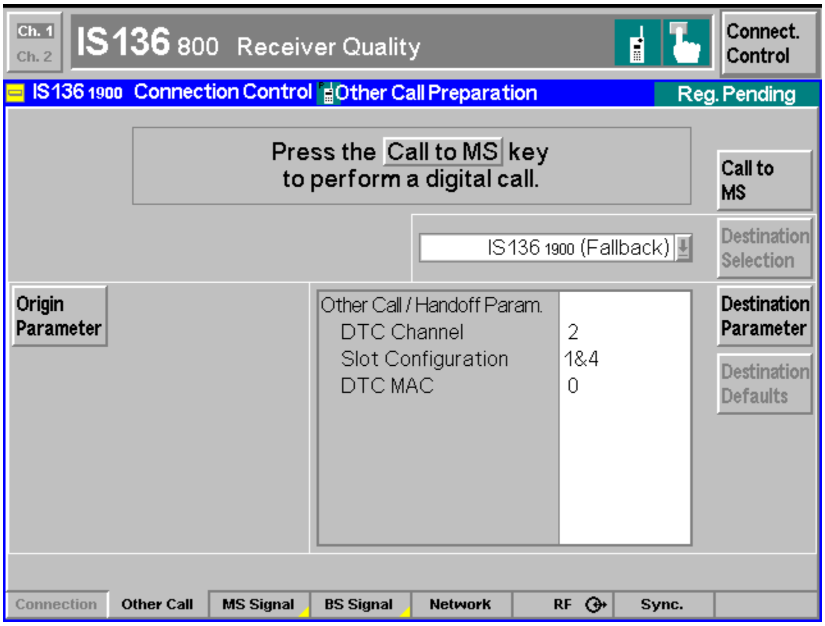
If the current function group corresponds to one of the two IS 136 bands, the default list of target networks contains the other IS 136 band and to the analog AMPS network. Furthermore, an *Other Call* destination with fallback (e.g. *AMPS (Fallback))* means that the CMU returns to the function group of the origin network after the call is released. The target network list may be restricted if the mobile under test does not support all target networks.

Note: *The* Destination Selection *list is automatically adapted to the connected mobile when the mobile* Capability Report *is received (parameters* Supported Freq. B. *and* 800 MHz Ana. Sp. Support*, see description of* Mobile Info *table on page 4.85. If the* Capability Report *is not requested (see section* Network Parameters (Connection Control – Network) *on page 4.102), the full (default) list is displayed and care must be taken to select a target network supported by the mobile.*

Once the selection of the target network is confirmed via *Enter,* the CMU changes to the *Reg. Pending* signalling state. In this state, the entire *Connection Control* menu is mapped onto the target function group, so it is possible to edit the *Destination Parameters* (see below), the *BS Signal*, and the *Network* parameters of the target network.

Remote control
```
STATus:OCALl:TARGet:LIST?
CONFigure:OCALl:TARGet <Target>
```

Note: Reg. Pending *is an intermediate signalling state that only occurs in the context of an Other Call process and is therefore not shown in Fig. 4-31 (page 4.61). For a complete overview of signalling states see Fig. 6.1 in chapter 6 of this manual.*



Press the Call to MS key
to perform a digital call.

Other Call / Handoff Param.
DTC Channel 2
Slot Configuration 1&4
DTC MAC 0

Fig. 4-50 Connection Control – Other Call (destination network preparation)

Destination Parameter

The *Destination Parameter* softkey sets important target network parameters that come into effect as soon as the call is established.

The entries depend on the target network selected via *Destination Selection*. For IS 136 destination networks, the following list is provided:

DTC Channel	Number of the digital traffic channel used in the destination network.
Slot Configuration	Numbers of two timeslots (1&4, 2&5, 3&6) that will be combined to form a full-rate traffic channel.
DTC MAC	Mobile attenuation code (set at the mobile), see Table 4-9 on page 4.78.

More destination parameters can be set in the *BS Signal* (see p. 4.96 ff.) and the *Network* tabs (see p. 4.102 ff.).

Remote control
```
CONFigure:BSSignal:OCHandoff[:DTC]:CHANnel <Channel>
CONFigure:BSSignal:OCHandoff[:DTC]:SLOTconfig C14 | C25 | C36
CONFigure:NETWork:OCHandoff[:MS]:DTCmac <MAC>
```

Destination Defaults

The *Destination Defaults* softkey resets all changed *Destination Parameters* to default values.

The softkey is disabled if no changes have been made in the *Destination Parameter* list.

Remote control
```
CONFigure:BSSignal:OCHandoff[:DTC]:CHANnel DEF
CONFigure:BSSignal:OCHandoff[:DTC]:SLOTconfig DEF
CONFigure:NETWork:OCHandoff[:MS]:DTCmac DEF
```

Call to MS

The *Call to MS* initiates the call to the target network.

Remote control `PROCedure:SIGNalling:ACTion OCALl`

Origin Parameter

The *Origin Parameter* softkey cancels the *Other Call* and resets the CMU to the previous signalling state *(Signal On* or *Registered;* see Fig. 4-49*)*.

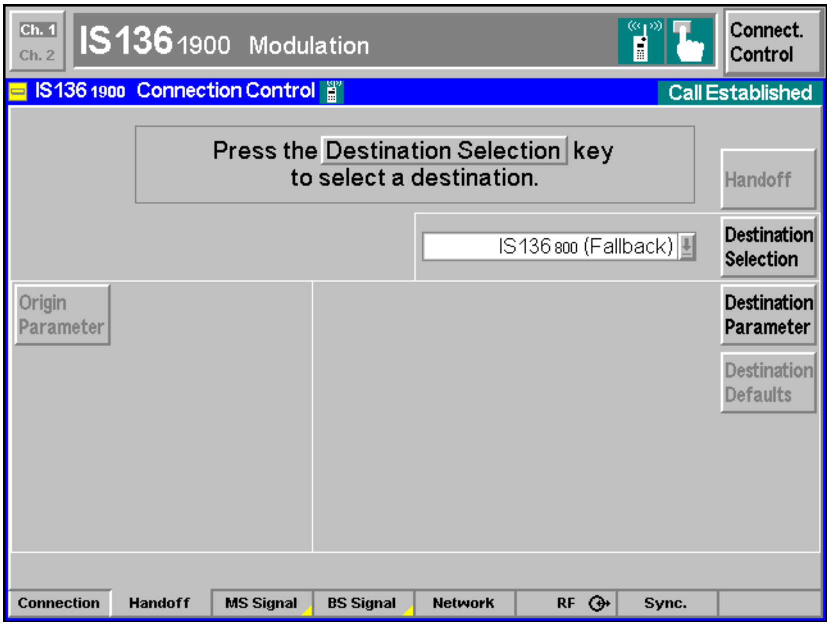
The destination parameters set in the *Reg. Pending* state are maintained. To drop the *Other Call* and return to the measurement mode, press the *ESCAPE* key or the *Connection Control* softkey.

Handoff to another Network (Connection Control – Handoff)

The *Handoff* tab initiates a handoff of the call connection to a different network. It is therefore available in the *Call Established* signalling state only. The handoff process includes:

- Selection of the target network *(Destination Selection)* and the handoff parameters *(Destination Parameter, Destination Defaults)*
- Start of the handoff procedure *(Handoff)*
- Return to the original network *(Origin Parameter)*

Connect. Control →



Press the Destination Selection key to select a destination.

Fig. 4-51 Connection Control – Handoff (destination selection)

Destination Selection

The softkey *Destination Selection* selects the target network for handoff.

If the origin network is one of the two IS 136 bands, the default list of target networks contains the other IS 136 band and to the analog AMPS network. Furthermore, a *Handoff* destination with fallback (e.g. *AMPS (Fallback))* means that the CMU returns to the function group of the origin network after the call is released. The target network list may be restricted if the mobile under test does not support all target networks.

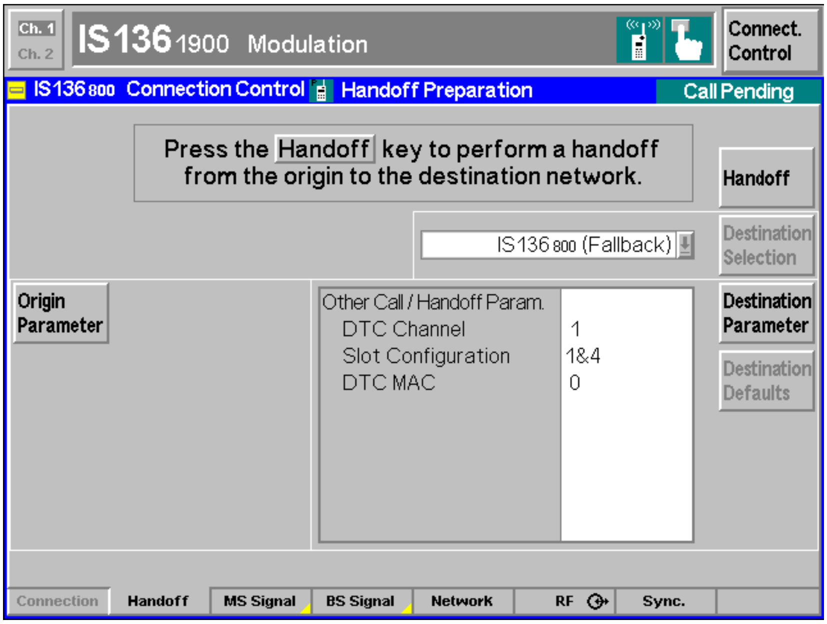
Note: *The* Destination Selection *list is automatically adapted to the connected mobile (parameters* Supported Freq. B. *and* 800 MHz Ana. Sp. Support *in the* Capability Report*, see description of* Mobile Info *table on page 4.85.*

Once the selection of the target network is confirmed via *Enter,* the CMU changes to the *Call Pending* signalling state. In this state, the entire *Connection Control* menu is mapped onto the target function group, so it is possible to edit the *Destination Parameters* (see below), the *BS Signal*, and the *Network* parameters of the target network.

Remote control

```
STATus:HANDoff:TARGet:LIST?
CONFigure:HANDoff:TARGet <Target>
```

Note: Call Pending *is an intermediate signalling state that only occurs in the context of a handoff process and is therefore not shown in Fig. 4-31 (page 4.61). For a complete overview of signalling states see Fig. 6.1 in chapter 6 of this manual.*


Press the Handoff key to perform a handoff from the origin to the destination network.

Other Call / Handoff Param.
DTC Channel 1
Slot Configuration 1&4
DTC MAC 0

Fig. 4-52 Connection Control – Handoff (destination network preparation)

Destination Parameter

The *Destination Parameter* softkey sets important target network parameters that come into effect as soon as the call is handed off.

The entries depend on the target network selected via *Destination Selection*. For IS 136 destination networks, the following list is provided:

DTC Channel	Number of the digital traffic channel used in the destination network.
Slot Configuration	Numbers of two timeslots (1&4, 2&5, 3&6) that will be combined to form a full-rate traffic channel.
DTC MAC	Mobile attenuation code (set at the mobile), see Table 4-9 on page 4.90.

More destination parameters can be set in the *BS Signal* (see p. 4.96 ff.) and the *Network* tabs (see p. 4.102 ff.).

Remote control

```
CONFigure:BSSignal:OCHandoff[:DTC]:CHANnel <Channel>
CONFigure:BSSignal:OCHandoff[:DTC]:SLOTconfig C14 | C25 | C36
CONFigure:NETWork:OCHandoff[:MS]:DTCmac <MAC>
```

Destination Defaults

The *Destination Defaults* softkey resets all changed *Destination Parameters* to default values.

The softkey is disabled if no changes have been made in the *Destination Parameter* list.

Remote control

```
CONFigure:BSSignal:OCHandoff[:DTC]:CHANnel DEF
CONFigure:BSSignal:OCHandoff[:DTC]:SLOTconfig DEF
CONFigure:NETWork:OCHandoff[:MS]:DTCmac DEF
```

Handoff

The *Handoff* initiates handoff to the target network.

Remote control

```
PROCedure:SIGNalling:ACTion HANDoff
```

Origin Parameter

The *Origin Parameter* softkey cancels the *Handoff* procedure and resets the CMU to the *Call Established* signalling state (see Fig. 4-51).

The destination parameters set in the *Call Pending* state are maintained. To drop the *Handoff* procedure and return to the measurement mode, press the *ESCAPE* key or the *Connection Control* softkey.

Signals of the Mobile Phone (Connection Control – MS Signal)

The popup menu *MS Signal* configures the signals of the mobile phone and the RF input path. The functionality of the menu depends on the signalling state:

- Most signal parameters must be set before a call is attempted to the mobile station. They are available in the signalling states Signal Off, Signal On and Registered (otherwise grayed). These parameters are listed in a table-oriented version of the MS Signal tab.
- The Mobile Attenuation Code *(DTC MAC)* can still be changed after the call has been set up, i.e. in the signalling state *Call Established*. This parameter is listed in a softkey-oriented version of the *MS Signal* tab.

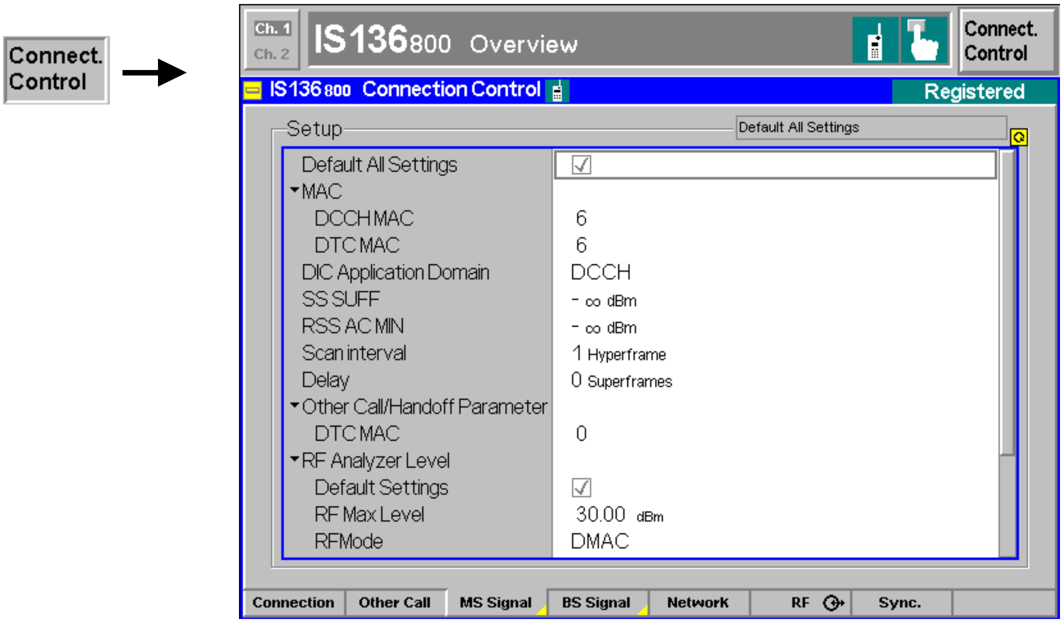
The *MS Signal* hotkey toggles between the two versions if it is pressed repeatedly.

Table-Oriented Version

The table-oriented version of the *MS Signal* tab configures the signals of the mobile phone (default values; see note on *current vs. default values* on p. 4.65) and the RF input path of the CMU. This includes:

- The output power of the mobile station *(MAC)* and various control channel parameters
- For processes switching between different networks, the DTC MAC in the destination network *(Other Call/Handoff Parameters)*
- The RF input path configuration *(RF Analyzer Level)*
- The *Trigger* settings

All settings are available in the signalling states *Signal Off, Signal On,* and *Registered.*



Default All Settings	☑
▾MAC	
DCCH MAC	6
DTC MAC	6
DIC Application Domain	DCCH
SS SUFF	- ∞ dBm
RSS AC MIN	- ∞ dBm
Scan interval	1 Hyperframe
Delay	0 Superframes
▾Other Call/Handoff Parameter	
DTC MAC	0
▾RF Analyzer Level	
Default Settings	☑
RF Max Level	30.00 dBm
RFMode	DMAC

Fig. 4-53 Connection Control – MS Signal (table)

Default Settings The *Default All Settings* switch assigns default values to all settings in the *MS Signal* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, a default switch is provided for some of the individual table sections.

DCCH MAC / DTC MAC The MAC levels *(mobile attenuation code)* determine the output power (for both the DCCH and DTC) at which the mobile station sets up a call to the network and performs a registration. The MAC scale defined in the TIA/EIA standard is listed in section *Connection Control with Call Established* on page 4.89 ff.

Remote control
```
CONFigure:NETWork[:MS]:DCCMac  <MAC>
CONFigure:NETWork[:MS]:DTCMac  <MAC>
```

DIC Application Domain The parameter *DIC Application Domain* determines whether DIC (delay interval compensation) is applied in traffic channel (DTC) or control channels (DCCH).

Remote control
```
CONFigure:NETWork[:MS]:DIC  DCCH | DTC
```

SS SUFF The parameter *SS SUFF* defines the received signal strength from a preferred candidate DCCH above which the mobile may reselect to it, or the received signal strength on the current DCCH below which the mobile may reselect to another control channel. According to the standard, the permissible range of values is –111 dBm to –51 dBm in 2 dB steps, and – ∞ (channel reselection switched off).

Remote control
```
CONFigure:NETWork[:MS]:SUFF  <Suff>
```

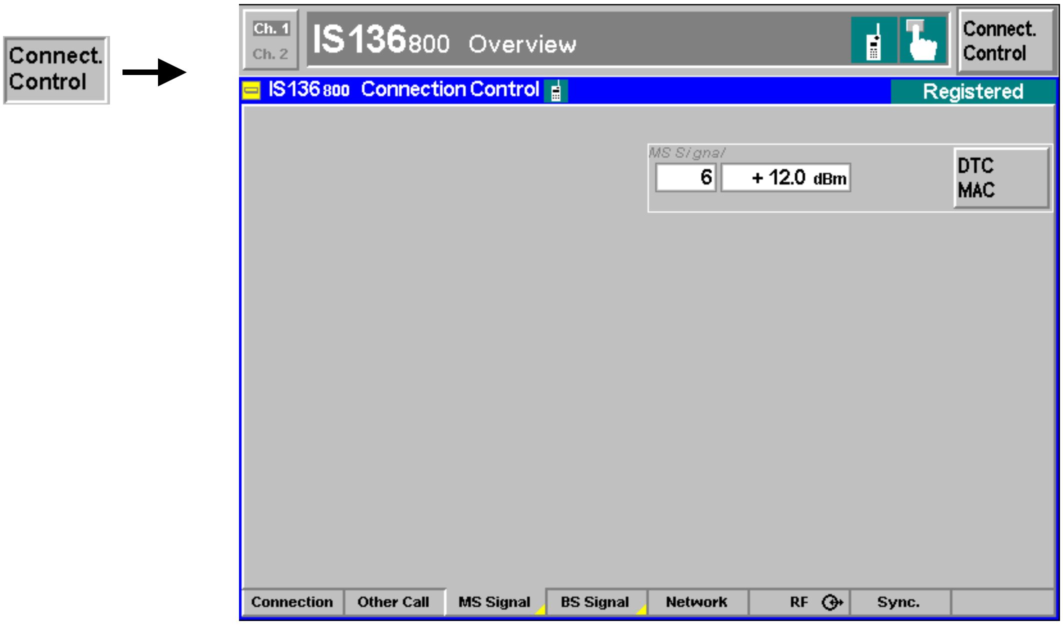
RSS ACC MIN The parameter *RSS ACC MIN* defines the minimum received signal strength at the mobile required to access a DCCH. According to the standard, the permissible range of values is –111 dBm to –51 dBm in 2 dB steps, and – ∞ (DCCH access always possible).

Remote control
```
CONFigure:NETWork[:MS]:RAMin  <Level>
```

Scan Interval	The parameter *Scan Interval* defines an interval between two consecutive signal strength measurements on candidate control channels for reselection purposes. According to the standard, the scan interval may range between 1 and 16 hyperframes.
Remote control	`CONFigure:NETWork[:MS]:SCANinterval  <Interv>`
Delay	The parameter *Delay* defines a minimum period of time the mobile must obtain service on the current DCCH before considering DCCH reselection. According to the standard, the permissible range is 0 to 105 superframes (in 15-superframe steps) and 105 to 420 superframes (in 45-superframe steps).
Remote control	`CONFigure:NETWork[:MS]:DELay  <Delay>`
Shortened Burst Indicator	The parameter *Shortened Burst Indicator* specifies which DCCH burst type (normal burst or shortened burst) is transmitted after a handoff. See figures in section *Limit Lines* on page 4.15 ff. and section *Measurement menu Power* on page 4.66 ff.
Remote control	`CONFigure:NETWork[:MS]:SBINdicator  NORMal | SHORtened`
Other Call / Handoff Parameter	The *Other Call / Handoff Parameter* section defines the *DTC MAC* of the current network, which comes into effect if the call is set up or handed off from another network; see sections *Call to Another Network (Connection Control – Other Call)* on page 4.92 and *Handoff to another Network (Connection Control – Handoff)* on page 4.94. This can be used to set parameters that are relevant for a call connection without actually setting up a call.
Remote control	`CONFigure:NETWork:OCHandoff[:MS]:DTCMac <MAC>`
RF Analyzer Level	The *RF Analyzer Level* section configures the RF input signal path. All settings are identical to the corresponding settings in *Non Signalling* mode *(Analyzer* tab of the *Connection Control* menu; see section *Table-Oriented Version* on p. 4.49 ff.). In addition, the RF level can also be set according to the DTC MAC of the mobile phone (setting *RF Mode = DMAC)*.
Remote control	`[:SENSe]:LEVel...`
Trigger	The *Trigger* section defines the trigger settings for the measurements. Most settings are identical to the corresponding settings in *Non Signalling* mode *(Analyzer* tab of the *Connection Control* menu; see section *Table-Oriented Version* on p. 4.49 ff.). In contrast to the *Non Signalling* mode, no external trigger signal (setting *Source = External)* can be used. Instead, the measurements can be triggered by the signalling unit of the CMU (setting *Source = Signalling).*
Remote control	`TRIGger[:SEQuence]...`

Softkey-Oriented Version

The softkey-oriented version of the *MS Signal* tab sets the Mobile Attenuation Code *(DTC MAC)*. This parameter can be set in the signalling states *Signal Off, Signal On* and *Registered* (default value). However, it can still be changed while a call connection is established (current value, signalling state *Call Established)*. See note on *current vs. default values* on p. 4.65.



MS Signal 6 + 12.0 dBm

Fig. 4-54 Connection Control – MS Signal (softkey)

The MAC scale defined in the standard is listed in Table 4-9 on page 4.90 ff.

Signals of the CMU (Connection Control – BS Signal)

The popup menu *BS Signal* configures the signals of the CMU (which simulates a base station transmitting a control channel (DCCH) and a traffic channel (DTC) signal), selects the speech coder and transmit data. The functionality of the menu depends on the signalling state:

- Most signal parameters must be set before a call is set up to the mobile station. They are available in the signalling states *Signal Off, Signal On* and *Registered*. These parameters are listed in a table-oriented version of the *BS Signal* tab.
- The DTC level and the speech mode can still be changed after the call has been set up, i.e. in the Signalling state *Call Established*. These parameters are listed in a softkey-oriented version of the *BS Signal* tab.

The *BS Signal* hotkey toggles between the two versions if it is pressed repeatedly.

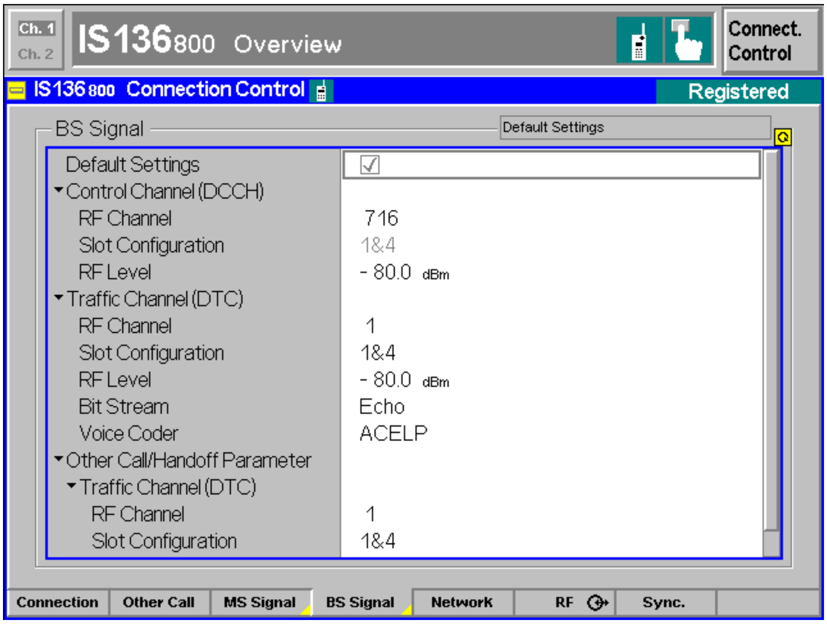
Table-Oriented Version

The table-oriented version of the *BS Signal* tab configures the signals that the CMU uses to attempt a call to the mobile phone (default values; see note on *current vs. default values* on p. 4.65). This includes:

- The parameters of the control and traffic channels

- For processes switching between different networks, the traffic channel parameters in the destination network *(Other Call/Handoff Parameters).*

Connect. Control →



Default Settings	☑
Control Channel (DCCH)	
RF Channel	716
Slot Configuration	1&4
RF Level	- 80.0 dBm
Traffic Channel (DTC)	
RF Channel	1
Slot Configuration	1&4
RF Level	- 80.0 dBm
Bit Stream	Echo
Voice Coder	ACELP
Other Call/Handoff Parameter	
Traffic Channel (DTC)	
RF Channel	1
Slot Configuration	1&4

Fig. 4-55 Connection Control – BS Signal (table)

Default Settings The *Default Settings* switch assigns default values to all parameters of the popup menu *BS Signal.* The default values are quoted in the command description in chapter 6 of this manual.

Remote control –

Control channel (DCCH) The *Control Channel (DCCH)* section defines the *RF Channel* number and *RF Level* (in dBm) of the control channel signal generated by the CMU. For an overview of IS 136 channels in the forward path see Table 4-2 on p. 4.54.

The DCCH of the CMU represents a full-rate traffic channel occupying timeslots 1 and 4. This *Slot Configuration* is indicated in the table section but can not be changed.

Remote control `CONFigure:BSSignal:DCCH:...`

Traffic channel (DTC) The *Traffic Channel (DTC)* section defines the *RF Channel* number, *Slot Configuration*, and *RF Level* (in dBm) of the traffic channel signal generated by the CMU. See also section *Connection Control with Call Established* on page 4.89 ff. For an overview of IS 136 channels in the forward path see Table 4-2 on p. 4.54.

Remote control

```
CONFigure:BSSignal:DCCH:...
CONFigure:BSSignal[:DTC]...
```

Traffic Channel – Speech Mode The *Speech Mode* parameter determines how the CMU returns the data received from the mobile. For details see also section *Connection Control with Call Established* on page 4.89 ff.

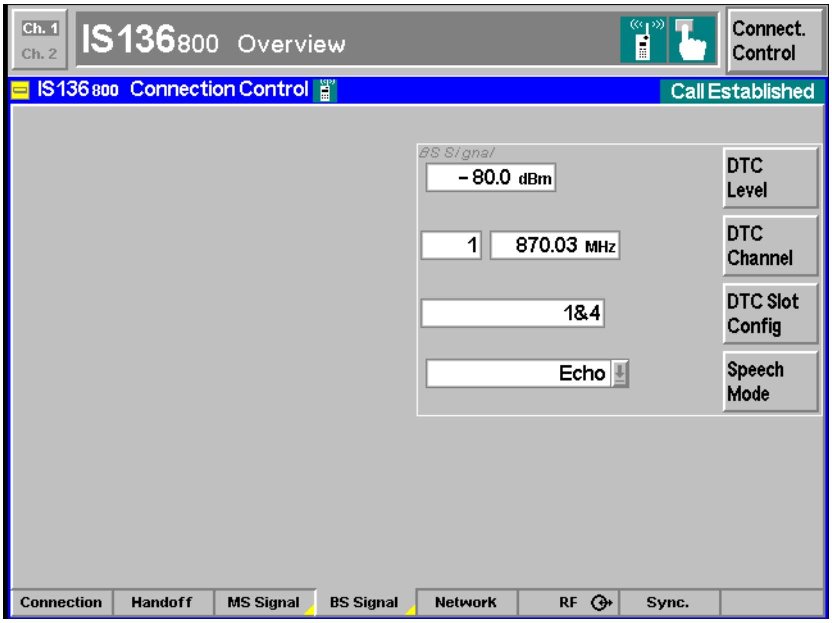
Remote control `CONFigure:BSSignal:SPEech  ECHO | LOOP | HSET`

Traffic Channel – Voice Coder	The parameter *Voice Coder* specifies the voice coder used by the CMU. Either a specific model *(ACELP, VSELP)* or the preferred voice coder of a mobile under test that supports several voice coders *(Mobile Selected)* can be selected. If a voice coder that is not supported is selected, the CMU displays a warning message, switches over to a supported voice coder, and is ready to set up the call. The voice coder selection does not affect any of the measurement results. If the *Speech Mode* is set to *Handset* and a voice coder other than ACELP is selected, the speech mode is automatically adapted to *Echo*.
Remote control	`CONFigure:BSSignal:VCODer ACELp	VSELp	MSELected`
Other Call / Handoff Parameter	The *Other Call / Handoff Parameter* section defines the *DTC* parameters of the mobile in the current network, which come into effect if the call is set up or handed off from another network; see sections *Call to Another Network (Connection Control – Other Call)* on page 4.92 and *Handoff to another Network (Connection Control – Handoff)* on page 4.94. This can be used to set parameters that are relevant for a call connection without actually setting up a call.
Remote control	`CONFigure:BSSignal:OCHandoff...`

Softkey-Oriented Version

The softkey-oriented version of the *BS Signal* tab sets the level, channel number, and slot configuration of the Digital Traffic Channel (DTC) as well as the speech mode. These parameters can be set in the signalling states *Signal Off, Signal On* and *Registered* (default values). However, they can still be changed while a call connection is established (current values, signalling state *Call Established)*. See note on *current vs. default values* on p. 4.65.

Connect. Control →



- 80.0 dBm
1 870.03 MHz
1&4
Echo

Fig. 4-56 Connection Control – BS Signal (Call Established)

All settings are explained in the previous section (section Table-Oriented Version on page 4.99 ff.).

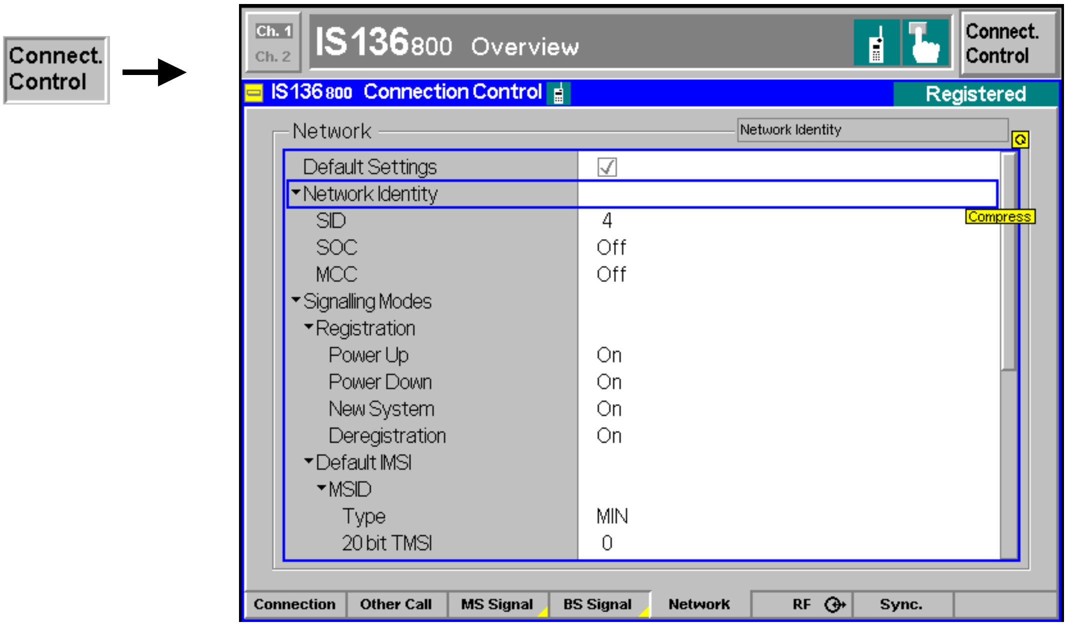
Remote control	`PROCedure:BSSignal[:DTC]:LEVel <Level>`
	`PROCedure:SIGNalling[:DTC]:CHANnel <Number>`
	`PROCedure:SIGNalling[:DTC]:SLOTconfig <Config>`
	(Attn. !) `CONFigure:BSSignal:SPEech ECHO | LOOP`

Network Parameters (Connection Control – Network)

The popup menu *Network* defines various parameters of the network. This includes

- Parameters characterizing the network *(Network Identity)*
- Control parameters for registration and default IMSI *(Signalling Modes)*
- Parameters of the mobile station that are requested by the CMU during registration or when a call is delivered *(Requested Mobile Data)*
- *System Parameters*
- *Timeouts*
- For processes switching between different networks, traffic channel parameters in the destination network *(Other Call/Handoff Parameter).*

The Network parameters are disabled (grayed) in the *Alerting* and in the *Call Established* signalling states.



Default Settings	☑
▾Network Identity	
SID	4
SOC	Off
MCC	Off
▾Signalling Modes	
▾Registration	
Power Up	On
Power Down	On
New System	On
Deregistration	On
▾Default IMSI	
▾MSID	
Type	MIN
20 bit TMSI	0

Fig. 4-57 Connection Control – Network parameters

Network Identity The field *Network Identity* contains parameters identifying the radio network:

SID	Decimal value of the system identity (coded as 15 bits) used to identify the mobile's home system
SOC	Decimal value of the system operator code (coded as 12 bits) used to identify the service provider
MCC	3-digit mobile country code.

Remote control	`CONFigure:NETWork:IDENtity:SID <SID>`
	`CONFigure:NETWork:IDENtity:SOC <SOC>`
	`CONFigure:NETWork:IDENtity:MCC <MCC>`

Signalling Modes The *Signalling Modes* field determines signalling parameters that the CMU sends to the mobile station to control its function (the parameters for CMU signals, on the other hand, are set in the popup menu BS-Signal, see section *Signals of the CMU (Connection Control – BS Signal)* on page 4.99 ff.). The parameters refer to:

- *Registration,*
- Input of a mobile subscriber identity *(Default IMSI).*

Registration

The section *Registration* defines when a registration procedure is to be executed. All of the following registration type parameters can be switched *On* and *Off*:

Power up	Registration on power-up of the mobile,
Power down	Registration on power-down of the mobile,
New System	Registration on change in SID,
Deregistration	Registration on change to other DCCH (in the network, in order to switch over to another BTS).

Registration is the process by which the mobile phone identifies itself to the network and makes itself available for service. Registration may be in order in many cases where the operating mode of the mobile is changed; typical registration types are given in the parameter list above.

In practice, when the mobile encounters a registration type, it checks whether the associated registration parameter is set. If this is true, it sends a registration message including the registration type to the network. The network may either accept or reject registration.

After successful registration of the mobile phone under test, the CMU passes on to the signalling state *Registered*.

Remote control

```
CONFigure:NETWork:SMODe:PUReg  ON | OFF
CONFigure:NETWork:SMODe:PDReg  ON | OFF
CONFigure:NETWork:SMODe:SYReg  ON | OFF
CONFigure:NETWork:SMODe:DEReg  ON | OFF
```

Default IMSI / MSID

The section *Default IMSI/MSID* defines the mobile station identity (MSID) which is used as a default value during call setup to the mobile. The type of MSID to be used is selected in the *Type* field first:

TMSI	20- or 24-bit temporary mobile station identity
MIN	34-bit mobile identification number
IMSI	50-bit international mobile subscriber identity in the format MCC.MNC.MSIN where

MCC	3-digit mobile country code,
MNC	2-digit mobile network code,
MSIN	10-digit mobile subscriber id. no.

The default setting enables a call to a mobile station with known MSID which is not registered yet. If the MSID is not known, a call can still be set up from the mobile. In this case (and if the mobile initiates a registration, see above) the actual MSID of the mobile station supersedes the default MSID as soon as it is transferred to the tester (see also *Mobile Info* table on page 4.85).

Remote control

```
CONFigure:NETWork:SMODe:ID<nr>  <TMSI>
CONFigure:NETWork:SMODe:IDMin  <MIN>
CONFigure:NETWork:SMODe:IDIMsi  <IMSI>
```

Requested Mobile Data

The field *Requested Mobile Data* determines the signalling parameters of the mobile station to be requested during registration and displayed in the *Connection Control – Connection (Registered)* menu (see page 4.84 ff.):

Serial Number	Request of the mobile's serial number *(On)* or no request *(Off)*.

Capability	Request of the mobile's capability report *(On***)** or no request *(Off)*.

The *Capability Report* contains a list of all networks supported by the mobile (see *Mobile Info* table on page 4.85), which supersedes the *Destination Network* list in the *Other Call* (see p. 4.92) and *Handoff* (see p. 4.94) tabs. To avoid an erroneous destination selection, it is recommendable to request the *Capability Report* before initiating an *Other Call.*

Remote control

```
CONFigure:NETWork:REQuest:SNUMber  ON | OFF
CONFigure:NETWork:REQuest:CAPability  ON | OFF
```

System Parameters

The field *System Parameters* determines the following parameters for the radio link:

No. of FBCCH Slots	Number of *Fast Broadcast Control Channel (FBCCH)* slots per superframe (equal to 16 TDMA frames). 5 to 10 slots may be allocated.
No. of EBCCH Slots	Number of *Extended Broadcast Control Channel (EBCCH)* slots per superframe. According to the standard, 1 to 8 slots may be allocated.
Color Code SAT DVCC	Digital verification color code used to identify both the DCCH and the DTC for call setup and voice (de)coding.

Remote control

```
CONFigure:NETWork:SYSTem:NOFSlots  <Slots>
CONFigure:NETWork:SYSTem:NOESlots  <Slots>
CONFigure:NETWork:SYSTem:CCSDvcc  <Slots>
```

Timeouts

The *Timeouts* field defines timeouts after which the CMU drops an interrupted radio link or forces a registration of the mobile:

Loss of Radiolink	Time (in s) after which the CMU drops an established, but interrupted connection (e.g. due to low signal level).
Registration Period	Time period in s after which the CMU forces the mobile station to (re-)register (or *Off,* for no forced registration). With forced registration, it is possible to return to the *Registered* state automatically if the BS signal is temporarily switched off.

Time limits are of particular importance in remote-control mode. For example, the remote-control program will not be able to continue if the keyboard of the mobile station is defective and the mobile is not able to answer the call.

Remote control

```
CONFigure:NETWork:TIMeout:RORLink  <Time>
CONFigure:NETWork:TIMeout:RPERiod  <Time>
```

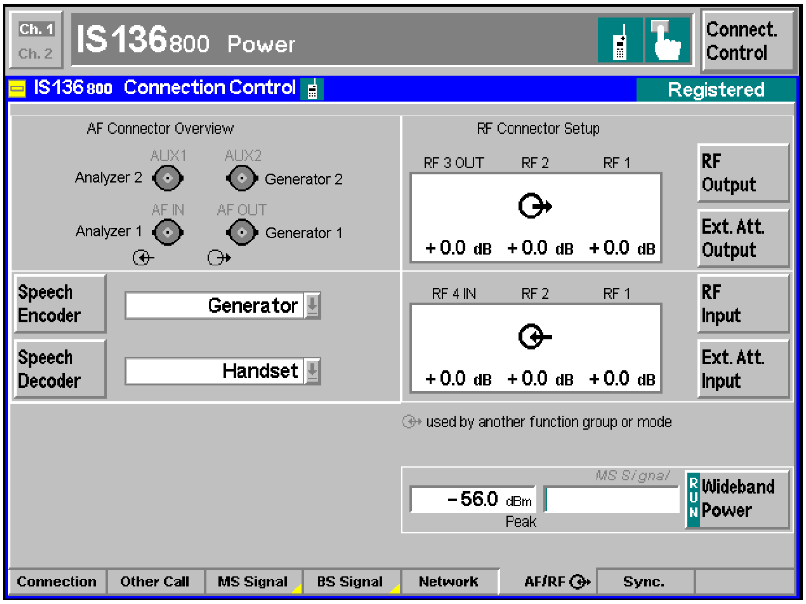
AF/RF Connectors (Connection Control – AF/RF)

The AF/RF ⊙→ tab selects the connectors for RF and AF signals. This includes the setting of

- The RF input and output at the CMU *(RF Output, RF Input)*
- An external attenuation at the connectors *(Ext. Att. Output, Ext. Att. Input)*
- The input source of the CMU speech encoder and the output destination of its speech decoder

If the *Audio Generator and Analyzer* (option CMU-B41) is not fitted, the speech codec (option CMU-B52) is connected to the 9-pole *SPEECH* (handset) connector on the CMU front panel, see chapter 8 of the CMU operating manual. The *Speech Encoder* and *Speech Decoder* settings are not available.

Connect. Control →



Speech Encoder: Generator
Speech Decoder: Handset
+0.0 dB +0.0 dB +0.0 dB
+0.0 dB +0.0 dB +0.0 dB
–56.0 dBm

Fig. 4-1 Connection Control – AF/RF connectors

With the exception of the *Speech Encoder* and *Speech Decoder* routing, all functions of this menu are described in the section *IS 136 800/1900-MS Non Signalling* on page 4.56 ff.

Speech Encoder

The *Speech Encoder* softkey selects the input source for the CMU speech encoder (option CMU-B52). The following two input sources are available:

Handset	Use the signal of the 9-pole *SPEECH* (handset) connector on the CMU front panel
Generator	Use the audio generator signal which is also fed to the *AF OUT* and *AUX 2* connectors on the CMU front panel

Remote control
`ROUTe:SPENcoder[:INPut] HANDset | GENserator`

Speech Decoder

The *Speech Decoder* softkey selects the output destination for the CMU speech decoder (option CMU-B52). The following output destinations are available:

Handset	Route speech decoder output to the 9-pole *SPEECH* (handset) connector on the CMU front panel
Analyzer	Route speech decoder output to primary audio analyzer. The standard primary analyzer input socket *AF IN* is disabled *(Off).*
Analyzer 2	Route speech decoder output to secondary audio analyzer. The standard secondary analyzer input socket *AUX 1* is disabled *(Off).*

Analyzer Both	Route speech decoder output to primary audio analyzer. The standard primary and secondary analyzer input sockets *AF IN* and *AUX 1* are disabled *(Off).*

The primary and secondary audio circuits are described in detail in chapter 4 and 6 of the CMU200/300 operating manual.

Remote control

```
ROUTe:SPDecoder[:OUTPut] HANDset | ANALyzer | ANA2 | ABOTh
```

AF Connector Overview

The *AF Connector Overview* shows the destination of the input signals fed in via AF IN and AUX 1 and the signals sources for the two audio output connectors AF OUT and AUX 2. The routing of input and output signals does not depend on the *Speech Encoder* settings but is a function of the *Speech Decoder* output destination. In the default configuration *(Speech Decoder = Handset),* the connectors AF IN and AF OUT are used as input and output for the primary audio circuit (Analyzer 1, Generator 1). AUX 1 and AUX 2 are used as input and output for the secondary audio circuit (Analyzer 2, Generator 2). If the *Speech Decoder* output is routed to one of the Analyzers, it replaces the external audio input signal. The corresponding input connector is disabled *(Off)*.

Reference Frequency (Connection Control – Sync.)

The popup menu *Sync.* determines the reference signal for synchronization. This includes

- Selection of an internal or external reference frequency
- The output mode for the reference frequency *(F REF OUT 2)*

These functions are described in section *IS 136 800/1900-MS Non Signalling* on page 4.57 f.

Contents

5 Remote Control – Basics

This chapter gives a survey of the basic features and concepts of IS 136-MS remote control commands. Remote control can be described in terms analogous to the ones used in chapter 3 for the classification of measurement and configuration menus. In the following, we will particularly point out the similarities and differences between manual and remote control.

Structure of the IS 136-MS Function Groups

Chapter 6 of this manual lists gives a description of all IS 136-MS remote control commands, including their parameters, as well as the default values and ranges of all numerical parameters.

Function groups and test modes The commands for the two function groups *IS 136 800-MS* and *IS 136 1900-MS* are largely identical, however, the ranges of numerical values and some default settings may not coincide. In such cases, the numerical values are explicitly quoted for both function groups.

Commands for the two test modes *Signalling* and *Non Signalling* are also listed separately although many of them have the same syntax. The commands for the measurement groups `WPOWer, POWer[:NBURst], MODulation` and `SPECtrum` are identical in both test modes, so they are reported only once.

Addressing The CMU uses extended addressing: The instrument is assigned a primary address while each function group and test mode is identified via a secondary address. This allows the same remote commands to be used in several function groups and modes:

```
ibwrt(h_IS800MS_SIG, "INITiate:POWer")
ibwrt(h_IS1900MS_SIG, "INITiate:POWer")
ibwrt(h_IS800MS_NSIG, "INITiate:POWer")
```

provided that the variables `h_IS800MS_SIG, etc.` have been appropriately defined, see program examples in chapter 7 of the CMU operating manual.

The remote control commands for first (`SYST:COMM:GPIB:ADDR`) and secondary (`SYST:REM:ADDR:SEC`) addressing are described in the CMU operating manual. The `SYST:REM:ADDR:SEC` command uses the following names to address the GSM network tests described in this manual:

IS136800MS_Nsig	*IS136800MS_Sig*
IS1361900MS_Nsig	*IS1361900MS_Sig*

Order of commands The commands are arranged to form groups belonging to the same measurement or to the same type of configurations. These command groups are identified by the second-level keyword (as in `POWer`). Applications belonging to a measurement group (see chapter 5 of the CMU operating manual) are identified by the third-level keyword of each command (as in `MODulation:EVMagnitude`). Chapter 6 is organized as follows:

IS 136-MS Non Signalling:

General configurations (second-level keywords `LEVEL, TRIGger, RFANalyzer, RFGENerator, INPut, OUTPut, CORRection:LOSS, DM:CLOCk`)

Measurement groups: `RXQuality:BER`

Measurement groups (identical in Signalling and Non Signalling mode):

`WPOWer, POWer[:NBURst], MODulation[:OVERview], MODulation:EVMagnitude, MODulation:PERRor, MODulation:MERRor, SPECtrum[:ACPower]`

IS 136-MS Signalling:

Measurement groups (`POWer[:SBURst], RXQuality:MAHO, RXQuality:EMAHo`)

General configurations and signalling (`LEVel, TRIGger, SIGNalling, HANDover, BSSignal, NETWork, INPut, OUTPut, CORRection:LOSS, DM:CLOCk`), `MSSinfo`

The structure of chapter 6 differs from chapter 4 *(Functions and their Application)* where the measurements are presented first and configurations pertaining to the whole function group and test mode are reported at the end of each section.

The menu of the graphical user interface corresponding to a group of commands is quoted at the beginning of each section. Alphabetical lists of all commands are annexed to chapter 6.

SCPI Conformity

In view of the particular requirements of IS 136-MS measurements not all commands could be taken from the SCPI standard. However, the syntax and structure of all commands is based on SCPI rules. For a detailed description of the SCPI standard refer to chapter 5 of the CMU operating manual.

SCPI confirmed and SPCI approved commands are explicitly marked throughout chapter 6.

Remote Control

All commands may be used for control of the CMU via GPIB interface or serial (RS-232) interface.

Measurement Control

The commands in the measurement groups quoted above (`WPOWer, POWer..., MODulation..., SPECtrum... etc.`) have an analogous structure and syntax. The measurements are controlled according to the common concepts outlined in Chapter 5 of the CMU operating manual. The following sections show how the general concepts are applied to IS 136-MS measurements.

Measurement Groups

The measurement groups are referred to as *measurement objects* (keyword <meas_obj>) in remote control. For IS 136-MS measurements, the following measurement objects are defined:

Table 5-1 Measurement objects in the *Signalling* and *Non Signalling* mode

IS 136-MS Non Signalling	**IS 136-MS Signalling**
`WPOWer` Wide-band peak power measurement of the input signal.	**`WPOWer`** Wide-band peak power measurement of the input signal.
`POWer` Normal burst power as a function of time including statistical evaluations and the results of the limit check.	**`POWer`** Normal or shortened burst power as a function of time including statistical evaluations and the results of the limit check.
`MODulation...` Phase error (`MODulation:PERRor`), magnitude error (`MODulation:MERRor`) and error vector magnitude (`MODulation:EVMagnitude`) of the transmitted burst as a function of time plus scalar modulation quantities (`MODulation[:OVERview]`).	**`MODulation...`** Phase error (`MODulation:PERRor`), magnitude error (`MODulation:MERRor`) and error vector magnitude (`MODulation:EVMagnitude`) of the transmitted burst as a function of time plus scalar modulation quantities (`MODulation[:OVERview]`).
`SPECtrum[:ACPower]` Off-carrier power due to the modulation and the bursty nature of the RF signal including limit check in frequency-domain and time-domain (`SPECtrum[:ACPower]:TIME`) representation.	**`SPECtrum[:ACPower]`** Off-carrier power due to the modulation and the bursty nature of the RF signal including limit check in frequency-domain and time-domain (`SPECtrum[:ACPower]:TIME`) representation.
`RXQuality` Single shot bit error rate test including limit check.	**`RXQuality`** Bit error rate measurement and readout of the RSSI and the MAHO and extended MAHO (EMAHO) report transmitted by the mobile phone.

The measurement objects in Table 5-1 are complemented by groups of commands used to retrieve results that are automatically provided by the mobile station (e.g. the mobile properties reported by the MS under test). These command groups do not represent real measurement objects; they consist of queries only. For an overview, see the list of remote control commands at the end of chapter 6.

Measurement Statistics

In the digital IS 136 networks, the (modulated) RF signal is divided into periodic TDMA timeslots serving as basic evaluation periods for the measurement and for the calculation of statistical results.

Together with the *Statistic Count*, the *Repetition Mode* defines how many evaluation periods are measured if the measurement is not stopped explicitly (measurement control commands `STOP...`, `ABORT...`) or by a limit failure. With remote control the three repetition modes *Single Shot, Continuous* and *Counting* are available (*Counting* is not available in manual control, see chapter 3).

In `POWer`, `MODulation`, and `SPECtrum` measurements, different traces corresponding to the result in the current evaluation period, the maximum, minimum, extreme value, or average over a set of evaluation periods (bursts) are determined. These results can be queried independently.

Table 5-2 Repetition mode in remote control

Setting	**Description**	**Command**

Statistic Count	Integer number of evaluation periods forming one statistics cycle. An evaluation period is equal to a TDMA timeslot/burst (`POWer | MODulation | SPECtrum`) or a full TDMA frame (`RXQuality`).
	The statistic count is set together with the measured quantity.
		`CONFigure:<meas_obj>:CONTrol`
		`SCALar | ARRay,` **`1 ... 1000 | NONE`**
		`(<meas_obj> = POWer... | WPOWer | MODulation... | SPECtrum...)`
		`CONFigure:RXQuality:BER:CONTrol:TSETup1:FRAMes`
		`1 ... 500 | NONE` (Non Signaling only)

Repetition mode
Single Shot
	The measurement is stopped after one statistics cycle.	`CONFigure:<meas_obj>:CONTrol:REPetition`
		`SINGleshot``, <StopCondition>, <Stepmode>`
		`(<meas_obj> = POWer... | WPOWer | MODulation... | SPECtrum...| RXQuality:BER)`

Continuous	The measurement is continued until stopped explicitly or by a limit failure. Average results are calculated according to the rules given in chapter 3.	`CONFigure:<meas_obj>:CONTrol:REPetition`
		`CONTinuous``, <StopCondition>, <Stepmode>`
		`(<meas_obj> = POWer... | WPOWer | MODulation... | SPECtrum...| RXQuality:BER)`

Counting	Repeated single shot measurement with configured statistics cycles.	`CONFigure:<meas_obj>:CONTrol:REPetition`
		`1 ... 10000``, <StopCondition>, <Stepmode>`
		`(<meas_obj> = POWer... | WPOWer | MODulation... | SPECtrum...| RXQuality:BER)`
		TA counting measurement with 1 evaluation period is equivalent to a single shot measurement..

Traces	The specifiers `CURRent, MAXimum, MINimum, MMAX`, and `AVERage` denote the traces for the current evaluation period, the maximum, minimum, extreme value, or average of a set of evaluation periods. They correspond to the *Display Mode* set in the measurement configuration menus.
	In general all four traces are evaluated during the measurement. They are selected via the specifiers used as last keywords in the `READ..., FETCh...` or `SAMPle...` queries.
		Measurement results:
		`READ:ARRay:POWer...<disp>[:RESult]?`
		`READ:SUBarrays:POWer...<disp>[:RESult]?`
		`...`
		Burst matching:
		`CALCULATE:ARRay:POWER...<disp>[:RESult]:MATChing:LIMit...?`
		`....`
		`<disp> = :CURRent | :AVERage |`
		`:MAXimum | MINimum`
		Analogous commands for `<meas_obj> =MODulation... | SPECtrum...` (use `:MMAX` instead of `:MAXimum` or `:MINimum`)

Specifying Limits

The following table gives an overview of the types of limits and possible results of the limit check.

Table 5-3 Limits and limit check

Type	Description	Command
Scalar limits	Limit values for a single (scalar) measured quantity. Depending on the measured quantity, either an upper limit or upper and lower limits can be defined.	`CONFigure:<meas_obj>:LIMit:<Spec.> [<LowerLimit>,]<UpperLimit>` `<Spec.>` denotes a keyword (an array of keywords) specifying the measured quantity.
Limit lines	For `POWer, MODulation,` and `SPECtrum` measurements a tolerance template consisting of several areas can be defined.	`CONFigure:<meas_obj>:LIMit[:LINE] :<Spec.> <Limit_line_param.>` `<Spec.>` denotes an array of keywords specifying the upper or lower limit line in a time range and the burst type considered. `<Limit_line_param.>` contains the coordinates of the start and end points of the limit line plus an information whether the current range is valid or not.
Limit check	All scalar limits belonging to the same measurement group are read out together with the command on the right side.	`CALCulate[:SCALar]:<meas_obj.> ...[:RESult]:MATChing?`
	Possible results of the scalar limit check are listed on the right side. Further messages assessing, e.g., the power ramp or the result of the BER test in general, may be issued in particular cases (see detailed command description in chapter 6).	`NMAU` not matching, underflow `NMAL` not matching, overflow `INV` measured value invalid `OK` no limit failure
	The result of the limit check depends on the statistics settings (see section *Measurement Statistics* on page *5.3*).	`CALCULATE:<meas_obj>: <disp>[:RESult]:MATChing? ....` where `<disp> = :CURRent | :AVERage | :MAXimum | :MINimum | MMAX`

Status Reporting System

A general description of SCPI status registers and of the status reporting system is given in chapter 5 of the CMU operating manual. This section is devoted to the particular features concerning IS 136-MS measurements.

The CMU offers 30 independent `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers (<nr>=1 ... 15) which are implemented in hierarchical form. The bits of the 30 `STATus:OPERation` registers are set only after the registers are assigned to a function group and measurement mode.

In the CONDition part, the `STATus:OPERation` register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last readout. All five parts of the registers can be read using one of the commands of the `STATus:OPERation:SUM1|2:CMU<nr>:...`

Note: *Symbolic status register evaluation by means of the commands `STATus:OPERation:SYMBolic:ENABle` and `STATus:OPERation:SYMBolic[:EVENt]?` is a convenient alternative method of retrieving status information. See also section* Symbolic Status Event Register Evaluation *in chapter 5 of the CMU operating manual and chapter 6 of this manual.*

IS 136-MS mobile tests comprise the two signalling modes *Non Signalling* and *Signalling* for each of the two function groups *IS 136 800/1900-MS* so that a total of 4 secondary addresses can be used. In the status registers for the *Non Signalling* mode no bits are assigned. In the status registers for the *Signalling* mode the bit assignment is as follows:

Table 5-4 Meaning of the bits used in the **`STATus:OPERation:CMU:SUM1|2:CMU<nr>`** sub-registers assigned to *IS 136 800/1900-MS Signalling*

Bit-No.	Meaning	Symbol in `STAT:OPER:SYMB...`
0	**Call from Mobile** This bit is set when the CMU receives a call from the mobile under test.	**CFM**
1	**Release from Mobile** This bit is set when the connection to the mobile is being released.	**RFM**
2	**Loss of Radio Link** This bit is set if the CMU had to leave the signalling state "Call Established" (because of a low signal etc.).	**LORL**
3	**Mobile Registered** This bit is set when a registration was successfully performed.	**MREG**
7	**Mobile Deregistered** This bit is set if the CMU had to leave the signalling state "Registered" (because of a low signal etc.).	**MDER**
9	**Traffic Channel Active** This bit is set when voice data is transmitted via the analog voice channel.	**TCH**
10	**MAHO Report** This bit when the CMU receives a MAHO report from the mobile under test.	**MREP**
11	**RF Input overdriven** This bit is set if one of the three RF input connectors is overdriven.	**RFIO**
12	**RF Input underdriven** This bit is set if one of the three RF input connectors is underdriven.	**RFIU**

Special Terms and Notation

Below we list some particular features in the syntax of the IS 136-MS commands. The general description of the SCPI command syntax can be found in chapter 5 of the CMU operating manual, section *"Structure and Syntax of Device Messages".*

Description of commands

The commands are arranged in tables. From top to bottom, the table rows contain the following entries:

1. Complete command syntax including the parameter list and a short description of the command
2. List and description of the parameters with their default values, the units and unit rings
3. Detailed description of the command, signalling state required for command execution (in *Signalling* mode), required firmware version

Detailed lists of default values are annexed to the command description. Occasionally, groups of analogous commands are described in common tables.

Order of commands

The commands are arranged according to their function specified by the keyword in the second level or in the second/third level combined. Lower-level keywords define the command in more detail. This means that commands with the same second-level, third-level etc. keywords are generally grouped together in the same sections.

Example: `CONFigure:WPOWer:CONTrol:REPetition`

Commands with the keyword *`WPOWer`* in the second level belong to the wideband power measurement. The keywords in the third and fourth level indicate that the command controls the repetition mode of the power measurement.

Combined measurements

To limit the number of remote control commands, scalar results are always measured together and output in lists. Arrays (e.g. the traces for `POWer` and `MODulation` measurements) are output as lists of values separated by commas; it is possible to retrieve either the whole list (see commands `READ:ARRay...` etc.) or the values located in a number of subranges that are part of the total measurement range (see commands `READ:SUBarrays...;` the subarrays are defined via `CONFigure:SUBarrays...`).

Parameters

Setting commands are usually supplemented by a parameter or a list of several parameters. Parameters either provide alternative options (setting a or setting b or setting c ..., see special character "|"), or they form a list separated by commas (setting x,y).

<Par_Name>

In the command tables and lists, parameters are generally described by a name (literal) written in angle brackets (<>). This literal merely serves as a parameters description; in an application program it must be replaced by one of the possible settings reported in the detailed parameter description.

Example: `[SENSe:]LEVel:MODE <Mode>`

with `<Mode>` = `MANual | AUTomatic`
possible command syntax: `LEV:MODE MAN`

NAN NAN (not a number) is generally used to represent missing data, e.g. if a portion of a trace has not been acquired yet. It is also returned after invalid mathematical operations such as division by zero. As defined in the SCPI standard, NAN is represented as 9.91 E 37.

INV INV (invalid) is returned if a limit check is performed without defining the appropriate tolerance values.

Upper / lower case

Upper/lower case characters characterize the long and short form of the keywords in a command. The short form consists of all upper-case characters, the long form of all upper case plus all lower case characters. On the CMU, either the short form or the long form are allowed; mixed forms will generally not be recognized. Note that the instrument itself does not distinguish upper case and lower case characters.

Special characters

| A vertical stroke in the parameter list characterizes alternative parameter settings. Only one of the parameters separated by **|** must be selected.

Example: The following command has two alternative settings:

```
TRIGger:SEQuence:DEFault ON | OFF
```

[ ] *Key words* in square brackets can be omitted when composing the command header (see chapter 5 of the CMU manual, section "Structure of a Command"). The complete command must be recognized by the instrument for reasons of compatibility with the SCPI standard.

Parameters in square brackets are optional as well. They may be entered in the command or omitted.

{ } Braces or curly brackets enclose one or more parameters that may be included zero or more times.

<nr> This symbol denotes a numeric suffix, e.g. an enumeration index for input and output connectors.

Lists of commands

Command: The *Command* column of the table contains all remote control commands arranged according to their function (configurations or measurement objects). Within a section, the commands are listed in alphabetical order.

Parameters: The *Parameter* column lists the parameters of the commands.

Remarks: The *Remarks* column gives additional information about the commands which

- Have no query form *(no query)*
- Have only a query form *(query only)*
- Can be used both as setting commands and as queries (*with query*, this applies to all commands belonging to none of the two preceding categories)

Alphabetical Lists Chapter 6 concludes with alphabetical command lists for both test modes.

Contents

6 Remote Control – Commands

In the following, all remote-control commands for the function groups *IS 136 800/1900-MS* are presented in tabular form with their parameters and the ranges of values. The structure of this chapter is analogous to that of the reference part for manual operation (chapter 4).

- The measurement modes *Non Signalling* and *Signalling* are presented separately.
- Within the measurement modes, first the general configuration and then the individual measurement groups (test objects) are dealt with.
- Measurement groups that are identical in both test modes *(`WPOWerm, POWer[:NBURst], MODulation..., SPECtrum...`)* are presented in a separate section between the two test modes.

General notes on remote control in the function group *IS 136 800/1900-MS* can be found in chapter 5. An introduction to remote control according to SCPI standard and the status registers of the CMU is given in chapter 5 of the operating manual for the CMU basic instrument.

TDMA Module Tests (Non Signalling)

In the *Non Signalling* mode, an RF test signal can be generated and an RF signal with IS-136 characteristics is analyzed. No signalling parameters are transferred.

Connection Control

The remote-control commands in this section configure the measurements in the function group *IS 136 800/1900-MS Non Signalling* globally, i.e., they provide settings that are valid for all measurements in the function group. They correspond to the settings in the popup menu of the softkey *Connect. Control* located to the right of the headline of each main menu.

Subsystem LEVel (Analyzer Level)

The subsystem *LEVel* controls the level in the RF input signal path. It corresponds to the table section *Analyzer Level* in the *Analyzer* tab of the *Connection Control* menu.

[SENSe:]LEVel:MODE <*Mode*>		Analyzer Level – RF Mode		
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
MANual | AUTomatic	Manual setting Automatic setting corresponding to average power of signal applied	MANual	–	
Description of command				FW vers.
This command defines the mode for setting the maximum input level.				V3.00

[SENSe:]LEVel:MAXimum <*Level*> RF Max. Level

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
0 dBm to +53 dBm	Maximum input level for RF 1	+30.0	dBm	
–14 dBm to 39 dBm	Maximum input level for RF 2	+30.0	dBm	
–37 dBm to 0 dBm	Maximum input level for RF 4 IN	0.0	dBm	

Description of command	FW vers.
This command defines the maximum expected input level. The value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command).	V2.41

[SENSe:]LEVel:ATTenuation <*Mode*> RF Attenuation

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
NORMal |	Mixer level in normal range	NORMal	–	
LNOise |	Low noise (mixer level 10 dB higher than in normal setting)			
LDIStortion	Low distortion (mixer level 10 dB lower than in normal setting)			

Description of command	FW vers.
This command tunes the RF analyzer for normal setting, low noise level (full dynamic range), or low distortion (high intermodulation spacing).	V2.41

[SENSe:]LEVel:DEFault Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.41

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* determines the trigger mode. It corresponds to the table section *Trigger* in the *Analyzer* tab of the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce <*Source*> Trigger Source

<Source>	Description of parameters	Def. value	Def. unit	Unit ring
FRUN |	Trigger by TDMA burst detected by instrument software	IFPower	–	
RFPower |	Wide-band power trigger			
IFPower |	Narrow-band trigger			
EXTern	External trigger signal via AUX3			

Description of command	FW vers.
This command determines the trigger condition. The settings *RFPower* and *IFPower* assume bursted signals.	V2.41

TRIGger[:SEQuence]:THReshold <*Threshold*>				Trigger Level
<Threshold>	Parameter description	Def. value	Default unit	Unit ring
LOW | **MEDium |** **HIGH**	Low trigger threshold (reference level - 26 dB) Medium trigger threshold (reference level - 16 dB) High trigger threshold (Reference level - 6 dB)	LOW	–	
Command description				FW vers.
This command sets the signal level at which the measurement is triggered (see `TRIG:SEQ:SOUR`). The command is enabled for trigger source `RFPower` and `IFPower` only.				V2.41

TRIGger[:SEQuence]:DEFault				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.41

Subsystem RFANalyzer (Analyzed Input Signals)

The subsystem *RFANalyzer* configures the RF analyzer, i.e., it specifies which type of RF signals can be analyzed. It corresponds to the *Analyzer Settings* section in the *Analyzer* tab in the popup menu *Connection Control*.

[SENSe:]RFANalyzer:FREQuency <*Number*>				RF Channel
<Number>	Description of parameters	Def. value	Def. unit	Unit ring
200 000 Hz to **2 700 000 000 Hz** (see also data sheet)	Input frequency (in multiples of 10 kHz)	824 010 000 (IS-136 800) 1 850 040 000 (IS-136 1900)	Hz Hz	
Description of command				FW vers.
This command defines the frequency of the RF signal analyzed. With the command `[SENSe:]RFANalyzer:FREQuency:UNIT`, the default frequency unit can be changed, and even IS 136 channel numbers can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the specification for the reverse channel (signal direction from mobile to CMU).				V2.41

[SENSe:]RFANalyzer:FREQuency:UNIT *<Unit>*				Frequency Unit
<Unit>	Description of parameters	Def. value	Def. unit	Unit ring
Hz | KHz | MHz | GHz | CH	Frequency unit Channel number	Hz	Hz	
Description of command				FW vers.
This command defines whether the frequency of the RF signal analyzed is specified in frequency units or as an IS 136 channel number. Frequency units must be used to select input signals that are outside the designated channel range.				V2.41

[SENSe:]RFANalyzer:FREQuency:OFFSet *<FreqOffset>*				Frequency Offset
<FreqOffset>	Description of parameters	Def. value	Def. unit	Unit ring
–15000 Hz to +15000 Hz	Offset for channel frequency	0	Hz	
Description of command				FW vers.
This command defines an offset for the RF analyzer frequency set with the command `[SENSe:]RFANalyzer:FREQuency <Number>`. The offset frequency must be in multiples of 1 Hz.				V2.41

[SENSe:]RFANalyzer:EMSSync *<SyncPattern>*				Expected MS Sync.
<SyncPattern>	Description of parameters	Def. value	Def. unit	Unit ring
OFF | IS1 to IS6 | ALL	No detection of sync. pattern Standard IS-136 sync. patterns All sync. patterns allowed	ALL	–	
Description of command				FW vers.
This command sets a condition for the synchronization pattern of the analyzed signal. If no sync. pattern is specified *(OFF),* all signals are measured. With the parameter *ALL*, the RF input signal is checked for an arbitrary sync. pattern.				V2.41

Generator Object "RFGenerator" – Generator control

The subsystem *RFGenerator* configures the RF signals generated by the CMU. It corresponds to the softkey *RF Generator* in the *Generator* tab of the popup menu *Connection Control* and the measurement menu *Analyzer/Generator*.

INITiate:RFGenerator **ABORt:RFGenerator**	Start RF generator, reserve resources Switch off RF generator, release resources	*RUN* *OFF*
Description of command		FW vers.
These commands have no query form. They start and stop the RF generator, setting it to the status indicated in the top right column.		V2.41

FETCh:RFGenerator:STATus?				Generator Status
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **ERR**	Generator switched off (`ABORt` or `*RST`) Running (`INITiate`) Switched off (could not be started)	OFF	–	
Description of command				FW vers.
This command is always a query. It returns the current generator status.				V2.41

Generator Level – Subsystem RFGenerator:LEVel

The subsystem *RFGenerator:LEVel* determines the level of the generated RF signal. It corresponds to the input field associated to the *RF Generator* softkey in the *Generator* tab of the popup menu *Connect. Control* and in the measurement menu *Analyzer/Generator*.

SOURce:RFGenerator:LEVel <*Level*>				RF Level
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	Output level at RF 1	–80	dBm	
–137 dBm to –10 dBm	Output level at RF 2	–80	dBm	
–90 dBm to +13 dBm	Output level at RF 3 OUT	–80	dBm	
Description of command				FW vers.
This command determines the RF generator level. The value range depends on the used RF output of the CMU and the external attenuation set (see `[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]` command).				V2.41

RF Generator Frequency – Subsystem RFGenerator:FREQuency

The subsystem *RFGenerator:FREQuency* determines the frequency of the generated RF signals. It corresponds to the softkeys *RF Channel* and *Frequency Offset* of the panel *RF Generator Settings*.

SOURce:RFGenerator:FREQuency <*Number*>				RF Channel
<Number>	Description of parameters	Def. value	Def. unit	Unit ring
20 000 Hz to **2 700 000 000 Hz** (see also data sheet)	Input frequency (in multiples of 10 kHz)	869 010 000 (IS 136 800) 1 845 000 000 (IS 136 1900)	Hz Hz	
Description of command				FW vers.
This command defines the frequency of the RF signal generated. With the command `SOURce:RFGenerator:FREQuency:UNIT`, the default frequency unit can be changed, and even IS 136 channel numbers can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the specification for the forward channel (signal direction from CMU to mobile under test).				V2.41

SOURce:RFGenerator:FREQuency:UNIT <*Unit*> Frequency Unit

<Unit>	Description of parameters	Def. value	Def. unit	Unit ring
Hz | KHz | MHz | GHz | CH	Frequency unit | Channel number	Hz	Hz	

Description of command	FW vers.
This command defines whether the frequency of the RF signal generated is specified in frequency units or as an IS 136 channel number. Frequency units must be used to select input signals that are outside the designated IS 136 channel range.	V2.41

SOURce:RFGenerator:FREQuency:OFFSet <*FrequencyOffset*> Frequency Offset

<FrequencyOffset>>	Description of parameters	Def. value	Def. unit	Unit ring
–15 000 Hz to +15 000 Hz	Frequency offset	0	Hz	

Description of command	FW vers.
This command defines an offset for the RF generator frequency set with the command `[SENSe:]RFGenerator:FREQuency <Number>`. The offset frequency must be in multiples of 1 Hz.	V2.41

Subsystem RFGenerator:MODulation

The subsystem *RFGenerator:MODulation* determines an bit sequence which is modulated on the RF signal. It corresponds to the softkey *RF Signal Type* in the *Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:MODulation:RFS:TYPE <*Selection*> RF Signal Type

<Selection>	Description of parameters	Def. value	Def. unit	Unit ring
BER |	BER test signal	BER	–	
CW |	Empty carrier (continuous wave)			
PRBS	Pseudo-random bit sequence			

Description of command	FW vers.
The command selects a bit sequence used to modulate the generated RF signal.	V2.41

Inputs and Outputs (External Attenuation)

The commands in this section configure the input and output connectors and the external attenuation. They correspond to the tab *RF* in the popup menu *Connection Control*.

INPut[:STATe] <*State*>				RF Input
<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 | **RF2 |** **RF4**	Connector RF 1 used as input Connector RF 2 used as input Connector RF 4 IN used as input	RF2	–	
Description of command				FW vers.
This command determines the connector to be used for RF input signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the same measurement (see `OUTPut[:STATe]`). Only one input and one output may be active at the same time, a new RF input setting supersedes the previous one.				V2.41

OUTPut[:STATe] <*State*>				RF Output
<State>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 | **RF2 |** **RF3**	Connector RF 1 used as output Connector RF 2 used as output Connector RF 3 OUT used as output	RF2	–	
Description of command				FW vers.
This command determines the connector to be used for RF output signals. The bidirectional connectors RF 1 and RF 2 can be used as input and output connectors in the same measurement (see `INPut[:STATe]`). Only one input and one output may be active at the same time, a new RF output setting supersedes the previous one.				V2.41

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation*> **SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation*>**				Ext. Att. Input
<Attenuation>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Value for ext. attenuation at input<nr> where <nr> = 1, 2	0.0	dB	
–90 dB to +90 dB	Value for ext. attenuation at RF4 IN (<nr> = 4)	0.0	dB	
Description of command				FW vers.
This command assigns an external attenuation value to the inputs of the instrument *(RF 1, RF 2, RF4 IN)*.				V2.41

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*> **SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*>**				Ext. Att. Output
<Attenuation>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Value for ext. attenuation at output<nr> where <nr> = 1, 2	0.0	dB	
–90 dB to +90 dB	Value for ext. attenuation at RF3 OUT (<nr> = 3)	0.0	dB	
Description of command				FW vers.
This command assigns an external attenuation value to the outputs of the instrument *(RF 1, RF 2, RF3 OUT)*.				V2.41

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock frequency specific to the network. This frequency is set in the tab *Sync.* in the popup menu *Connect. Control*.

SOURce:DM:CLOCk:STATe <*Mode*>				REF OUT 2 on/off
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch on/off system clock	OFF	–	
Description of command				FW vers.
This commands switches the system clock specific to the network at the *REF OUT 2* connector on or off.				V2.41

SOURce:DM:CLOCk:FREQuency <Frequency>				REF OUT 2
<Frequency>	Description of parameters	Def. value	Def. unit	Unit ring
9.72 MHz to 38.88 MHz	System clock frequency	12.96	MHz	
Description of command				FW vers.
This command determines the system clock frequency applied to *REF OUT 2*. The frequency entered is internally rounded to one of the following discrete values: 38.88 MHz,19.44 MHz, 12.96 MHz, 9.72 MHz				V2.41

Symbolic Status Event Register Evaluation

The following commands are used to retrieve the events reported in function group *IS 136 800/1900-MS Non Signalling*; see section *Symbolic Status Event Register Evaluation* in Chapter 5 of the CMU operating manual.

STATus:OPERation:SYMBolic:ENABle <Event>{,<Event>}				Symbolic status evaluation
Parameter list	Parameter description	Def. Value[1]	Default Unit	Unit Ring
<Event>{,<Event>} | NONE	List of symbols for events to be reported No event reported	NONE	–	
Command description				FW vers.
This command enables event reporting for one or several events in the current *IS 136 800/1900-MS* function group, i.e. it sets the corresponding bits in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:ENABle` register (`<nr> = 1 | 2`, `<nr_event>` denotes the current function group) and in all sum registers up to the status byte. The events and the corresponding symbols for the function group are listed in Chapter 5 (see section *Status Registers).* The symbols may be entered in arbitrary order.				V3.05

STATus:OPERation:SYMBolic[:EVENt]?				Symbolic status evaluation
Response	Parameter description	Def. Value[2]	Default Unit	Unit Ring
NONE | <Event>{,<Event>}	No event in the *RF* function group List of reported events	NONE	–	
Command description				FW vers.
This command is always a query. It lists the events reported in the current *IS 136 800/1900-MS* function group and deletes these events in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:EVENt` register as well as in all sum registers.				V3.05

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[1] The default values quoted in this command are achieved after a `STATus:PRESet` command. `*RST` does not supersede the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

[2] The default values quoted in this command are achieved after a `*CLS` command. `*RST` does not supersede the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

Measurement Groups (Non Signalling only)

The measurement groups in this section are provided in *Non Signalling* mode only.

Receiver Quality

The subsystem *Receiver Quality* comprises the commands for all measurements of the receiver quality. The settings are used to assess the sensitivity of the MS receiver. The subsystem corresponds to the main menu *Receiver Quality.*

Receiver Quality – Single Shot

The subsystem *RXQuality:BER* contains the commands for receiver quality measurements. The subsystem corresponds to the main menu *Receiver Quality.*

Control of Measurement – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* controls the receiver quality measurements.

INITiate:RXQuality:BER	Start new measurement	*RUN*
ABORt:RXQuality:BER	Abort running measurement and switch off	*OFF*
STOP:RXQuality:BER	Stop measurement	*STOP*
CONTinue:RXQuality:BER	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands do not exist as queries. They start or stop the current measurement, setting it to the status indicated in the top right column.		V2.41

CONFigure:RXQuality:BER:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SRSQ No reporting	OFF	–	–
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5).				V2.41

FETCh:RXQuality:BER:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 500 |	Counter for current evaluation period (frame)	NONE	–	–
NONE	Statistic count set to off (only 1 frame)			
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapter 5).				V2.41

CONFigure:RXQuality:BER:TSETup <*TestSetup*>				Test Setup
<TestSetup>	Description of parameters	Def. value	Def. unit	Unit ring
T1 |	Test Setup 1	T1	–	–
T2 |	...			
...				
T5	Test Setup 5			
Description of command				FW vers.
This command selects one out of 5 test setups, i.e. one data set parametrizing a particular receiver quality measurement. When a new test setup is selected, the running measurement is aborted (measurement state *OFF)* and all measured values are set to *INV* (invalid). The new measurement must be re-started with `INITiate:RXQuality:BER`.				≥3.05

Subsystem RXQuality:BER:CONTrol

The subsystem *RXQuality:BER:CONTrol* defines the scope of the receiver quality measurements. The subsystem corresponds to the *Control* tab of the measurement menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER:CONTrol:TSETup<nr>:REPetition <*Repetition>,<StopCond>,<Stepmode>*				Test cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror |	Start measurement in case of error *(stop on error)*	NONE	–	–
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. The suffix <nr> refers to the test setup (<nr> = 1 to 5). **Note:** *In the case of READ commands (READ:...), the <Repetition> parameter has no effect; the measurement is always aborted after a single shot.*	all	V3.05

CONFigure:RXQuality:BER:CONTrol:TSETup<nr>:FRAMes <*FramesToSend*>				Frames
<FramesToSend>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 500 | **NONE**	No. of frames to be sent No average (only 1 frame considered)	100	–	
Description of command				FW vers.
This command defines the measured value and the number of frames to be sent in a single shot measurement, constituting a statistics cycle. The suffix <nr> refers to the test setup (<nr> = 1 to 5).				V2.41

CONFigure:RXQuality:BER:CONTrol:TSETup<nr>[:DTC]:LEVel <*Level*>				TCH BER Level, Used Timeslot
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	RF1 level in used timeslot	–90	dBm	
–137 dBm to –10 dBm	RF2 level in used timeslot	–90	dBm	
–90 dBm to +13 dBm	RF3 OUT level in used timeslot	–90	dBm	
Description of command				FW vers.
This command defines the absolute level of the traffic channel (*DTC*) in the used timeslot for test setup <nr> (<nr> = 1 to 5). This level is valid for the receiver quality measurement only.				V2.41

Subsystem RXQuality:BER:LIMit

The subsystem *RXQuality:BER:LIMit* defines tolerance values for the receiver quality measurement. The subsystem corresponds to the *Limits* tab of the *Receiver Quality Configuration* menu*.*

CONFigure:RXQuality:BER:LIMit:TSETup<nr>:ABITs <*Limit*>				Limit
<ClassIIBER>	Description of parameters	Def. value	Def. unit	Unit ring
0 % to 100 %	Upper limit of bit error rate	2.0	%	Ratio
Description of command				FW vers.
This command defines an upper limit for the bit error rate in application <nr>. Irrespective of the application, the default setting is 2 %.				V2.41

CONFigure:RXQuality:BER:LIMit:DEFault				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V3.05

Measured Values – Subsystem RXQuality:BER[:RESult]

The subsystem *RXQuality:BER[:RESult]* returns all results of the *Receiver Quality* measurement. In particular, it measures and returns the bit error rate and compares it with the tolerance values.

READ[:SCALar]:RXQuality:BER[:RESult]? **FETCh[:SCALar]:RXQuality:BER[:RESult]?** **SAMPle[:SCALar]:RXQuality:BER[:RESult]?**		Scalar Results: Start single shot measurement and return results Read out meas. results (unsynchronized) Read out measurement results (synchronized)		
Returned Values	Value range	Def. value	Def. unit	Unit ring
ProgressTime,	0.04 s to 20.0 s	NAN	s	
BitErrorRate,	0.0% to 100.0%	NAN	%	
Bit Errors,	0 to 130 000	NAN	–	
BERMatching,	PASS | FAIL | INV	INV	–	
FramesTr,	0 to 500	NAN	–	
MSPower,	–4 dBm to 36 dBm	INV	dBm	
CarrFreqErr,	0 to 5000	NAN	Hz	
MSSyncDet,	IS1 to IS6 | OFF	INV	–	
MSSync@	0% to 100%	NAN	%	
Description of command				FW vers.
These commands are always queries. They start a bit-error-rate test and return the measurement results (see also detailed explanation of measured values in chapter 4). The results are				V2.41

ProgressTime	Measurement time in s
BitErrorRate	Measured bit error rate for all bits
BitErrors	Total number of bit errors detected
FramesTr	Total number of frames transmitted
MSPower	Effective radiated power of the mobile station
CarrFreqErr	Carrier frequency error
MSSyncDet	IS 136 synchronization pattern detected
MSSync@	Percentage of bursts with synchronization pattern <MSSyncDet>

CALCulate[:SCALar]:RXQuality:BER[:RESult]:MATChing?				Limit Matching
Returned Value	Value range	Def. value	Def. unit	Unit ring
BitErrorRate	PASS | FAIL | INV	INV	–	
Description of command				FW vers.
This command is always a query. It indicates whether and in which way the permissible error limit for the measured values of the bit error rate test (see command above) has been exceeded. The following messages can be returned:				V2.41

FAIL	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
PASS	all tolerances matched	

Common Measurement Groups

The commands for the measurement groups in this section are identical in both test modes; they can be used in *Non Signalling* as well as in *Signalling* measurements.

Note: **Measurements and signalling states**

In order to perform any kind of measurement and obtain a meaningful result, an appropriate test setup is required (see application examples in chapter 2 of this manual). Consequently, if the measurements reported in this section are performed in Signalling *mode, the* Call Established (CEST) *signalling state must be reached before any of the commands retrieving test results* (`READ...[:RESult]?`, `FETCh...[:RESult]?`, `SAMPle...[:RESult]?`, *or* `CALCulate...LIMit?`) *can be used. Test configurations, however, can be defined any time.*

Exception: *The wideband power (`WPOWer`) does not involve any signalling. It can be measured irrespective of the current signalling state.*

WPOWer (Wide Band Power)

The subsystem *WPOWer* measures the power of the signal transmitted by the mobile phone using a wideband filter. It corresponds to the softkey *Wideband Power* in the *Connect. Control* menu.

INITiate:WPOWer	Start new measurement	*RUN*
ABORt:WPOWer	Abort running measurement and switch off	*OFF*
STOP:WPOWer	Stop measurement after current stat. cycle	*STOP*
CONTinue:WPOWer	Next measurement step (only *stepping mode*)	*RUN*
Description of command	Sig. State	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status given in the top right column.	all	V2.41

CONFigure:WPOWer:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	
Description of command			Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5).			all	V2.41

FETCh:WPOWer:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU200/300 operating manual).	all	V2.41

CONFigure:WPOWer:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>* Test cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	–
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror |	Start measurement in case of error *(stop on error)*	NONE	–	–
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP |	Interrupt measurement after each statistics cycle	NONE	–	–
NONE	Continue measurement according to its rep. mode			

Description of command	Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always aborted after a single shot.*	all	V2.41

READ[:SCALar]:WPOWer[:RESult]? Start single shot measurement and return results
FETCh[:SCALar]:WPOWer[:RESult]? Read out measurement results (unsynchronized)
SAMPle[:SCALar]:WPOWer[:RESults]? Read out measurement results (synchronized)

Return	Description of parameters	Def. value	Def. unit	Unit ring
–30.0 dBm to +30.0 dBm	Maximum burst power (not averaged)	NAN	dBm	

Description of command	Sig. State	FW vers.
These commands are always queries. They start the measurement of the maximum burst power of the signals transmitted by the mobile *(peak burst power)* and output the result.	all	V2.41

POWer[:NBURst]

The subsystem *POWer* measures the MS output carrier power versus time. The subsystem corresponds to the measurement menu *Power* and the associated popup menu *Power Configuration.*

The optional keyword `[:NBURst]` denotes normal burst measurements that are available in both test modes. A second application (shortened bursts, `SBURst`) is available in *Signalling* mode only; the corresponding commands are reported in section *IS-136 Mobile Tests (Signalling Mode)*.

Control of measurement – Subsystem Power

The subsystem *POWer* controls the power measurement.

INITiate:POWer[:NBURst][:DQPSk]	Start new measurement	*RUN*
ABORt:POWer[:NBURst][:DQPSk]	Abort running measurement and switch off	*OFF*
STOP:POWer[:NBURst][:DQPSk]	Stop measurement after current stat. cycle	*STOP*
CONTinue:POWer[:NBURst][:DQPSk]	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the power measurement, setting it to the status indicated in the top right column.		V2.41

CONFigure:POWer[:NBURst][:DQPSk]:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200/300 operating manual).				V2.41

FETCh:POWer[:NBURst][:DQPSk]:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	
NONE,	No counting mode set			
1 to 1000 |	Counter for current evaluation period within a cycle	NONE	–	
NONE	Statistic count set to off			
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU200/300 operating manual).				V2.41

Subsystem POWer:CONTrol

The subsystem *POWer:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* tab in the popup menu *Power Configuration.*

CONFigure:POWer[:NBURst][:DQPSk]:CONTrol *<Mode>, <Statistics>*	Scope of Measurement			
<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay,**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
Description of command				FW-Vers.
This command specifies the type of measured values and defines the number of bursts forming a statistics cycle.				≥1.15

CONFigure:POWer[:NBURst][:DQPSk]:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*	Test Cycles			
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V2.41

DISPlay:POWer[:NBURst][:DQPSk]:CONTrol:GRID *<Enable>*	Grid on/off			
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on the grid lines Switch off the grid lines	ON	–	
Description of command				FW vers.
This command switches the grid lines in the test diagram on or off.				V2.41

CONFigure:POWer[:NBURst][:DQPSk]:CONTrol:DEFault				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.41

Test Configuration

The commands of the following subsystems determine the parameters of the signal power measurement. They correspond to the *Power Configuration* popup menu. For a detailed explanation of the power tolerance template defined in the TDMA standard see chapter 4.

Subsystem POWer:LIMit:LINE

The subsystem *POWer:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the power measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Power Configuration.*

CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical] **:UPPer:AREA<nr>:ENABle *<Enable>*** **CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical]** **:UPPer:AREA<nr> *<LevelRel>, <EnableArea>***			Upper Limit Line
Parameters	Value range	Description of parameters	Def. unit
<Enable>	ON | OFF	Area on/off	See below
<LevelRel>, ***<EnableArea>***	–100 dB to +10 dB, ON | OFF	Relative level Range of limit lines on/off	
Description of command			FW vers.
These commands activate and define upper limit lines for normal bursts. The limit lines are defined area by area; the suffix <nr> numbers the five areas in the burst diagram (see chapter 4). The `:ENABle` command is suitable for reactivating a limit line area that was previously defined and disabled.			V2.41

The default settings are given in the table below:

Suffix	EnableArea	LevelRel
1	ON	–60 dB
2	OFF	+6 dB
3	ON	+4 dB
4	OFF	+6 dB
5	ON	–60 dB

The setting *EnableArea = Off* implies that the corresponding range, including the limit check, is switched off. *Enable = Off* switches off the entire limit check.

CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical]:LOWer:AREA1:ENABle <*Enable*>
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical]:LOWer:AREA1 <*LevelRel*>, <*EnableArea*>
Upper Limit Line

Parameters	Value range	Description of parameters	Def. unit
<Enable>	ON | OFF	Area on/off	
<LevelRel>, ***<EnableArea>***	–100 dB to 10 dB, ON | OFF	Relative level Range of limit lines on/off	

Description of command	FW vers.
These commands activate and define the lower limit line for normal bursts. The default relative level is *LevelRel = –20 dB*. The setting *EnableArea = Off* implies that the corresponding range, including the limit check, is switched off. *Enable = Off* switches off the entire limit check.	V2.41

CONFigure:POWer[:NBURst][:DQPSk]:LIMit:POINt[:ASYMmetrical]:LPOWer <*Limit*>
Leakage Power Limit

<Limit>	Description of parameters	Def. value	Def. unit	Unit ring
–80 dBm to 0 dBm	Upper limit of leakage power	–60	dBm	

Description of command	FW vers.
This commands defines the upper limit for the leakage power.	V2.41

CONFigure:POWer[:NBURst][:DQPSk]:LIMit:DEFault Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	

Description of command	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	V2.41

Subsystem POWer:TIME

The subsystem *POWer:...TIME* corresponds to the hotkey *Display/Marker – Oversampling* in the graphical measurement menu *Power.*

CONFigure:POWer[:NBURst][:DQPSk]:TIME:OVERsampling <*Factor*> Oversampling

<Factor>	Description of parameters	Def. value	Def. unit	Unit ring
1 | 8	Oversampling factor; no. of samples per symbol	8	–	

Description of command	FW vers.
This command defines how many samples are taken and displayed per symbol.	V2.41

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer[:NBURst][:DQPSk] Definition of Subarrays
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–20 Symbols to 181 Symbols,	Start time in current range	–20	Symb.	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 202 | **0 to 1616**	No. of samples in range, oversamp. 1 No. of samples in range, oversamp. 8	202 1616	– –	

Description of command	FW vers.
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by a start time and the number of test points which are located on a fixed, equidistant grid. The spacing between the test points is given by the oversampling factor set via `CONFigure:POWer[:NBURst][:DQPSk]:TIME:OVERsampling 1 | 8`. The subranges may overlap but must be within the total range of the *POWer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.41

Measured Values – Subsystem POWer[:RESult]

The subsystem *POWer[:RESult]* determines and outputs the results of the signal power measurement. They correspond to the graphical measurement menu *Power* with its various display elements.

READ[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]? Scalar results:
Start single shot measurement and return results
FETCh[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?
Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
BurstsOutOfTol,	0.0 % to 100.0 %	NAN	%	
BurstPwCurrPeak,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstPwCurrRMS,	–100.0 dBm to +20.0 dBm	NAN	dBm	
LeakPowPeak,	–100.0 dBm to +20.0 dBm	NAN	dBm	
LeakPowRMS,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstMatchCurr,	MATC | NMAT | INV | OUT	INV	–	
BurstMatchMin,	MATC | NMAT | INV | OUT	INV	–	
BurstMatchMax,	MATC | NMAT | INV | OUT	INV	–	
BurstMatchAvg	MATC | NMAT | INV | OUT	INV	–	

Description of command	FW vers.
These commands are always queries. They start a measurement and output all scalar measurement results (see chapter 5). These are: *Peak power of current burst* *Average power of current burst* *Peak leakage power* *Average leakage power* *Matching of current burst power, average, minimum, and maximum burst power* The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *display modes*).The following messages may be output for the value *BurstMatch...*: MATC *matching* NMAT *not matching* INV *invalid* OUT *out of range*	V2.41

CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:CURRent[:RESult]:MATChing? Limit Matching
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:AVERage[:RESult]:MATChing?
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:MINimum[:RESult]:MATChing?
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]:MATChing?

Returned values	Value range	Def. value	Def. unit	Unit ring
BurstPwCurrRMS,	NMAU | NMAL | INV | OK	INV	–	
LeakPowRMS,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching	MATC | NMAT | INV | OUT	INV	–	

Description of command — FW vers.: V2.41

This command is always a query. It indicates whether and in which way the tolerances for the effective burst and leakage power (see command above) have been exceeded (the *BurstMatching* parameter combines the two preceding values).

The following messages may be output for the values *LeakPowRMS and BurstPwCurrRMS:*

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Tolerance value matched	

CALCulate[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]:MATChing:RAMP? Limit Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
BurstMatchCurr,	For all values:	INV	–	
BurstMatchMin,		INV	–	
BurstMatchMax,	MATC | NMAT | INV | OUT	INV	–	
BurstMatchAvg		INV	–	

Description of command — FW vers.: V2.41

This command is always a query. It indicates whether and in which way the tolerances for the scalar measured values (see command above) have been exceeded.

The following messages may be output for the value *BurstMatching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
OUT	*out of range*

READ:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult]? Burst Power
READ:ARRay:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?
READ:ARRay:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?
READ:ARRay:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?
Start single shot measurement and return results *RUN*

FETCh:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?
FETCh:ARRay:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?
FETCh:ARRay:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?
FETCh:ARRay:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?
Read meas. results (unsynchronized) *RUN*

SAMPle:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?
SAMPle:ARRay:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?
SAMPle:ARRay:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?
SAMPle:ARRay:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?
Read results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB... + 10.0 dB,	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB... + 10.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time at fixed, equidistant test points. The number of measured values is 202 (oversampling factor 1) or 1616 (oversampling factor 8; see command `CONFigure:POWer[:NBURst][:DQPSk]:TIME:OVERsampling` <*Factor*>). The calculation of results in the modes *current, average, maximum* and *minimu*m is explained in chapter 3 (see *display modes*).	V2.41

READ:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]? Subarray Results
READ:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?
READ:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?
READ:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB... + 10.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB... + 10.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	V2.41

CALCulate:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult]:MATChing:
LIMit[:LINE][:ASYMmetrical][:COMBined]?
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:AVERage[:RESult]:MATChing:
LIMit[:LINE][:ASYMmetrical][:COMBined]?
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:MINimum[:RESult]:MATChing:
LIMit[:LINE][:ASYMmetrical][:COMBined]?
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]:MATChing:
LIMit[:LINE][:ASYMmetrical][:COMBined]?
Burst Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
32-bit field,	Indicator for upper limit matching in area 1 to 5 (5 least significant bits)	NAN	–	
32-bit field	Indicator for lower limit matching in area 1 to 5 (5 least significant bits)	NAN	–	

Description of command	FW vers.
This command is always a query. Any set bit of the two returned bit fields indicates that the corresponding section of the limit lines is violated.	V2.41

MODulation[:OVERview]

The subsystem *MODulation[:OVERview]* measures general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Overview,* and the associated popup menu *Modulation Configuration.*

Control of Measurement – Subsystem MODulation[:OVERview]

The subsystem *MODulation[:OVERview]* controls the modulation measurement. It corresponds to the softkey *Overview DQPSK* in the measurement menu *Modulation*.

INITiate:MODulation[:OVERview][:DQPSk]	Start new measurement	*RUN*
ABORt:MODulation[:OVERview][:DQPSk]	Abort running measurement and switch off	*OFF*
STOP:MODulation[:OVERview][:DQPSk]	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation[:OVERview][:DQPSk]	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.41

CONFigure:MODulation[:OVERview][:DQPSk]:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	–
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200/300 operating manual).				V2.41

FETCh:MODulation[:OVERview][:DQPSk]:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU200/300 operating manual).				V2.41

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Overview* application.

Subsystem MODulation[:OVERview][:DQPSk]:CONTrol

The subsystem *MODulation[:OVERview][:DQPSk]:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol *<Mode>, <Statistics>*				Scope of Measurement
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values (incl. tolerance matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V2.41

CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*				Test Cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V2.41

CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol:DEFault *<Mode>*		Default Settings		
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.41

Tolerance values – Subsystem MODulation:OEMP[:DQPSk]:LIMit

The subsystem *MODulation:OEMP[:DQPSk]:LIMit* defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:OEMP[:DQPSk]:CMMax:LIMit[:WBURst] ***<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>***		Limits Whole Burst		
Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg,	PhaseErrorPeak	+12.0	deg	
0.0 deg to +50.0 deg,	PhaseErrorRMS	+5.0	deg	
0.0 % to +50.0 %,	MagnErrorPeak	+35.0	%	
0.0 % to +50.0 %,	MagnErrorRMS	+12.5	%	
0.0 % to +50.0 %,	EVMErrorPeak	+35.0	%	
0.0 % to +50.0 %,	EVMErrorRMS	+12.5	%	
–100.0 dB to 0.0 dB,	OriginOffset	–20.0	dB	
–100.0 dB to 0.0 dB,	IQImbalance	–20.0	dB	
0 Hz to 1000 Hz	FrequencyError	+200	Hz	
Description of command				FW vers.
This command defines upper limits for the *Current* and *Max./Min*. traces evaluated over the whole burst and for the scalar modulation parameters derived from them.				V2.41

CONFigure:MODulation:OEMP[:DQPSk]:CMMax:LIMit:FTSYmbols Limits 1st 10 Symbols
<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg,	PhaseErrorPeak	+12.0	deg	
0.0 deg to +50.0 deg,	PhaseErrorRMS	+10.0	deg	
0.0 % to +50.0 %,	MagnErrorPeak	+35.0	%	
0.0 % to +50.0 %,	MagnErrorRMS	+25.0	%	
0.0 % to +50.0 %,	EVMErrorPeak	+35.0	%	
0.0 % to +50.0 %,	EVMErrorRMS	+25.0	%	
–100.0 dB to 0.0 dB,	OriginOffset	–20.0	dB	
–100.0 dB to 0.0 dB,	IQImbalance	–20.0	dB	
0 Hz to 1000 Hz	FrequencyError	+200	Hz	

Description of command	FW vers.
This command defines upper limits for the *Current* and *Max./Min*. traces evaluated over the first ten valid symbols of the burst and for the scalar modulation parameters derived from them.	V2.41

CONFigure:MODulation:OEMP[:DQPSk]:AVERage:LIMit[:WBURst] Limits Whole Burst
<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>

Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg,	PhaseErrorPeak	+12.0	deg	
0.0 deg to +50.0 deg,	PhaseErrorRMS	+5.0	deg	
0.0 % to +50.0 %,	MagnErrorPeak	+35.0	%	
0.0 % to +50.0 %,	MagnErrorRMS	+12.5	%	
0.0 % to +50.0 %,	EVMErrorPeak	+35.0	%	
0.0 % to +50.0 %,	EVMErrorRMS	+12.5	%	
–100.0 dB to 0.0 dB,	OriginOffset	–20.0	dB	
–100.0 dB to 0.0 dB,	IQImbalance	–20.0	dB	
0 Hz to 1000 Hz	FrequencyError	+200	Hz	

Description of command	FW vers.
This command defines upper limits for the *Average* trace evaluated over the whole burst and for the scalar modulation parameters derived from it.	V2.41

CONFigure:MODulation:OEMP[:DQPSk]:AVERage:LIMit:FTSYmbols ***<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>, <EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>***	Limits 1st 10 Symbols			
Parameter	Description of parameters	Def. value	Def. unit	Unit ring
0.0 deg to +50.0 deg,	PhaseErrorPeak	+12.0	deg	
0.0 deg to +50.0 deg,	PhaseErrorRMS	+10.0	deg	
0.0 % to +50.0 %,	MagnErrorPeak	+35.0	%	
0.0 % to +50.0 %,	MagnErrorRMS	+25.0	%	
0.0 % to +50.0 %,	EVMErrorPeak	+35.0	%	
0.0 % to +50.0 %,	EVMErrorRMS	+25.0	%	
–100.0 dB to 0.0 dB,	OriginOffset	–20.0	dB	
–100.0 dB to 0.0 dB,	IQImbalance	–20.0	dB	
0 Hz to 1000 Hz	FrequencyError	+200	Hz	
Description of command				FW vers.
This command defines upper limits for the *Average* trace evaluated over the first ten valid symbols of the burst and for the scalar modulation parameters derived from it.				V2.41

CONFigure:MODulation:OEMP[:DQPSk]:LIMit:DEFault *<Mode>*	Default Settings			
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.41

Measured Values – Subsystem MODulation[:OVERview][:DQPSk][:RESult]

The subsystem *MODulation[:OVERview][:DQPSk][:RESult]* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Overview.*

READ[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]? Scalar Results:
READ[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]?
FETCh[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]?
SAMPle[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
PhErrorPeakCurr,	–100.0 deg to +100.0 deg	NAN	deg	
PhErrorPeakAvg,	–100.0 deg to +100.0 deg	NAN	deg	
PhErrorPeakMMax,	–100.0 deg to +100.0 deg	NAN	deg	
PhErrorRMS (x3),	–100.0 deg to +100.0 deg	NAN	deg	
MagnErrorPeak (x3),	0.0 % to 100.0 %	NAN	%	
MagnErrorRMS (x3),	0.0 % to 100.0 %	NAN	%	
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
MSSyncDetectedCurr,	IS1 to IS6 | NONE	NAN	–	
AmplitudeDroopCurr,	–100.0 dB to +100.0 dB	NAN	dB	
TimingErrorCurr,	–100.0 Symb. to +100.0 Symb.	NAN	Symb.	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.41

CALCulate[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:MATChing:LIMit[:WBURst]?
CALCulate[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:MATChing:LIMit:FTSYmbols?

Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),		INV	–	
MagnErrorPeak (x3),	**For all measured values:**	INV	–	
MagnErrorRMS (x3),				
EVMPeak (x3),		INV	–	
EVMRMS (x3),		INV	–	
	NMAU | NMAL | INV | OK	INV	–	
OriginOffset (x3),		INV	–	
IQImbalance (x3),		INV	–	
FrequencyError (x3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.41

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* measures the error vector magnitude as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *EVM DQPSK,* and the associated popup menu *Modulation Configuration.*

Control of Measurement – Subsystem MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* controls the modulation measurement. It corresponds to the softkey *EVM DQPSK* in the measurement menu *Modulation*.

INITiate:MODulation:EVMagnitude[:DQPSk]	Start new measurement	*RUN*
ABORt:MODulation:EVMagnitude[:DQPSk]	Abort running measurement and switch off	*OFF*
STOP:MODulation:EVMagnitude[:DQPSk]	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:EVMagnitude[:DQPSk]	Next measurement step (only *stepping mode*)	*RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V2.41

CONFigure:MODulation:EVMagnitude[:DQPSk]:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200/300 operating manual).	V2.41

FETCh:MODulation:EVMagnitude[:DQPSk]:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	

Description of command	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU200/300 operating manual).	V2.41

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Error Vector Magnitude* application.

Subsystem MODulation:EVMagnitude[:DQPSk]:CONTrol

The subsystem *MODulation:EVMagnitude[:DQPSk]:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol *<Mode>, <Statistics>*				Scope of Measurement
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values (incl. tolerance matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V2.41

CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol:REPetition *<Repetition> ,<StopCond>,<Stepmode>*				Test Cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V2.41

DISPlay:MODulation:EVMagnitude[:DQPSk]:CONTrol:GRID <*Enable*>				Grid on/off
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on grid lines Switch off grid lines	ON	–	
Description of command				FW vers.
This command switches the grid lines in the test diagrams on or off.				V2.41

CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol:DEFault <*Mode*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.41

Tolerance values – Subsystem MODulation:OEMP[:DQPSk]:LIMit

The subsystem *MODulation:OEMP[:DQPSk]:LIMit* (see p. 6.28 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:EVMagnitude[:DQPSk]
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum,	Return maximum value in every range			

<Start>	Description of parameters	Def. value	Def. unit	Unit ring
6 Symbols to 162 Symbols,	Start time in current range	6	Symb.	

<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 157	Number of samples in current range	157	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symbol period. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.41

Measured Values – Subsystem MODulation:EVMagnitude[:DQPSk][:RESult]

The subsystem *MODulation:EVMagnitude[:DQPSk][:RESult]* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *EVM DQPSK.*

READ[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]? Scalar Results:
READ[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]?
FETCh[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]?
SAMPle[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
EVMPeak (x3),	0.0 % to 100.0 %	NAN	%	
EVMRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
MSSyncDetected,	IS1 to IS6 | NONE	NONE	–	
AmplitudeDroop,	–100.0 dB to +100.0 dB	NAN	dB	
Timing Error	–100.0 Symb. to +100.0 Symb.	NAN	Symb.	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.41

CALCulate[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:MATChing:LIMit[:WBURst]?
CALCulate[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:MATChing:LIMit:
FTSYmbols? Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
EVMPeak (x3),		INV	–	
EVMRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),				
IQImbalance (x3),	**NMAU | NMAL | INV | OK**	INV	–	
FrequencyError (x3)		INV	–	

Description of command — FW vers.

V2.41

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands.

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]? EVM in Burst
READ:ARRay:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?
READ:ARRay:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?
FETCh:ARRay:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?
FETCh:ARRay:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?
SAMPle:ARRay:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?
SAMPle:ARRay:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for error vector magnitude	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	xth value for error vector magnitude	NAN	%	

Description of command — FW vers.

V2.41

These commands are always queries. They return the error vector magnitude vs. time at fixed, equidistant test points. The number of measured values is 157, corresponding to a time range of 6 symbols to 162 symbols.

The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]? Subarray Results
READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?
READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %, **... ,** **0.0 % to+ 100.0 %**	1st value for error vector magnitude ... xth value for error vector magnitude	NAN ... NAN	% ... %	

Description of command	FW vers.
These commands are always queries. They measure and return the error vector magnitude versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:EVMagnitude[:DQPSk]` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:EVMagnitude[:DQPSk]` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	V2.41

MODulation:PERRor

The subsystem *MODulation:PERRor* measures the phase error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Phase Error DQPSK,* and the associated popup menu *Modulation Configuration.*

Control of Measurement – Subsystem MODulation:PERRor

The subsystem *MODulation:PERRor* controls the modulation measurement. It corresponds to the softkey *Phase Error DQPSK* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor[:DQPSk]	Start new measurement	*RUN*
ABORt:MODulation:PERRor[:DQPSk]	Abort running measurement and switch off	*OFF*
STOP:MODulation:PERRor[:DQPSk]	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:PERRor[:DQPSk]	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.41

CONFigure:MODulation:PERRor[:DQPSk]:EREPorting *<Mode>*				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200/300 operating manual).				V2.41

FETCh:MODulation:PERRor[:DQPSk]:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU200/300 operating manual).				V2.41

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Magnitude Error* application.

Subsystem MODulation:PERRor[:DQPSk]:CONTrol

The subsystem *MODulation:PERRor[:DQPSk]:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:PERRor[:DQPSk]:CONTrol *<Mode>, <Statistics>* Scope of Measurement				
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values (incl. tolerance matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
Description of command				FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.				V2.41

CONFigure:MODulation:PERRor[:DQPSk]:CONTrol:REPetition *<Repetition> ,<StopCond>,<Stepmode>* Test Cycles				
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V2.41

DISPlay:MODulation:PERRor[:DQPSk]:CONTrol:GRID <*Enable*>				Grid on/off
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on grid lines Switch off grid lines	ON	–	
Description of command				FW vers.
This command switches the grid lines in the test diagrams on or off.				V2.41

CONFigure:MODulation:PERRor[:DQPSk]:CONTrol:DEFault <*Mode*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.41

Tolerance values – Subsystem MODulation:OEMP[:DQPSk]:LIMit

The subsystem *MODulation:OEMP[:DQPSk]:LIMit* (see p. 6.28 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation:PERRor[:DQPSk]

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor[:DQPSk]
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
6 Symbols to 162 Symbols,	Start time in current range	6	Symb.	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 157	Number of samples in current range	157	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symbol period. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.41

Measured Values – Subsystem MODulation:PERRor[:DQPSk][:RESult]

The subsystem *MODulation:PERRor[:DQPSk][:RESult]* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Phase Error DQPSK.*

READ[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?
READ[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?
FETCh[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?
SAMPle[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
PhErrorPeak (x3),	–100.0 deg to 100.0 deg	NAN	deg	
PhErrorRMS (x3),	–100.0 deg to 100.0 deg	NAN	deg	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
MSSyncDetected,	IS1 to IS6 | NONE	NONE	–	
AmplitudeDroop,	–100.0 dB to +100.0 dB	NAN	dB	
Timing Error	–100.0 Symb. to +100.0 Symb.	NAN	Symb.	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.41

CALCulate[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:MATChing:LIMit[:WBURst]?
CALCulate[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:MATChing:LIMit:FTSYmbols?
Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
PhErrorPeak (x3),		INV	–	
PhErrorRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),				
IQImbalance (x3),	**NMAU | NMAL | INV | OK**	INV	–	
FrequencyError (x3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands.	V2.41

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:PERRor[:DQPSk]:CURRent[:RESult]? Phase Error in Burst
READ:ARRay:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?
READ:ARRay:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?
FETCh:ARRay:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?
FETCh:ARRay:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?
SAMPle:ARRay:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?
SAMPle:ARRay:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	deg	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	xth value for phase error	NAN	deg	

Description of command	FW vers.
These commands are always queries. They return the phase error vs. time at fixed, equidistant test points. The number of measured values is 157, corresponding to a time range of 6 bit to 162 symbols. The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).	V2.41

READ:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]? Subarray Results
READ:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?
READ:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
100.0 deg to+ 100.0 deg,	1st value for phase error	NAN	deg	
... ,	...	...	...	
–100.0 deg to+ 100.0 deg	xth value for phase error	NAN	deg	

Description of command	FW vers.
These commands are always queries. They measure and return the phase error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:PERRor[:DQPSk]` command. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:PERRor[:DQPSk]` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical, MINimum, MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	V2.41

MODulation:MERRor

The subsystem *MODulation:MERRor* measures the magnitude error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Magn. Error DQPSK,* and the associated popup menu *Modulation Configuration.*

Control of Measurement – Subsystem MODulation:MERRor

The subsystem *MODulation:MERRor* controls the modulation measurement. It corresponds to the softkey *Magn. Error DQPSK* in the measurement menu *Modulation*.

INITiate:MODulation:MERRor[:DQPSk]	Start new measurement	*RUN*
ABORt:MODulation:MERRor[:DQPSk]	Abort running measurement and switch off	*OFF*
STOP:MODulation:MERRor[:DQPSk]	Stop measurement after current stat. cycle	*STOP*
CONTinue:MODulation:MERRor[:DQPSk]	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V2.41

CONFigure:MODulation:MERRor[:DQPSk]:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200/300 operating manual).				V2.41

FETCh:MODulation:MERRor[:DQPSk]:STATus?				Measurement Status
Ret. values	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle			
NONE,	No counting mode set	NONE	–	
1 to 1000 |	Counter for current evaluation period within a cycle			
NONE	Statistic count set to off	NONE	–	
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU200/300 operating manual).				V2.41

Subsystem MODulation:MERRor[:DQPSk]:CONTrol

The subsystem *MODulation:MERRor[:DQPSk]:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:MERRor[:DQPSk]:CONTrol *<Mode>, <Statistics>*

Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values (incl. tolerance matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	

Description of command	FW vers.
This command selects the type of measured values and determines the number of bursts forming one statistics cycle.	V2.41

CONFigure:MODulation:MERRor[:DQPSk]:CONTrol:REPetition *<Repetition> ,<StopCond>,<Stepmode>*

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	

Description of command	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*	V2.41

DISPlay:MODulation:MERRor[:DQPSk]:CONTrol:GRID *<Enable>*

Grid on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on grid lines Switch off grid lines	ON	–	

Description of command	FW vers.
This command switches the grid lines in the test diagrams on or off.	V2.41

CONFigure:MODulation:MERRor[:DQPSk]:CONTrol:DEFault <*Mode*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command				FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				V2.41

Tolerance values – Subsystem MODulation:OEMP[:DQPSk]:LIMit

The subsystem *MODulation:OEMP[:DQPSk]:LIMit* (see p. 6.28 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:MERRor[:DQPSk]
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
6 Symbols to **162 Symbols,**	Start time in current range	6	Symb.	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 157	Number of samples in current range	157	–	
Description of command				FW vers.
This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 symbol period. The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				V2.41

Measured Values – Subsystem MODulation:MERRor[:DQPSk][:RESult]

The subsystem *MODulation:MERRor[:DQPSk][:RESult]* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Magn. Error DQPSK.*

READ[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?
READ[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?
FETCh[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?
SAMPle[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
MErrPeak (x3),	0.0 % to 100.0 %	NAN	%	
MErrRMS (x3),	0.0 % to 100.0 %	NAN	%	
OriginOffset (x3),	–100.0 dB to +100.0 dB	NAN	dB	
IQImbalance (x3),	–100.0 dB to +100.0 dB	NAN	dB	
FrequencyError (x3),	–1000.0 Hz to +1000.0 Hz	NAN	Hz	
MSSyncDetected,	IS1 to IS6 | NONE	NONE	–	
AmplitudeDroop,	–100.0 dB to +100.0 dB	NAN	dB	
Timing Error	–100.0 Symb. to +100.0 Symb.	NAN	Symb.	
AvgBurstPowerCurr,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstsOutOfTol	0.0 % to 100.0 %	NAN	%	

Description of command	FW vers.
These commands are always queries. They start a modulation measurement and output all scalar measurement results (see chapter 4), either for the whole burst or for the 1st ten valid symbols in the burst. The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *calculation of statistical quantities*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value.	V2.41

CALCulate[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:MATChing:LIMit[:WBURst]?
CALCulate[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:MATChing:LIMit:FTSYmbols?
Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
MErrPeak (x3),		INV	–	
MErrRMS (x3),	**For all measured values:**	INV	–	
		INV	–	
OriginOffset (x3),				
IQImbalance (x3),	**NMAU | NMAL | INV | OK**	INV	–	
FrequencyError (x3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *MMax* value. The limits are defined with the `CONFigure:MODulation:OEMP`... commands.	V2.41

The following messages may be output for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	all tolerances matched	

READ:ARRay:MODulation:MERRor[:DQPSk]:CURRent[:RESult]? Phase Error in Burst
READ:ARRay:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?
READ:ARRay:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:ARRay:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?
FETCh:ARRay:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?
FETCh:ARRay:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?
Read measurement results (unsynchronized) *RUN*
SAMPle:ARRay:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?
SAMPle:ARRay:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?
SAMPle:ARRay:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?
Read measurement results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for magnitude error	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	xth value for magnitude error	NAN	%	

Description of command	FW vers.
These commands are always queries. They return the magnitude error vs. time at fixed, equidistant test points. The number of measured values is 157, corresponding to a time range of 6 bit to 162 symbols.	V2.41

The calculation of *current, average, and mmax* (Min./Max.) results is explained in chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]? Subarray Results
READ:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?
READ:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?
Read results (synchronized) *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
0.0 % to+ 100.0 %,	1st value for magnitude error	NAN	%	
... ,	...	...	...	
0.0 % to+ 100.0 %	xth value for magnitude error	NAN	%	

Description of command	FW vers.
These commands are always queries. They measure and return the magnitude error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:MERRor[:DQPSk]` command. In the default setting of the configuration command the `READ:SUBarrays..., FETCh:SUBarrays..., and SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay..., FETCh:ARRay..., and SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:MODulation:MERRor[:DQPSk]` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical, MINimum, MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	V2.41

SPECtrum

The subsystem *SPECtrum[:ACPower]* measures the off-carrier power of the IS-136 signal. The subsystem corresponds to the measurement menu *Spectrum* and the associated configuration popups.

Control of Measurement – Subsystem SPECtrum[:ACPower]

The subsystem *SPECtrum[:ACPower]* controls the *Spectrum* measurement.

INITiate:SPECtrum[:ACPower]	Start new measurement	*RUN*
ABORt:SPECtrum[:ACPower]	Abort running measurement and switch off	*OFF*
STOP:SPECtrum[:ACPower]	Stop measurement after current stat. cycle	*STOP*
CONTinue:SPECtrum[:ACPower]	Next measurement step (only *stepping mode*)	*RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.		V2.41

CONFigure:SPECtrum[:ACPower]:EREPorting <*Mode*>		Event Reporting		
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	–
Description of command				FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200/300 operating manual).				V2.41

FETCh:SPECtrum[:ACPower]:STATus?		Measurement Status		
Returned values	Description of parameters	Def. value	Def. unit	Unit ring
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	–
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	–
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	–
Description of command				FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU200/300 operating manual).				V2.41

Test Configuration

The commands of the following subsystems configure the *Spectrum* measurement. They correspond to the *Spectrum Configuration* menu.

Subsystem SPECTrum[:ACPower]:CONTrol

The subsystem *SPECtrum[:ACPower]:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* tab in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum[:ACPower]:CONTrol *<Mode>,<Statistics>* Scope of Measurement

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Only scalar measured values Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
Description of command				FW vers.
This command restricts the type of measured values and determines the number of bursts within a statistics cycle.				V2.41

CONFigure:SPECtrum[:ACPower]:CONTrol:REPetition
<Repetition>,<StopCondition>*,*<Stepmode> Test cycles

<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCondition>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command				FW vers.
This command defines the number of test cycles, the stepping mode and, if required, a stop condition for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*				V2.41

CONFigure:SPECtrum[:ACPower]:CONTrol:ACHannel <*Adj_Channel*>

Time Domain Adjacent Channel

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
–3 to –1 | +1 to +3	Adjacent channel no.	–3	–	

Description of command	FW vers.
This command selects the adjacent channel for time-domain representation.	V2.41

DISPlay:SPECtrum[:ACPower]:CONTrol:GRID <*Enable*> Grid on/off

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	Switch on grid lines	ON	–	
OFF	Switch off grid lines			

Description of command	FW vers.
This command switches the grid lines in the test diagrams on or off.	V2.41

CONFigure:SPECtrum[:ACPower]:CONTrol:DEFault <*Mode*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All the parameters of the subsystem are set to default values	ON	–	
OFF	At least one parameter of the subsystem differs from its default value			

Description of command	FW vers.
If used as a setting command with the parameter *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.	V2.41

Subsystem SPECTrum[:ACPower]:LIMit

The subsystem *SPECtrum[:ACPower]:LIMit* defines the limit lines, i.e. the tolerance values for the spectrum due to modulation measurement The subsystem corresponds to the *due to Modulation* sections in the tab *Limit Lines* in the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum[:ACPower]:LIMit:CHN<nr>:ENABle <Enable> **CONFigure:SPECtrum[:ACPower]:LIMit:CHN<nr> *<LevelPeak>, <LevelRMS>,<Enable>***			Limits
Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to3	Measurement point (channel) no.	
Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check in channel <nr> on/off	See below
<LevelPeak>, ***<LevelRMS>,*** ***<Enable>***	–99.9 dB to 99.9 dB –99.9 dB to 99.9 dB ON | OFF	Limit for peak power Limit for effective power Limit check in channel <nr> on/off	
Description of command			FW vers.
These commands activate and define limit lines for the spectrum measurement. The numbers <nr> denote the (lower) adjacent channel, the first and second alternate channel (<nr> = 1 to 3, carrier frequency – <nr> * 30 kHz). The `:ENABle` command is suitable for reactivating a limit line area that was previously defined and disabled. Default values for IS-136 800 and IS-136 1900:			V2.41

<nr>	Frequency from carrier	<LevelPeak>	<LevelRMS>
1	+30 kHz	–26 dB	–26 dB
2	+60 kHz	–45 dB	–45 dB
3	+90 kHz	–45 dB	–45 dB

CONFigure:SPECtrum[:ACPower]:LIMit:CHP<nr>:ENABle <Enable> **CONFigure:SPECtrum[:ACPower]:LIMit:CHP<nr> *<LevelPeak>, <LevelRMS>,<Enable>***			Limits
Numeric Suffix	Value range	Description of parameters	Def. value
<nr>	1 to3	Measurement point (channel) no.	
Parameters	Value range	Description of parameters	Def. value
<Enable>	ON | OFF	Limit check in channel <nr> on/off	See below
<LevelPeak>, ***<LevelRMS>,*** ***<Enable>***	–99.9 dB to 99.9 dB –99.9 dB to 99.9 dB ON | OFF	Limit for peak power Limit for effective power Limit check in channel <nr> on/off	
Description of command			FW vers.
These commands activate and define limit lines for the spectrum measurement. The numbers <nr> denote the (upper) adjacent channel, the first and second alternate channel (<nr> = 1 to 3, carrier frequency + <nr> * 30 kHz). The `:ENABle` command is suitable for reactivating a limit line area that was previously defined and disabled. Default values for IS-136 800 and IS-136 1900:			V2.41

<nr>	Frequency from carrier	<LevelPeak>	<LevelRMS>
1	–30 kHz	–26 dB	–26 dB
2	–60 kHz	–45 dB	–45 dB
3	–90 kHz	–45 dB	–45 dB

CONFigure:SPECtrum[:ACPower]:LIMit:DEFault <*Enable*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	All the parameters of the subsystem are set to default values	ON	–	
OFF	At least one parameter of the subsystem differs from its default value			
Description of command				FW vers.
If used as a setting command with *ON*, this command sets all the parameters of the subsystem to their default values (*OFF* has no effect). In the query format, the command returns *ON* if all the parameters of the subsystem correspond to their default values, otherwise it returns *OFF*.				V2.41

Subsystem SUBarrays:SPECtrum[:ACPower]:TDOMain

The subsystem *SUBarrays:SPECtrum[:ACPower]:TDOMain* defines the measurement range in the *ACP Time Domain* application.

CONFigure:SUBarrays:SPECtrum[:ACPower]:TDOMain[:DQPSk]
<Mode>,<Start>,<Samples>{,<Start>,<Samples>} Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	–
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–27 Symbols to +190 Symbols	Start time in current range	–27	Symb.	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 872	Number of samples in current range	872	–	

Description of command	FW vers.
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points; the spacing of the test points is given by the fixed oversampling factor of 4 samples per symbol. The subranges may overlap but must be within the total range of the *SPECtrum:TDOMain* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.	V2.41

Measured Values

The commands of the following subsystems determine and return the results of the spectrum due to modulation measurement. They correspond to the graphical menu *Spectrum* with its various display elements.

Subsystem SPECtrum[:ACPower][:RESult]

The subsystem *SPECtrum[:ACPower][:RESult]* measures and returns the frequency spectum (due to modulation) and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum.*

READ[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]? Scalar Results

Start single shot measurement and return results

FETCh[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?

Read measurement results (unsynchronized)

SAMPle[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?

Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
MSPowerPeak,	–100.0 dBm to +100.0 dBm	NAN	dBm	
MSPowerRMS,	–100.0 dBm to +100.0 dBm	NAN	dBm	
ACPowerPeak (–3 to +3),	–100.0 dBc to +100.0 dBc	NAN	dBc	
ACPowerRMS (–3 to +3),	–100.0 dBc to +100.0 dBc	NAN	dBc	
ACPPeak (Peak) (–3 to +3),	–100.0 dBc to +100.0 dBc	NAN	dBc	
ACPPeak (RMS) (–3 to +3),	–100.0 dBc to +100.0 dBc	NAN	dBc	
ACPAvg (RMS) (–3 to +3),	–100.0 dBc to +100.0 dBc	NAN	dBc	
OutOfTolerance	0.0% to 100.0%	NAN	%	

Description of command	FW vers.
These commands are always queries. They return the following scalar quantities describing the radiated power in the designated radio channel and the adjacent channels. The symbol (–3 to +3) behind a value indicates that the list contains six results corresponding to the alternate channel nos. –3 to –1 and +1 to +3.	V2.41

MSPowerPeak	*Average power of current burst*
MSPowerRMS	*Effective power of current burst*
ACPPowerPeak	*Peak alternate channel power*
ACPPowerRMS	*Effective alternate channel power*
ACPPeak (Peak)	*Maximum of all ACPPowerPeak values in the measurement*
ACPPeak (RMS)	*Maximum of all ACPPowerRMS values in the measurement*
ACPAvg (RMS)	*Average of all ACPPowerRMS values in the measurement*
OutOfTolerance	*Percentage of bursts out of tolerance*

CALCulate[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]:MATChing:LIMit?
Bursts out of Tolerance

Returned values	Value range	Def. value	Def. unit	Unit ring
ACPowerPeak (–3 to +3),		INV	–	
ACPowerRMS (–3 to +3),	**For all measured values:**	INV	–	
ACPPeak (Peak) (–3 to +3),		INV	–	
ACPPeak (RMS) (–3 to +3),	**NMAU | NMAL | INV | OK**	INV	–	
ACPAvg (RMS) (–3 to +3)		INV	–	

Description of command	FW vers.
This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see above command) have been exceeded. The symbol (–3 to +3) behind a value indicates that the list contains six results corresponding to the alternate channel nos. –3 to –1 and +1 to +3. The following messages may be output for all measured values: NMAU Underflow of tolerance value *not matching, underflow* NMAL Tolerance value exceeded *not matching, overflow* INV Measurement invalid *invalid* OK all tolerances matched	V2.41

READ:ARRay:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]? Burst Power
READ:ARRay:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?
READ:ARRay:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?
READ:ARRay:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:ARRay:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?
FETCh:ARRay:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?
FETCh:ARRay:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?
FETCh:ARRay:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?
Read meas. results (unsynchronized) *RUN*
SAMPle:ARRay:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?
SAMPle:ARRay:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?
SAMPle:ARRay:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?
SAMPle:ARRay:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?
Read results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–120.0 dBm to +40.0 dBm,	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–120.0 dBm to +40.0 dBm	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time (application *ACP Time Domain)* in the adjacent channel selected via `CONFigure:SPECtrum[:ACPower]:Control:ACHannel` at fixed, equidistant test points. The number of measured values is 872 corresponding to an oversampling factor of 4. The calculation of results in the modes *current, average, maximum* and *minimu*m is explained in chapter 3 (see *display modes*).	V2.41

READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]? Subarray Results
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?
Start single shot measurement and return results *RUN*
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?
Read meas. results (unsynchronized) *RUN*
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?
Read results (synchronized) *RUN*

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–120.0 dBm to +40.0 dBm,	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–120.0 dBm to +40.0 dBm	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	FW vers.
These commands are always queries. They output the burst power versus time in the adjacent channel selected via `CONFigure:SPECtrum[:ACPower] :Control:ACHannel` and in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:SPECtrum` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical, MINimum, MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	V2.41

Measurement Groups (Signalling only)

The measurement groups in this section are provided in *Signalling* mode only.

RXQuality:MAHO

The subsystem *RXQuality:MAHO* tests the capability of the mobile station to provide the mobile-assisted handoff (MAHO) report. The subsystem corresponds to the main menu *Receiver Quality,* application *MAHO* and the associated popup menu *Receiver Quality Configuration.* The MAHO report is provided by the mobile phone alone; it does not actually represent a CMU measurement.

The neighbor cell MAHO report is empty unless a list of neighbor channels is defined via the `CONFigure:RXQuality:MAHO:CONTrol...` commands.

Configuration of Channel List – Subsystem RXQuality:MAHO:CONTrol

The subsystem *RXQuality:MAHO:CONTrol* configures the list of measured neighbor channels. It corresponds to the sections in the *Receiver Quality Configuration* menu associated to the *MAHO* application.

CONFigure:RXQuality:MAHO:CONTrol:NCELls:BAND *<Band_1>,..., <Band_24>* Band

<Band_n>	Description of parameters	Def. value	Def. unit	Unit ring
B08 | **B19**	IS 136 800 hyperband IS 136 1900 hyperband	current hyperband (according to current function group)	–	–

Description of command	Sig. State	FW vers.
This command defines the list of 24 IS 136 hyperband selections (n = 1 to 24) for the neighbor cell channels defined via `CONFigure:RXQuality:MAHO:CONTrol:NCELls:CHANnel`.	all	V3.05

Neighbor Channels
CONFigure:RXQuality:MAHO:CONTrol:NCELls:CHANnel *<Channel_1>, ..., <Channel_24>*

<Channel_n>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 | OFF **1 to 1999 | OFF**	Channel number for IS 136 800 Channel number for IS 1361900	OFF	–	–

Description of command	Sig. State	FW vers.
This command defines the list of 24 channels (n = 1 to 24) in the neighbor cells. An *OFF* setting means that the corresponding entry of the list remains empty.	all	V3.05

The channel numbers entered must be compatible with the selected hyperband; see command `CONFigure:RXQuality:MAHO:CONTrol:NCELls:BAND`. This is important is the 800 MHz band (B08) is selected where the channel numbers 800 to 989 and 1024 to 1999 are not used. If a number in the channel gap between 800 and 989 is entered, the CMU overwrites the entered channel with the value 799. For entries above 1023, an SCPI error message no. –120, "Numeric data error", is generated.

The current band is never changed implicitly if it is incompatible with the selected channel number.

CONFigure:RXQuality:MAHO:CONTrol:NCELls:CELL<nr> *<Band>, <Channel>*				Neighbor Cell
<Band>	Description of parameters	Def. value	Def. unit	Unit ring
B08 | **B19 |** **OFF,**	IS 136 800 hyperband IS 136 1900 hyperband current hyperband	OFF (current hyperband)	–	–
<Channel>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 | OFF **1 to 1999 | OFF**	Channel number for IS 136 800 Channel number for IS 1361900	OFF	–	–
Description of command			Sig. State	FW vers.
This command defines the IS 136 hyperband and the used channel in neighbor cell <nr> where <nr> = 1 to 24. The channel number must be compatible with the selected band (even if the <*Band*> parameter is set to OFF); see `CONFigure:RXQuality:MAHO:CONTrol:NCELls:CHANnel` command.			all	V3.05

CONFigure:RXQuality:MAHO:CONTrol:NCELls:LSORted *<Mode>*				List Sorted
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	List sorted according to channel numbers List unsorted/sorted acc. to cell numbers (query only)	OFF	–	–
Description of command			Sig. State	FW vers.
This command determines whether the list of neighbor channels is sorted according to channel numbers or kept as defined via `CONFigure:RXQuality:MAHO:CONTrol:NCELls:CHANnel`.			all	V3.05

CONFigure:RXQuality:MAHO:CONTrol:DEFault				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	–
Description of command			Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.			all	V3.05

MAHO Results – Subsystem RXQuality:MAHO...?

The subsystem *RXQuality:MAHO...?* starts a MAHO measurement and returns the results. It corresponds to the *MAHO* measurement control softkey and the output fields in the *Receiver Quality* menu.

[SENSe]:RXQuality:MAHO:CQUality?				MAHO Results
Returned Value	Description of parameters	Def. value	Def. unit	Unit ring
BER0 to BER7,	Reported BER interval	NAN	%	–
RS0 to RS31	Reported RSSI	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the BER and the RSSI of the current CMU traffic channel (DTC) The BER and RSSI can be retrieved separately by means of the commands `[SENSe]:RXQuality:MAHO:CQUality:BER?` and `[SENSe]:RXQuality:MAHO:CQUality:RSSI?`; see below.			CEST	V3.05

[SENSe]:RXQuality:MAHO:CQUality:BER?				Channel Quality: BER
Returned Value	Description of parameters	Def. value	Def. unit	Unit ring
BER0 to BER7	Reported BER interval	NAN	%	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the BER of the current CMU traffic channel (DTC).			CEST	V3.05

[SENSe]:RXQuality:MAHO:CQUality:RSSI?				Channel Quality: RSSI
Returned Value	Description of parameters	Def. value	Def. unit	Unit ring
RS0 to RS31	Reported RSSI	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the RSSI level of the current CMU traffic channel (DTC).			CEST	V3.05

[SENSe]:RXQuality:MAHO:NCELls:CELL<nr>?				MAHO Report, Single Cell
Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell <nr>, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell <nr>, IS 136 1900			
RS0 to RS31	Reported RSSI in cell <nr>	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the reported traffic channel (DTC) number and the RSSI in neighbor cell <nr> where <nr> = 1 to 24.			all	V3.05

[SENSe]:RXQuality:MAHO:NCELls:RESult:CELL<nr>?				MAHO Report, Single Cell
Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
B08 | B19 | OFF,	IS 136 hyperband in cell <nr>	OFF	–	–
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell <nr>, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell <nr>, IS 136 1900			
RS0 to RS31	Reported RSSI in cell <nr>	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the IS 136 hyperband, the reported traffic channel (DTC) number; and the RSSI in neighbor cell <nr> where <nr> = 1 to 24.			all	V3.05

[SENSe]:RXQuality:MAHO:NCELls?				MAHO Report, All Cells
Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell 1, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell 1, IS 136 1900		–	–
RS0 to RS31,	Reported RSSI in cell 1	NAN	–	–
... ,	...			
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell 24, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell 24, IS 136 1900		–	–
RS0 to RS31	Reported RSSI in cell 24	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the reported traffic channel (DTC) numbers and the RSSIs in 24 neighbor cells.			all	V3.05

[SENSe]:RXQuality:MAHO:NCELls:RESult?				MAHO Report, All Cells
Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
B08 | B19 | OFF,	IS 136 hyperband in cell no. 1	OFF	–	–
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell 1, IS 136 800	OFF		–
1 to 1999 | OFF,	Rep. channel in cell 1, IS 136 1900		–	–
RS0 to RS31,	Reported RSSI in cell 1	NAN	–	–
... ,	...			
B08 | B19 | OFF,	IS 136 hyperband in cell no. 24	OFF	–	–
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell 24, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell 24, IS 136 1900		–	–
RS0 to RS31	Reported RSSI in cell 24	NAN	–	–
Description of command			Sig. State	FW vers.
This command is always a query. It returns the hyperband, the reported traffic channel (DTC) number and the RSSI in 24 neighbor cells.			all	V3.05

[SENSe]:RXQuality:MAHO:NCELls:BAND?				MAHO Report, Band, All Cells
Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
B08 | B19 | OFF,	Band (800 MHz or 1900 MHz) in cell 1,	OFF	–	
... ,	...	...	–	
B08 | B19 | OFF	Band (800 MHz or 1900 MHz) in cell 24	OFF	–	
Description of command			Sig. State	FW vers.
This command is always a query. It returns the IS 136 hyperband in 24 neighbor cells. OFF means that the no entry has been made yet.			all	V3.05

RXQuality:EMAHo

The subsystem *RXQuality:EMAHo* tests the capability of the mobile station to provide the extended mobile-assisted handoff report. The subsystem corresponds to the main menu *Receiver Quality,* application *Extended MAHO* and the associated popup menu *Receiver Quality Configuration.* The extended MAHO report is provided by the mobile phone alone; it does not actually represent a CMU measurement.

The extended neighbor cell MAHO report is empty unless a list of neighbor channels is defined via the `CONFigure:RXQuality:EMAHo:CONTrol...` commands.

Configuration of Channel List – Subsystem RXQuality:EMAHo:CONTrol

The subsystem *RXQuality:EMAHo:CONTrol* configures the list of measured neighbor channels. It corresponds to the sections of the *Receiver Quality Configuration* menu associated to the *Extended MAHO* application.

CONFigure:RXQuality:EMAHo:CONTrol:NCELls:BAND *<Band_1>,..., <Band_22>* Band

<Band_n>	Description of parameters	Def. value	Def. unit	Unit ring
B08 | **B19**	IS 136 800 hyperband IS 136 1900 hyperband	current hyperband (according to current function group)	–	–
Description of command			Sig. State	FW vers.
This command defines the list of 22 IS 136 hyperband selections (n = 1 to 22) for the neighbor cell channels defined via `CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CHANnel`.			all	V3.05

Neighbor Channels
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CHANnel *<Channel_1>, ..., <Channel_22>*

<Channel>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 | OFF **1 to 1999 | OFF**	Channel number for IS 136 800 Channel number for IS 1361900	OFF	–	–
Description of command			Sig. State	FW vers.
This command defines the list of 22 channels (n = 1 to 22) in the neighbor cells. An *OFF* setting means that the corresponding entry of the list remains empty.			all	V3.05

The channel numbers entered must be compatible with the selected hyperband; see command `CONFigure:RXQuality:EMAHo:CONTrol:NCELls:BAND`. This is important is the 800 MHz band (B08) is selected where the channel numbers 800 to 989 and 1024 to 1999 are not used. If a number in the channel gap between 800 and 989 is entered, the CMU overwrites the entered channel with the value 799. For entries above 1023, an SCPI error message no. –120, "Numeric data error", is generated.

The current band is never changed implicitly if it is incompatible with the selected channel number.

CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CELL<nr> *<Band>*, *<Channel>*				Neighbor Cell
<Band>	Description of parameters	Def. value	Def. unit	Unit ring
B08 | B19 | OFF,	IS 136 800 hyperband IS 136 1900 hyperband current hyperband	OFF (current hyperband)	–	–
<Channel>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 | OFF 1 to 1999 | OFF	Channel number for IS 136 800 Channel number for IS 1361900	OFF	–	–
Description of command			Sig. State	FW vers.
This command defines the IS 136 hyperband and the used channel in neighbor cell <nr> where <nr> = 1 to 22. The channel number must be compatible with the selected band (even if the *<Band>* parameter is set to OFF); see `CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CHANnel` command.			all	V3.05

CONFigure:RXQuality:EMAHo:CONTrol:NCELls:LSORted *<Mode>*				List Sorted
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	List sorted according to channel numbers List unsorted/sorted acc. to cell numbers (query only)	OFF	–	–
Description of command			Sig. State	FW vers.
This command determines whether the list of neighbor channels is sorted according to channel numbers or kept as defined via `CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CHANnel`.			all	V3.05

CONFigure:RXQuality:EMAHo:CONTrol:NCELls:RSELect *<Mode>*				Report Selection
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
CIR | WER	CIR measurement without WER measurement WER measurement without CIR measurement	WER	–	–
Description of command			Sig. State	FW vers.
This command determines whether the mobile station is to measure the WER or the CIR in addition to the BER and the RSSI of the current CMU traffic channel.			all	V3.05

CONFigure:RXQuality:EMAHo:CONTrol:DEFault				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	–
Description of command			Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.			all	V3.05

EMAHo Results – Subsystem RXQuality:EMAHo...?

The subsystem *RXQuality:EMAHo...?* starts a EMAHo measurement and returns the results. It corresponds to the *Extended MAHO* measurement control softkey and the ouput fields in the *Receiver Quality* menu.

Note: *Compared to the MAHO measurement (subsystem RXQuality:MAHO, see section* RXQuality:MAHO *on p. 6.62 ff.), the extended MAHO measurement uses different BER and RSSI levels and a different maximum number of neighbor channels. For an overview refer to the tables in Chapter 4.*

[SENSe]:RXQuality:EMAHo:CQUality? Extended MAHO Results

Returned Value	Description of parameters	Def. value	Def. unit	Unit ring
EB00 to EB15,	Reported BER interval	NAN	%	–
ER00 to ER41	Reported RSSI	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the BER and the RSSI of the current CMU traffic channel (DTC) The BER and RSSI can be retrieved separately by means of the commands `[SENSe]:RXQuality:MAHO:CQUality:BER?` and `[SENSe]:RXQuality:MAHO:CQUality:RSSI?`; see below.	CEST	V3.05

[SENSe]:RXQuality:EMAHo:CQUality:BER? Channel Quality: BER

Returned Value	Description of parameters	Def. value	Def. unit	Unit ring
EB00 to EB15	Reported BER interval	NAN	%	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the BER of the current CMU traffic channel (DTC).	CEST	V3.05

[SENSe]:RXQuality:EMAHo:CQUality:RSSI? Channel Quality: RSSI

Returned Value	Description of parameters	Def. value	Def. unit	Unit ring
ER00 to ER41	Reported RSSI	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the RSSI level of the current CMU traffic channel (DTC).	CEST	V3.05

[SENSe]:RXQuality:EMAHo:CQUality:CIR? Carrier to Interference Ratio

Returned Value	Description of parameters	Def. value	Def. unit	Unit ring
CI00 to CI15	Reported CIR	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the Carrier to Interference Ratio (CIR) of the current CMU traffic channel (DTC).	CEST	V3.05

[SENSe]:RXQuality:EMAHo:CQUality:WER? Word Error Rate

Returned Value	Description of parameters	Def. value	Def. unit	Unit ring
WE00 to WE15	Reported WER	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the Word Error Rate (WER) measured by the MS under test.	CEST	V3.05

[SENSe]:RXQuality:EMAHo:NCELls:CELL<nr>? Extended MAHO Report, Single Cell

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell <nr>, IS 136 800	OFF	–	
1 to 1999 | OFF,	Rep. channel in cell <nr>, IS 136 1900			
ER00 to ER41	Reported RSSI in cell <nr>	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the reported traffic channel (DTC) number, the RSSI, and the IS 136 hyperband in neighbor cell <nr> where <nr> = 1 to 22.	all	V3.05

[SENSe]:RXQuality:EMAHo:NCELls:RESult:CELL<nr>? Extended MAHO Report, Single Cell

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
B08 | B19 | OFF,	IS 136 hyperband in cell <nr>	OFF	–	–
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell <nr>, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell <nr>, IS 136 1900			
ER00 to ER41	Reported RSSI in cell <nr>	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the IS 136 hyperband, the reported traffic channel (DTC) number; and the RSSI in neighbor cell <nr> where <nr> = 1 to 24.	all	V3.05

[SENSe]:RXQuality:EMAHo:NCELls? Extended MAHO Report, All Cells

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell 1, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell 1, IS 136 1900			
ER00 to ER41,	Reported RSSI in cell 1	NAN	–	–
... ,	...			
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell 22, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell 22, IS 136 1900			
ER00 to ER41	Reported RSSI in cell 22	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the reported traffic channel (DTC) numbers and the RSSIs in 22 neighbor cells.	all	V3.05

[SENSe]:RXQuality:MAHO:NCELls:RESult? MAHO Report, All Cells

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
B08 | B19 | OFF,	IS 136 hyperband in cell no. 1	OFF	–	–
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell 1, IS 136 800	OFF		–
1 to 1999 | OFF,	Rep. channel in cell 1, IS 136 1900			
ER00 to ER41,	Reported RSSI in cell 1	NAN	–	–
... ,	...			
B08 | B19 | OFF,	IS 136 hyperband in cell no. 22	OFF	–	–
1 to 799 | 990 to 1023 | OFF	Rep. channel in cell 22, IS 136 800	OFF	–	–
1 to 1999 | OFF,	Rep. channel in cell 22, IS 136 1900			
ER00 to ER41	Reported RSSI in cell 22	NAN	–	–

Description of command	Sig. State	FW vers.
This command is always a query. It returns the hyperband, the reported traffic channel (DTC) number and the RSSI in 22 neighbor cells.	all	V3.05

[SENSe]:RXQuality:EMAHo:NCELls:BAND? Extended MAHO Report, Band, All Cells

Returned Values	Description of parameters	Def. value	Def. unit	Unit ring
B08 | B19 | OFF,	Band (800 MHz or 1900 MHz) in cell 1,	OFF	–	
... ,	...	...	–	
B08 | B19 | OFF	Band (800 MHz or 1900 MHz) in cell 22	OFF	–	

Description of command	Sig. State	FW vers.
This command is always a query. It returns the IS 136 hyperband in 22 neighbor cells. OFF means that the no entry has been made yet.	all	V3.05

POWer:SBURst

The subsystem *POWer:SBURst* measures the MS output carrier power versus time. The subsystem corresponds to the measurement menu *Power*, application *Short. Burst,* and the associated popup menu *Power Configuration.*

The optional keyword `:SBURst` denotes shortened burst measurements that are available in *Signalling* modes only. A second application (normal bursts, [`:NBURst]`) is available in both test modes; the corresponding commands are reported in section *Common Measurement Groups*.

Control of measurement – Subsystem Power

The subsystem *POWer* controls the power measurement.

INITiate:POWer:SBURst[:DQPSk]	Start new measurement		*RUN*
ABORt:POWer:SBURst[:DQPSk]	Abort running measurement and switch off		*OFF*
STOP:POWer:SBURst[:DQPSk]	Stop measurement after current stat. cycle		*STOP*
CONTinue:POWer:SBURst[:DQPSk]	Next measurement step (only *stepping mode*)		*RUN*
Description of command		Sig. State	FW vers.
These commands have no query form. They start and stop the power measurement, setting it to the status indicated in the top right column.		all	V2.41

CONFigure:POWer:SBURst[:DQPSk]:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
SRQ |	Service request	OFF	–	
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command			Sig. State	FW vers.
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200/300 operating manual).			all	V2.41

FETCh:POWer:SBURst[:DQPSk]:STATus?				Measurement Status
Return	Description of parameters	Def. value	Def. unit	Unit ring
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 10000 |	Counter for current statistics cycle	NONE	–	
NONE,	No counting mode set			
1 to 1000 |	Counter for current evaluation period within a cycle	NONE	–	
NONE	Statistic count set to off			
Description of command			Sig. State	FW vers.
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of the CMU200/300 operating manual).			all	V2.41

Subsystem POWer:CONTrol

The subsystem *POWer:CONTrol* defines the repetition mode, statistic count, and stop condition of the measurement. These settings are provided in the *Control* and *Statistics* tabs in the popup menu *Power Configuration.*

CONFigure:POWer:SBURst[:DQPSk]:CONTrol <*Mode*>, <*Statistics*>			Scope of Measurement	
<Mode>	Desciption of parameters	Def. value	Def. unit	Unit ring
SCALar | **ARRay**	Scalar values only (incl. ramp matching) Scalar measured values and arrays	ARRay	–	
<Statistics>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 1000 | **NONE**	Number of bursts per statistics cycle Statistics off (equivalent to 1)	100	–	
Description of command			Sig. State	FW-Vers.
This command specifies the type of measured values and defines the number of bursts forming a statistics cycle.			all	≥1.15

CONFigure:POWer:SBURst[:DQPSk]:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*>				Test Cycles
<Repetition>	Description of parameters	Def. value	Def. unit	Unit ring
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	Unit ring
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	Unit ring
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	
Description of command			Sig. State	FW vers.
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*			all	V2.41

DISPlay:POWer:SBURst[:DQPSk]:CONTrol:GRID <*Enable*>				Grid on/off
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	Switch on the grid lines Switch off the grid lines	ON	–	
Description of command			Sig. State	FW vers.
This command switches the grid lines in the test diagram on or off.			all	V2.41

CONFigure:POWer:SBURst[:DQPSk]:CONTrol:DEFault		Default Settings		
<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	
Description of command			Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.			all	V2.41

Test Configuration

The commands of the following subsystems determine the parameters of the signal power measurement. They correspond to the *Power Configuration* popup menu. For a detailed explanation of the power tolerance template defined in the TDMA standard see chapter 4.

Subsystem POWer:LIMit:LINE

The subsystem *POWer:LIMit:LINE* defines the limit lines, i.e. the tolerance values for the power measurement. The subsystem corresponds to the tab *Limit Lines* in the popup menu *Power Configuration.*

CONFigure:POWer:SBURst[:DQPSk]:LIMit[:LINE][:ASYMmetrical] :UPPer:AREA<nr>:ENABle *<Enable>* CONFigure:POWer:SBURst[:DQPSk]:LIMit[:LINE][:ASYMmetrical] :UPPer:AREA<nr> *<LevelRel>, <EnableArea>*		Upper Limit Line	
Parameters	Value range	Description of parameters	Def. unit
<Enable>	ON | OFF	Area on/off	See below
<LevelRel>, ***<EnableArea>***	–100 dB to +10 dB, ON | OFF	Relative level Range of limit lines on/off	
Description of command		Sig. State	FW vers.
These commands activate and define upper limit lines for shortened bursts. The limit lines are defined area by area; the suffix <nr> numbers the five areas in the burst diagram (see chapter 4). The `:ENABle` command is suitable for reactivating a limit line area that was previously defined and disabled.		all	V2.41

The default settings are given in the table below:

Suffix	EnableArea	LevelRel
1	ON	–60 dB
2	OFF	+6 dB
3	ON	+4 dB
4	OFF	+6 dB
5	ON	–60 dB

The setting EnableArea = Off implies that the corresponding range, including the limit check, is switched off. Enable = Off switches off the entire limit check.

CONFigure:POWer:SBURst[:DQPSk]:LIMit[:LINE][:ASYMmetrical]:LOWer:AREA1:ENABle *<Enable>*
CONFigure:POWer:SBURst[:DQPSk]:LIMit[:LINE][:ASYMmetrical]:LOWer:AREA1
<LevelRel>, <EnableArea> Upper Limit Line

Parameters	Value range	Description of parameters	Def. unit
<Enable>	ON | OFF	Area on/off	
<LevelRel>, ***<EnableArea>***	–100 dB to 10 dB, ON | OFF	Relative level Range of limit lines on/off	

Description of command	Sig. State	FW vers.
These commands activate and define the lower limit line for shortened bursts. The default relative level is *LevelRel = –20 dB*. The setting *EnableArea = Off* implies that the corresponding range, including the limit check, is switched off. *Enable = Off* switches off the entire limit check.	all	V2.41

CONFigure:POWer:SBURst[:DQPSk]:LIMit:POINt[:ASYMmetrical]:LPOWer <*Limit*> Leakage Power Limit

<Limit>	Description of parameters	Def. value	Def. unit	Unit ring
–80 dBm to 0 dBm	Upper limit of leakage power	–60	dBm	

Description of command	Sig. State	FW vers.
This commands defines the upper limit for the leakage power.	all	V2.41

CONFigure:POWer:SBURst[:DQPSk]:LIMit:DEFault Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	
OFF	Some or all parameters differ from the default values			

Description of command	Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	all	V2.41

Subsystem POWer:TIME

The subsystem *POWer:...TIME* corresponds to the hotkey *Display/Marker – Oversampling* in the graphical measurement menu *Power.*

CONFigure:POWer:SBURst[:DQPSk]:TIME:OVERsampling <*Factor*> Oversampling

<Factor>	Description of parameters	Def. value	Def. unit	Unit ring
1 | 8	Oversampling factor; no. of samples per symbol	8	–	

Description of command	Sig. State	FW vers.
This command defines how many samples are taken and displayed per symbol.	all	V2.41

Subsystem SUBarrays:POWer

The subsystem *SUBarrays:POWer* defines the measurement range and the type of output values.

CONFigure:SUBarrays:POWer:SBURst[:DQPSk] **<Mode>,<Start>,<Samples>{,<Start>,<Samples>}**				Definition of Subarrays
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ALL |	Return all measurement values	ALL	–	
ARIThmetical |	Return arithm. mean value in every range			
MINimum |	Return minimum value in every range			
MAXimum,	Return maximum value in every range			
<Start>	Description of parameters	Def. value	Def. unit	Unit ring
–20 Symbols to 181 Symbols,	Start time in current range	–20	Symb.	
<Samples>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 182 |	No. of samples in range, oversamp. 1	182	–	
0 to 1456	No. of samples in range, oversamp. 8	1456	–	
Description of command				FW vers.
This command configures the `READ:SUBarrays:POWer...`, `FETCh:SUBarrays:POWer...`, and `SAMPle:SUBarrays:POWer` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by a start time and the number of test points which are located on a fixed, equidistant grid. The spacing between the test points is given by the oversampling factor set via `CONFigure:POWer:SBURst[:DQPSk]:TIME:OVERsampling 1 | 8`. The subranges may overlap but must be within the total range of the *POWer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. By default, only one range corresponding to the total measurement range is used and all measurement values are returned.				V2.41

Measured Values – Subsystem POWer...[:RESult]

The subsystem *POWer...[:RESult]* determines and outputs the results of the signal power measurement. They correspond to the graphical measurement menu *Power* with its various display elements.

READ[:SCALar]:POWer:SBURst[:DQPSk][:RESult]? Scalar results:
Start single shot measurement and return results
FETCh[:SCALar]:POWer:SBURst[:DQPSk][:RESult]?
Read out measurement results (unsynchronized).
SAMPle[:SCALar]:POWer:SBURst[:DQPSk][:RESult]?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	Unit ring
BurstsOutOfTol,	0.0 % to 100.0 %	NAN	%	
BurstPwCurrPeak,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstPwCurrRMS,	–100.0 dBm to +20.0 dBm	NAN	dBm	
LeakPowPeak,	–100.0 dBm to +20.0 dBm	NAN	dBm	
LeakPowRMS,	–100.0 dBm to +20.0 dBm	NAN	dBm	
BurstMatchCurr,	MATC | NMAT | INV | OUT	INV	–	
BurstMatchMin,	MATC | NMAT | INV | OUT	INV	–	
BurstMatchMax,	MATC | NMAT | INV | OUT	INV	–	
BurstMatchAvg	MATC | NMAT | INV | OUT	INV	–	

Description of command	Sig. State	FW vers.
These commands are always queries. They start a measurement and output all scalar measurement results (see chapter 5). These are: *Peak power of current burst* *Average power of current burst* *Peak leakage power* *Average leakage power* *Matching of current burst power, average, minimum, and maximum burst power* The calculation of results in an *average* or *peak* measurement is described in chapter 3 (see *display modes*).The following messages may be output for the value *BurstMatch...*: MATC *matching* NMAT *not matching* INV *invalid* OUT *out of range*	all	V2.41

CALCulate[:SCALar]:POWer:SBURst[:DQPSk]:CURRent[:RESult]:MATChing?
CALCulate[:SCALar]:POWer:SBURst[:DQPSk]:AVERage[:RESult]:MATChing?
CALCulate[:SCALar]:POWer:SBURst[:DQPSk]:MINimum[:RESult]:MATChing?
CALCulate[:SCALar]:POWer:SBURst[:DQPSk]:MAXimum[:RESult]:MATChing?

Limit Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
BurstPwCurrRMS,	NMAU | NMAL | INV | OK	INV	–	
LeakPowRMS,	NMAU | NMAL | INV | OK	INV	–	
BurstMatching	MATC | NMAT | INV | OUT	INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the tolerances for the effective burst and leakage power (see command above) have been exceeded (the *BurstMatching* parameter combines the two preceding values).		V2.41

The following messages may be output for the values *LeakPowRMS and BurstPwCurrRMS:*

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Tolerance value matched	

CALCulate[:SCALar]:POWer:SBURst[:DQPSk][:RESult]:MATChing:RAMP?

Limit Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
BurstMatchCurr,	For all values:	INV	–	
BurstMatchMin,		INV	–	
BurstMatchMax,	MATC | NMAT | INV | OUT	INV	–	
BurstMatchAvg		INV	–	

Description of command	Sig. State	FW vers.
This command is always a query. It indicates whether and in which way the tolerances for the scalar measured values (see command above) have been exceeded.		V2.41

The following messages may be output for the value *BurstMatching*:

MATC	*matching*
NMAT	*not matching*
INV	*invalid*
OUT	*out of range*

READ:ARRay:POWer:SBURst[:DQPSk]:CURRent[:RESult]? Burst Power
READ:ARRay:POWer:SBURst[:DQPSk]:AVERage[:RESult]?
READ:ARRay:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?
READ:ARRay:POWer:SBURst[:DQPSk]:MINimum[:RESult]?
Start single shot measurement and return results RUN
FETCh:ARRay:POWer:SBURst[:DQPSk]:CURRent[:RESult]?
FETCh:ARRay:POWer:SBURst[:DQPSk]:AVERage[:RESult]?
FETCh:ARRay:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?
FETCh:ARRay:POWer:SBURst[:DQPSk]:MINimum[:RESult]?
Read meas. results (unsynchronized) RUN
SAMPle:ARRay:POWer:SBURst[:DQPSk]:CURRent[:RESult]?
SAMPle:ARRay:POWer:SBURst[:DQPSk]:AVERage[:RESult]?
SAMPle:ARRay:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?
SAMPle:ARRay:POWer:SBURst[:DQPSk]:MINimum[:RESult]?
Read results (synchronized) RUN

Returned values	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB... + 20.0 dB,	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB... + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	Sig. State	FW vers.
These commands are always queries. They output the burst power versus time at fixed, equidistant test points. The number of measured values is 182 (oversampling factor 1) or 1456 (oversampling factor 8; see command `CONFigure:POWer:SBURst[:DQPSk]:TIME:OVERsampling <Factor>`). The calculation of results in the modes *current, average, maximum* and *minimum* is explained in chapter 3 (see *display modes*).	all	V2.41

READ:SUBarrays:POWer:SBURst[:DQPSk]:CURRent[:RESult]? Subarray Results
READ:SUBarrays:POWer:SBURst[:DQPSk]:AVERage[:RESult]?
READ:SUBarrays:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?
READ:SUBarrays:POWer:SBURst[:DQPSk]:MINimum[:RESult]?
Start single shot measurement and return results RUN
FETCh:SUBarrays:POWer:SBURst[:DQPSk]:CURRent[:RESult]?
FETCh:SUBarrays:POWer:SBURst[:DQPSk]:AVERage[:RESult]?
FETCh:SUBarrays:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?
FETCh:SUBarrays:POWer:SBURst[:DQPSk]:MINimum[:RESult]?
Read meas. results (unsynchronized) RUN
SAMPle:SUBarrays:POWer:SBURst[:DQPSk]:CURRent[:RESult]?
SAMPle:SUBarrays:POWer:SBURst[:DQPSk]:AVERage[:RESult]?
SAMPle:SUBarrays:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?
SAMPle:SUBarrays:POWer:SBURst[:DQPSk]:MINimum[:RESult]?
Read results (synchronized) RUN

Ret. values per subrange	Description of parameters	Def. value	Def. unit	Unit ring
–100.0 dB... + 20.0 dB	BurstPower[1], 1st value for burst power	NAN	dB	
...	...	...	...	
–100.0 dB... + 20.0 dB	BurstPower[x], xth value for burst power	NAN	dB	

Description of command	Sig. State	FW vers.
These commands are always queries. They output the burst power versus time in the subranges defined by means of the `CONFigure:SUBarrays:POWer` command. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above. The `CONFigure:SUBarrays:POWer` command defines a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange. The calculation of *current, average, minimum,* and *maximum* results is explained in chapter 3 (see *display mode*).	all	V2.41

CALCulate:ARRay:POWer:SBURst[:DQPSk]:CURRent[:RESult]:MATChing:
LIMit[:LINE][:ASYMmetrical][:COMBined]?
CALCulate:ARRay:POWer:SBURst[:DQPSk]:AVERage[:RESult]:MATChing:
LIMit[:LINE][:ASYMmetrical][:COMBined]?
CALCulate:ARRay:POWer:SBURst[:DQPSk]:MINimum[:RESult]:MATChing:
LIMit[:LINE][:ASYMmetrical][:COMBined]?
CALCulate:ARRay:POWer:SBURst[:DQPSk]:MAXimum[:RESult]:MATChing:
LIMit[:LINE][:ASYMmetrical][:COMBined]?
Burst Matching

Returned values	Value range	Def. value	Def. unit	Unit ring
32-bit field,	Indicator for upper limit matching in area 1 to 5	NAN	–	
32-bit field	Indicator for lower limit matching in area 1 to 5	NAN	–	

Description of command	Sig. State	FW vers.
This command is always a query. Any set bit of the two returned bit fields indicates that the corresponding section of the limit lines is violated.	all	V2.41

TDMA Mobile Tests (Signalling Mode)

In the *Signalling* mode, the CMU is able to generate DCCH and DTC signals and to set up a call to the mobile. A broad range of signalling parameters can be configured and measurements may be performed with a call connection established.

Channel Units – System UNIT

The remote-control commands in the *UNIT* system control the default physical units to be used in certain groups of commands. Default units defined by a *UNIT* command are superseded by an explicit unit definition in one of the associated commands.

UNIT:CHANnel *<Unit>*			RF Channel Units	
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
CH | **Hz | KHz | MHz | GHz**	IS 136 channel numbers Frequency units	CH	–	
Description of command			Sig. State	FW vers.
This command defines the default unit for all RF channel specifications. This includes the input and output signals in the control channels and voice channels.			all	V2.41

Connection Control

The remote-control commands in this section are used to configure the measurements in the menu group *IS 136 800/1900-MS Signalling* globally, i.e., they provide settings that are valid for all measurements within the function group. They correspond to the settings in the popup menu of the softkey *Connect. Control* located to the right of the headline of each main menu.

In particular, the remote-control commands control the input signal paths, the signalling (call setup and release, services, signalling parameters), determine the inputs and outputs as well as the reference frequency.

Important note: Current vs. default values

> *Some parameters of the CMU assume two independent values: The* default value *is used to set up a call; it can be modified in the signalling states* Signal Off, Signal On *and* Registered. *The* current value *during the call (signalling state* Call Established) *can still be changed, however, modifying this current value does not alter the default value. An example for such a double parameter in IS 136 800/1900-MS is the* DTC RF Level*.*
>
> *Default values are set with a* `CONFigure ...` *command, current values are set with the corresponding* `PROCedure ...` *command.*

Subsystem LEVel (Analyzer Level)

The subsystem *LEVel* controls the level in the RF input signal path. It corresponds to the table section *Analyzer Level* in the *MS Signal* tab of the *Connection Control* menu.

[SENSe:]LEVel:MODE <*Mode*> Analyzer level – RF Mode

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
MANual | **DMAC |** **AUTomatic**	Manual setting of max. input level According to attenuation code of the mobile Autoranging (for V3.00 and higher)	DMAC	–	–

Description of command	Sig. State	FW vers.
This command defines the mode for setting the maximum input level.	all	V2.41

[SENSe:]LEVel:MAXimum <*Level*> RF Max. Level

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
0 dBm to +53 dBm	Maximum input level for RF 1	+30.0	dBm	
–14 dBm to 39 dBm	Maximum input level for RF 2	+30.0	dBm	
–37 dBm to 0 dBm	Maximum input level for RF 4 IN	0.0	dBm	

Description of command	Sig. State	FW vers.
This command defines the maximum input level. The permissible value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command).	all	V2.41

[SENSe:]LEVel:ATTenuation <*Mode*> RF Attenuation

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
NORMal | **LNOise |** **LDIStortion**	Mixer level in normal range Low noise (mixer level 10 dB higher than in normal setting) Low distortion (mixer level 10 dB lower than in normal setting)	NORMal	–	–

Description of command	Sig. State	FW vers.
This command tunes the RF analyzer for normal setting, low noise level (full dynamic range), or low distortion (high intermodulation spacing).	all	V2.41

[SENSe:]LEVel:DEFault Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	–

Description of command	Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	all	V2.41

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* defines the trigger mode. It corresponds to the *Trigger* section in the *MS Signal* tab of the popup menu *Connection Control.*

TRIGger[:SEQuence]:SOURce <*Source*> Source

<Source>	Description of parameters	Def. value	Def. unit	Unit ring
SIGNalling |	The measurement is triggered by the signalling unit	SIGN	–	–
FRUN |	Trigger by TDMA burst detected by instrument software			
RFPower |	Wide-band power trigger			
IFPower	Narrow-band trigger			

Description of command	Sig. State	FW vers.
This command defines the trigger mode. The settings *RFPower* and *IFPower* assume bursted signals.	all	V2.41

TRIGger[:SEQuence]:THReshold <*Threshold*> Level

<***Threshold***>	Description of parameters	Def. value	Def. unit	Unit ring
LOW |	Low trigger threshold (reference level –26 dB)	LOW	–	–
MEDium |	Medium trigger threshold (ref. level –16 dB)			
HIGH	High trigger threshold (reference level –6 dB)			

Description of command	Sig. State	FW vers.
This command sets the the signal level at which the measurement is triggered (see `TRIG:SEQ:SOUR`). The command is enabled for trigger source `RFPower` and `IFPower` only.	all	V2.41

TRIGger[:SEQuence]:DEFault Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The parameters are set to their default values	ON	–	–
OFF	Some or all parameters differ from the default values			

Description of command	Sig. State	FW vers.
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	all	V2.41

Signalling – Subsystem SIGNalling (Call Setup and Cleardown)

The subsystem *SIGNalling* controls the call setup and cleardown from the CMU to the mobile and determines the signalling parameters. Together with the subsystem *WPOWer* it corresponds to the different *Connection* tabs (for different signalling states, see command `PROCedure:SIGNalling:ACTion`) in the popup menu *Connection Control*.

PROCedure:SIGNalling:ACTion <*Action*>				Signalling Control
<*Action*>	Description of parameters	Def. value	Def. unit	Unit ring
SOFF | **SON |** **CTM |** **CRELease |** **HANDoff |** **OCALI**	Switch off DCCH signal *(signal off)* Switch on DCCH signal *(signal on)* Call to mobile Call release Handoff Other call	–	–	–
Description of command			Sig. State	FW vers.
This command has no query form and no default value. It changes between the different signalling states of the CMU.			See below	V2.41

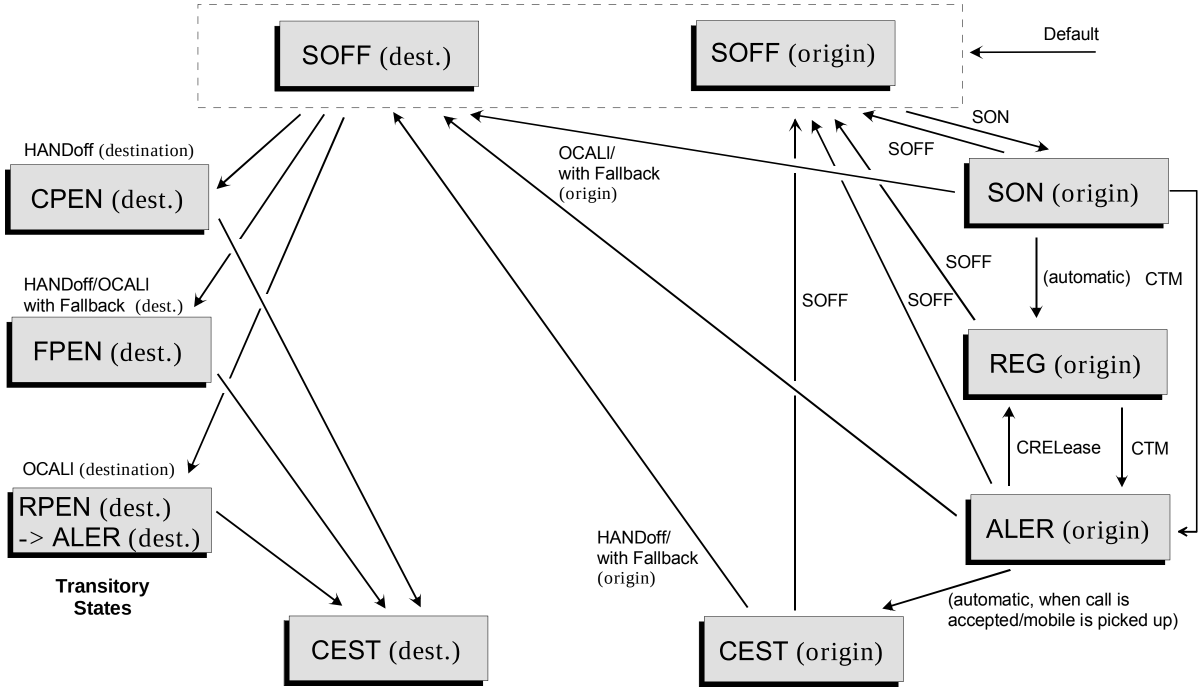

Fig. 6-1: Signalling states of the CMU and transitions including Other Call/Handoff

Signalling states:

See next command, `[SENSe:]SIGNalling:STATe?`

Actions (initiated from the CMU):

See description of command `[PROCedure:]SIGNalling:ACTion`

Further transitions between the signalling states (not shown in Fig. 6-1) may occur, e.g. in case of errors.

[SENSe:]SIGNalling:STATe?				Signalling State
Return	Description of parameters	Def. value	Def. unit	Unit ring
SOFF |	Control channel signal switched off *(Signal Off)*	SOFF	–	–
SON |	Control channel signal switched on *(Signal On)*			
REG |	MS registration performed *(Registered)*			
ALER |	Mobile is ringing *(Alerting)*			
CEST |	Call to mobile set up *(Call Established)*			
CPEN |	Call pending *(Handoff* procedures)			
RPEN |	Registration pending *(Other Call* procedures)			
FPEN	Fallback pending *(Other Call/Handoff* procedures)			
Description of command			Sig. State	FW vers.
This command is always a query. It returns the current signalling state.			all	V2.41

PROCedure:SIGNalling[:DTC]:CHANnel <*Number*>				DTC Channel
<*Number*>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023	Number of traffic channel, IS 136 800	1	–	
1 to 1999	Number of traffic channel, IS 1361 900	2	–	
Description of command			Sig. State	FW vers.
This command changes the traffic channel number (and thus the frequency) while a call is established.			CEST	V2.41

PROCedure:SIGNalling[:DTC]:MAC <*MAC*>				DTC MAC
<*MAC*>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 10	Power of mobile phone in PCL units	6	–	–
Description of command			Sig. State	FW vers.
This command changes the mobile attenuation code (and thus the effective radiated power of the mobile phone) while a call is established. For an overview of MACs see chapter 4.			CEST	V2.41

PROCedure:SIGNalling[:DTC]:SLOTconfig <*Config*>				DTC Slot Config.
<*Enable*>	Description of parameters	Def. value	Def. unit	Unit ring
C14 | C25 | C36	Pair of timeslos (1&4 or 2&5 or 3&6)	C14	–	–
Description of command			Sig. State	FW vers.
This command specifies the two timeslots that are paired to form a full-rate TDMA traffic channel.			CEST	V2.41

Subsystem OCALl (Other Call Target)

The subsystem *OCALl* sets the target for a call from the current to a different network. The corresponding softkeys are located in the tab *Other Call* in the popup menu *Connection Control*.

STATus:OCALl:TARGet:LIST?				Destination List
Response	Description of parameters	Def. value	Def. unit	Unit ring
"IS136800MS", "IS1361900MS", "AMPSMS", "IS136800MSFallback", "IS1361900MSFallback", "AMPSMSFallback"	Possible destination list for AMPS mobile	complete list	–	–
Description of command			Sig. State	FW vers.
This command is always a query and returns a list of all networks that are available for a OCALl. On registration, the complete (default) target list is replaced by the actual target list depending on the capabilities of the mobile station.			all	V2.41

CONFigure:OCALl:TARGet <*Target*>				Destination Selection
<Target>	Description of parameters	Def. value	Def. unit	Unit ring
"IS136800MS" | "IS1361900MS" | "AMPSMS" | "IS136800MSFallback" | "IS1361900MSFallback" | "AMPSMSFallback" | NONE	Possible destination for AMPS mobile No OCALl	NONE	–	–
Description of command			Sig. State	FW vers.
This command selects a OCALl target. The targets available depend on the capabilities of the mobile station; see previous command. The query returns `NONE` unless a destination has been selected before. OCALl is initiated via the `PROCedure:SIGNalling:ACTion OCALl` command.			SON, REG Q: all	V2.41

Subsystem HANDoff (Handoff Target)

The subsystem *HANDoff* sets the target for a forced handoff of the mobile phone. The corresponding softkeys are located in the tab *Handoff* in the popup menu *Connection Control*.

STATus:HANDoff:TARGet:LIST?				Destination List
Response	Description of parameters	Def. value	Def. unit	Unit ring
"IS136800MS", "IS1361900MS", "AMPSMS", "IS136800MSFallback", "IS1361900MSFallback", "AMPSMSFallback"	Target list for IS 136 800/1900 (excluding the origin network)	complete list	–	–
Description of command			Sig. State	FW vers.
This command is always a query and returns a list of all networks that are available for a handoff. On registration, the complete (default) target list is replaced by the actual target list depending on the capabilities of the mobile station.			all	V2.41

CONFigure:HANDoff:TARGet <*Target*>		Destination Selection		
<Target>	Description of parameters	Def. value	Def. unit	Unit ring
"IS136800MS" | "IS1361900MS" | "AMPSMS" | "IS136800MSFallback" | "IS1361900MSFallback" | "AMPSMSFallback" |	Possible target for IS 136 800/1900 (excluding the origin network)	NONE	–	–
NONE	No handoff			
Description of command			Sig. State	FW vers.
This command selects a handoff target. The targets available depend on the current network and on the capabilities of the mobile station; see previous command. The query returns `NONE` unless a destination has been selected before. Handoff is initiated via the `PROCedure:SIGNalling:ACTion HANDoff` command.			CEST Q: all	V2.41

Subsystem BSSignal (Signal of Base Station/CMU)

The subsystem *BSSignal* configures the control and traffic channels for the signals transmitted by the CMU to the mobile phone. It corresponds to the *BS Signal* tab in the *Connection Control* menu.

CONFigure:BSSignal:DCCH:CHANnel <*DCCH*>		Control Channel (DCCH)		
<DCCH>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023	Channel number for IS 136 800	716	–	
1 to 1999	Channel number for IS 1361900	314	–	
Description of command			Sig. State	FW vers.
This command determines the RF channel number for the CMU control channel signals (forward channel DCCH).			SON SOFF REG Q: all	V2.41

CONFigure:BSSignal:DCCH:LEVel <*Level*>		Control Channel RF Level		
<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	Absol. level of control channel, RF1	–80	dBm	
–137 dBm to –10 dBm	Absol. level of control channel, RF2	–80	dBm	
–90 dBm to +13 dBm	Absol. level of control channel, RF 3 OUT	–80	dBm	
Description of command			Sig. State	FW vers.
This command determines the level in the control channel in absolute units.			SON SOFF REG Q: all	V2.41

CONFigure:BSSignal[:DTC]:CHANnel <*DTChannel*> Traffic Channel (DTC)

<DTChannel>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023	Channel number for IS 136 800	1	–	
1 to 1999	Channel number for IS 1361900	2	–	

Description of command	Sig. State	FW vers.
This command determines the RF channel number for the CMU traffic channel signals (forward channel DTC).	SON, SOFF REG Q: all	V2.41

CONFigure:BSSignal[:DTC]:LEVel <*Level*> DTC RF Level
PROCedure:BSSignal[:DTC]:LEVel <*Level*>

<Level>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm	Absol. level of traffic channel, RF1	–80	dBm	
–137 dBm to –10 dBm	Absol. level of traffic channel, RF2	–80	dBm	
–90 dBm to +13 dBm	Absol. level of traffic channel, RF 3 OUT	–80	dBm	

Description of command	Sig. State	FW vers.
This command determines the level in the traffic channel in absolute units. The `CONFigure...` command is available in the signalling states SOFF, SON, and REG. It configures the traffic channel before it is switched on (default value). The `PROCedure...` command is available in the signalling state CEST. With an established call it changes the CMU traffic channel level, sets the device hardware to the new signal level and continues the measurement (current value).	all	V2.41

CONFigure:BSSignal[:DTC]:SLOTconfig <*Config*> DTC Slot Config.

<Enable>	Description of parameters	Def. value	Def. unit	Unit ring
C14 | C25 | C36	Pair of timeslos (1&4 or 2&5 or 3&6)	C14	–	

Description of command	Sig. State	FW vers.
This command specifies the two timeslots that are paired to form a full-rate TDMA traffic channel.	SON SOFF REG Q: all	V2.41

CONFigure:BSSignal:VCODer <*Vocoder*> Voice Coder

<Vocoder>	Description of parameters	Def. value	Def. unit	Unit ring
ACELp | VSELp |	Specific voice coder type	MSEL	–	
MSELected	Voice coder preferred by the mobile under test			

Description of command	Sig. State	FW vers.
This command specifies the voice coder used by the CMU.	SON SOFF REG Q: all	V2.41

CONFigure:BSSignal:SPEech <*Mode*>				Speech Mode
<*Mode*>	Description of parameters	Def. value	Def. unit	Unit ring
ECHO | **LOOP |** **HSET**	*Loop back* in the CMU with delay *Loop back* in the CMU with minimal delay Handset (with option CMU-B52 and ACELP voice coder only)	ECHO	–	
Description of command			Sig. State	FW vers.
This command determines how the CMU returns data transmitted over the traffic channel to the mobile.			all	V2.41

CONFigure:BSSignal:OCHandoff[:DTC]:CHANnel <*DTChannel*> Other Call/Handoff: Traffic Channel (DTC)				
<*DTChannel*>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 799 | 990 to 1023 **1 to 1999**	Channel number for IS 136 800 Channel number for IS 1361900	1 2	– –	
Description of command			Sig. State	FW vers.
This command determines the RF channel number for the CMU traffic channel signals (forward channel DTC) that comes into effect after an *Other Call* or *Handoff* from another to the current network.			all	V2.41

CONFigure:BSSignal:OCHandoff[:DTC]:SLOTconfig <*Config*>				Other Call/Handoff: Slot Config.
<*Enable*>	Description of parameters	Def. value	Def. unit	Unit ring
C14 | C25 | C36	Pair of timeslos (1&4 or 2&5 or 3&6)	C14	–	
Description of command			Sig. State	FW vers.
This command specifies the timeslots configuration that comes into effect after an *Other Call* or *Handoff* from another to the current network.			all	V2.41

CONFigure:BSSignal:OCHandoff[:DTC]:LEVel <*Level*>				Other Call/Handoff: DTC RF Level
<*Level*>	Description of parameters	Def. value	Def. unit	Unit ring
–137 dBm to –27 dBm **–137 dBm to –10 dBm** **–90 dBm to +13 dBm**	Absol. level of traffic channel, RF1 Absol. level of traffic channel, RF2 Absol. level of traffic channel, RF 3 OUT	–80 –80 –80	dBm dBm dBm	
Description of command			Sig. State	FW vers.
This command determines the level in the traffic channel in absolute units that comes into effect after an *Other Call* or *Handoff* from another to the current network.			all	V2.41

Subsystem NETWork

The subsystem *NETWork* determines the parameters of the radio network and the existing radio link. The subsystem corresponds to the *Network* tab and part of the *MS Signal* tab in the *Connection Control* menu.

Subsystem NETWork:IDENtity

The subsystem *NETWork:IDENtity* defines the identity of the mobile radio network. The subsystem corresponds to the *Network Identity* section in the *Network* menu.

CONFigure:NETWork:IDENtity:SID <*Code*>				SID
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 32767	15-bit system identity code	4	–	–
Description of command			Sig. State	FW vers.
This command defines the system identity code.			SON, SOFF, REG Q: all	V2.41

CONFigure:NETWork:IDENtity:MCC <*Code*>				MCC
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 1023 | **OFF |** **ON**	Mobile country code MCC not used/not signalled to MS Re-activate MCC defined previously	OFF	–	–
Description of command			Sig. State	FW vers.
This command defines the mobile country code. The MCC is stored to the nonvolatile RAM after the end of the session so it can be re-activated later.			SON, SOFF, REG Q: all	V2.41

CONFigure:NETWork:IDENtity:SOC <*Code*>				SOC
<Code>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 4095 | **OFF |** **ON**	12-bit system operator code SOC not used/not signalled to MS Re-activate SOC defined previously	OFF	–	–
Description of command			Sig. State	FW vers.
This command defines the system operator code. The SOC is stored to the nonvolatile RAM after the end of the session so it can be re-activated later.			SON, SOFF, REG Q: all	V3.05

Subsystem NETWork:SMODe (Signalling Modes)

The subsystem *NETWork:SMODe* defines the signalling parameters controlling the function of the mobile. The subsystem corresponds to the *Signalling Modes* section in the *Network* tab.

CONFigure:NETWork:SMODe:PUReg <*Enable*>				Power-Up
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Registration on power-up of the mobile on/off	ON	–	–
Description of command			Sig. State	FW vers.
This command determines whether a registration procedure is to be executed on power-up of the mobile.			SOFF, SON REG Q: all	V2.41

CONFigure:NETWork:SMODe:PDReg <*Enable*>				Power-Down
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Registration on power-down of the mobile on/off	ON	–	–
Description of command			Sig. State	FW vers.
This command determines whether a registration procedure is to be executed on power-down of the mobile.			SOFF, SON REG Q: all	V2.41

CONFigure:NETWork:SMODe:SYReg <*Enable*> New System

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Registration on change in SID on/off	ON	–	–

Description of command	Sig. State	FW vers.
This command determines whether a registration procedure is to be executed when the system identity is changed.	SOFF,SON REG Q: all	V2.41

CONFigure:NETWork:SMODe:DEReg <*Enable*> Deregistration

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Registration on DCCH change	ON	–	–

Description of command	Sig. State	FW vers.
This command determines whether a registration procedure is to be executed when the mobile changes to another DCCH (change of radio cell/BTS).	SOFF, SON, REG Q: all	V2.41

CONFigure:NETWork:SMODe:IDTYpe <*Type*> MSID Type

<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ID20 |	20-bit TMSI (temporary mobile station identity)	ID34	–	–
ID24 |	24-bit TMSI (temporary mobile station identity)			
ID34 |	34-bit MIN (mobile identification number)			
ID50	50-bit IMSI (international mobile subscriber identity)			

Description of command	Sig. State	FW vers.
This command determines which type of mobile station identity is to be used for call setup to the mobile phone.	SOFF, SON, REG Q: all	V2.41

CONFigure:NETWork:SMODe:ID20 <*TMSI20*>
CONFigure:NETWork:SMODe:ID24 <*TMSI24*> TMSI

<TMSI>	Description of parameters	Def. value	Def. unit	Unit ring
"0" to "1048575"	20-bit TMSI (temporary mobile station identity)	0	–	–
"0" to "16777215"	24-bit TMSI (temporary mobile station identity)	0		

Description of command	Sig. State	FW vers.
This command defines a 20-bit or a 24-bit default TMSI used to set up a call to the mobile phone.	SOFF, SON, REG Q: all	V2.41

CONFigure:NETWork:SMODe:IDMin <*MIN*> MIN

<MIN>	Description of parameters	Def. value	Def. unit	Unit ring
"0" to "2^{34} – 1"	34-bit MIN (mobile identification number)	0	–	–

Description of command	Sig. State	FW vers.
This command defines the default MIN used to set up a call to the mobile phone.	SOFF SON REG Q: all	V2.41

CONFigure:NETWork:SMODe:IDIMsi <*MIN*> IMSI

<*MIN*>	Description of parameters	Def. value	Def. unit	Unit ring
"0" to "2^{50} – 1"	50-bit IMSI (international mobile subscriber identity)	0	–	–

Description of command	Sig. State	FW vers.
This command defines the default IMSI used to set up a call to the mobile phone.	SOFF SON REG Q: all	V2.41

Subsystem NETWork:REQuest (Requested Mobile Data)

The subsystem *NETWork:REQuest* determines the signalling parameters of the mobile to be requested. The subsystem corresponds to the *Requested Mobile Data* section in the *Network* tab.

CONFigure:NETWork:REQuest:SNUMber <*Enable*> Serial Number Request

<*Enable*>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Request of the mobile's serial number or no request	ON	–	–

Description of command	Sig. State	FW vers.
This command determines whether the serial number of the mobile phone is requested during registration.	SOFF SON REG Q: all	V2.41

CONFigure:NETWork:REQuest:CAPability <*Enable*> Capability Report Request

<*Enable*>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Request of the mobile's capability report or no request	ON	–	–

Description of command	Sig. State	FW vers.
This command determines whether the capability report of the mobile phone is requested during registration.	SOFF SON REG Q: all	V2.41

Subsystem NETWork[:MS] (Mobile Settings)

The subsystem *NETWork[:MS]* defines the mobile parameters. The subsystem corresponds to the *MS Signal* tab of the popup menu *Connection Control*.

CONFigure:NETWork[:MS]:SUFF <*Level*> SS SUFF

<*Level*>	Description of parameters	Def. value	Def. unit	Unit ring
–∞ | **–111 dBm to –51 dBm**	Channel reselection disabled Received signal strength, in 2-dB steps	–∞	dBm	

Description of command	Sig. State	FW vers.
This command defines the SS SUFF. This information element identifies the minimum signal strength deemed sufficient for control channel reselection.	SOFF SON REG	V2.41

	Q: all	

CONFigure:NETWork[:MS]:DCCMac <*MAC*> DCCH MAC

<*MAC*>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 7	Mobile attenuation code	6	–	

Description of command	Sig. State	FW vers.
This command defines the mobile attenuation code (MAC) for control channel signals. An overview of MAC levels in IS 136 and the corresponding effective radiated powers is given in chapter 4.	SOFF SON REG Q: all	V2.41

CONFigure:NETWork[:MS]:DTCMac <*MAC*> DTC MAC

<*MAC*>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 10	Mobile attenuation code	6	–	

Description of command	Sig. State	FW vers.
This command defines the mobile attenuation code (MAC) for traffic channel signals. An overview of MAC levels in IS 136 and the corresponding effective radiated powers is given in chapter 4.	SOFF SON REG Q: all	V2.41

CONFigure:NETWork[:MS]:RAMin <*Level*> RSS ACC MIN

<*Level*>	Description of parameters	Def. value	Def. unit	Unit ring
–∞ | **–111 dBm to –51 dBm**	DCCH access always possible Received signal strength, in 2-dB steps	–∞	dBm	

Description of command	Sig. State	FW vers.
This command defines the RSS ACC MIN. This information element identifies the minimum signal strength at the mobile required to access a DCCH.	SOFF SON REG Q: all	V2.41

CONFigure:NETWork[:MS]:DELay <*Level*> Delay

<*Level*>	Description of parameters	Def. value	Def. unit	Unit ring
0 superfr. to 105 superfr. | **105 superfr. to 420 superfr.**	Delay time, in 15-superframe steps Delay time, in 45-superframe steps	0	Superfr	

Description of command	Sig. State	FW vers.
This command defines the Delay. This information element identifies the time that the mobile must obtain service on the current DCCH before considering DCCH reselection.	SOFF SON REG Q: all	V2.41

CONFigure:NETWork[:MS]:DIC <*Channel*> DIC Application Domain

<*Channel*>	Description of parameters	Def. value	Def. unit	Unit ring
DCCH | **DTC**	Control channel Traffic	DCCH	–	

Description of command	Sig. State	FW vers.
This command defines the DIC (delay interval compensation) domain.	SOFF SON REG	V2.41

	Q: all	

CONFigure:NETWork[:MS]:SCANinterval <*Interval*>		Scan Interval		
<Interval>	Description of parameters	Def. value	Def. unit	Unit ring
1 hyperfr. to 16 hyperfr.	Scan interval	1	Hyperfr	
Description of command			Sig. State	FW vers.
This command defines the Scan Interval, i.e. the time between two consecutive signal strength measurements on candidate control channels for reselection purposes.			SOFF SON REG Q: all	V2.41

CONFigure:NETWork[:MS]:SBINdicator <*Type*>		Shortened Burst Indicator		
<Type>	Description of parameters	Def. value	Def. unit	Unit ring
NORMal | **SHORtened**	Normal burst Shortened burst	NORMal	–	
Description of command			Sig. State	FW vers.
This command determines which DCCH burst type is transmitted after a handoff.			SOFF SON REG Q: all	V2.41

Subsystem NETWork:SYSTem (System Parameters)

The subsystem *NETWork:System* determines system parameters for the radio connection. The subsystem corresponds to the *System Parameters* section in the *Network* tab.

CONFigure:NETWork:SYSTem:NOFSlots <*Slots*>		No. of FBCCH Slots		
<Slots>	Description of parameters	Def. value	Def. unit	Unit ring
5 Slots to 10 Slots	FBCCH Slots	5	Slots	
Description of command			Sig. State	FW vers.
This command defines the number of Fast Broadcast Control Channel (FBCCH) slots per superframe.			SOFF SON REG Q: all	V2.41

CONFigure:NETWork:SYSTem:NOESlots <*Slots*>		No. of EBCCH Slots		
<Slots>	Description of parameters	Def. value	Def. unit	Unit ring
1 Slots to 8 Slots	EBCCH Slots	1	Slots	
Description of command			Sig. State	FW vers.
This command defines the number of Extended Broadcast Control Channel (EBCCH) slots per superframe.			SOFF SON REG Q: all	V2.41

CONFigure:NETWork:SYSTem:CCSDvcc <*Slots*>				Color Code SAT DVCC
<*Slots*>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 255	8-bit color code	255	–	
Description of command			Sig. State	FW vers.
This command defines the Digital Verification Color Code (DVCC) that is used to identify both the DCCH and DTC for call setup and voice (de)coding.			SOFF, SON, REG Q: all	V2.41

Subsystem NETWork:TIMeout

The subsystem *NETWork:TIMeout* defines timeouts for dropping an unused radio link or forcing a registration. The subsystem corresponds to the *Timeouts* section in the *Network* tab.

CONFigure:NETWork:TIMeout:LORLINk <*Time*>				Loss of Radiolink
<*Time*>	Description of parameters	Def. value	Def. unit	Unit ring
1 s to 60 s	Radio link timeout	4	s	
Description of command			Sig. State	FW vers.
This command defines the time after which the CMU drops an interrupted connection.			SOFF, SON, REG Q: all	V2.41

CONFigure:NETWork:TIMeout:RPERiod <*Time*>				Registration Period
<*Enable*>	Description of parameters	Def. value	Def. unit	Unit ring
4 s to 3600 s | **OFF**	Timeout for forced registration No forced registration	10	s	
Description of command			Sig. State	FW vers.
This command determines a period of time after which the CMU forces the mobile station to (re-)register. In the setting OFF, no forced registration takes place.			SOFF, SON, REG Q: all	V2.41

Subsystem NETWork:OCHandoff

The subsystem *NETWork:OCHandoff* defines parameters that come into effect after an *Other Call* or a *Handoff* from another to the current network. The subsystem corresponds to the table field *Other Call/Handoff Parameter* in the popup menu *Network*.

CONFigure:NETWork:OCHandoff[:MS]:DTCMAC <*MAC*>				Other Call/Handoff: DTCMAC
<*MAC*>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 10	Digital traffic channel attenuation code	6	–	
Description of command			Sig. State	FW vers.
This command determines the DTC MAC that comes into effect after an *Other Call* or *Handoff* from another to the current network.			SOFF, SON, REG Q: all	V2.41

Inputs and Outputs (External Attenuation)

The commands in this section configure the input and output connectors. They correspond to the tab *RF* in the popup menu *Connection Control*.

INPut[:STATe] <*State*> RF Input

<*State*>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 RF2 RF4	Connector RF1 used as input Connector RF2 used as input Connector RF4 IN used as input	RF2	–	–

Description of command	Sig. State	FW vers.
This command determines the connector to be used for RF input signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the same measurement (see `OUTPut[:STATe]`). Only one input and one output may be active at the same time, a new RF input setting supersedes the previous one.	all	V2.41

OUTPut[:STATe] <*State*> RF Output

<*State*>	Description of parameters	Def. value	Def. unit	Unit ring
RF1 **RF2** **RF3**	Connector RF1 used as output Connector RF2 used as output Connector RF3 OUT used as output	RF2	–	–

Description of command	Sig. State	FW vers.
This command determines the connector to be used for RF output signals. The bidirectional connectors RF 1 and RF 2 can be used as input and output connectors in the same measurement (see `INPut[:STATe]`). Only one input and one output may be active at the same time, a new RF output setting supersedes the previous one.	all	V2.41

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation*>
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] <*Attenuation*> Ext. Att. Input

<*Attenuation*>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Value for ext. attenuation at input<nr> where <nr> = 1, 2	0.0	dB	
–90 dB to +90 dB	Value for ext. attenuation at RF4 IN (<nr> = 4)	0.0	dB	

Description of command	FW vers.
This command assigns an external attenuation value to the inputs of the instrument *(RF 1, RF 2, RF4 IN)*.	V2.41

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*>
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] <*Attenuation*> Ext. Att. Output

<*Attenuation*>	Description of parameters	Def. value	Def. unit	Unit ring
–50 dB to +50 dB	Value for ext. attenuation at output<nr> where <nr> = 1, 2	0.0	dB	
–90 dB to +90 dB	Value for ext. attenuation at RF3 OUT (<nr> = 3)	0.0	dB	

Description of command	FW vers.
This command assigns an external attenuation value to the outputs of the instrument *(RF 1, RF 2, RF3 OUT)*.	V2.41

<table>
<tr><td colspan="3">ROUTe:SPENcoder[:INPut] <<i>Source</i>></td><td colspan="2">Speech Encoder</td></tr>
<tr><td><<i>Source</i>></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>HANDset |
GENerator</td><td>Handset is used as source
AF generator is used as source</td><td>HAND</td><td>–</td><td>–</td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command determines the input source that feeds the CMU speech encoder (option CMU-B52).</td><td>all</td><td>3.05</td></tr>
</table>

<table>
<tr><td colspan="3">ROUTe:SPDecoder[:OUTPut] <<i>Destination</i>></td><td colspan="2">Speech Decoder</td></tr>
<tr><td><<i>Destination</i>></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>HANDset |
ANALyzer |
ANA2 |
ABOTh</td><td>Speech decoder output routed to the handset
Speech dec. output routed to primary AF analyzer
Speech dec. output routed to secondary AF analyzer
Speech dec. output routed to both AF analyzers</td><td>HAND</td><td>–</td><td>–</td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command routes the CMU speech decoder output (option CMU-B52).</td><td>all</td><td>3.05</td></tr>
</table>

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock specific to the network. This frequency is set in the tab *Sync.* in the popup menu *Connection Control*.

SOURce:DM:CLOCk:STATe <*Mode*>		REF OUT 2 on/off		
<Mode>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Switch on/off system clock	OFF	–	–
Description of command			Sig. State	FW vers.
This command switches the system clock at output *REF OUT 2* on or off.			all	V2.41

SOURce:DM:CLOCk:FREQuency <Frequency>		REF OUT 2		
<Frequency>	Description of parameters	Def. value	Def. unit	Unit ring
9.72 MHz to 38.88 MHz	System clock frequency	12.96	MHz	
Description of command			Sig. State	FW vers.
This command determines the system clock frequency applied to *REF OUT 2*. The frequency entered is internally rounded to one of the following discrete values: 38.88 MHz, 19.44 MHz, 12.96 MHz, 9.72 MHz			all	V2.41

Subsystem MSSinfo
(Signalling information of mobile phone)

The subsystem *MSSinfo* contains the commands for querying the properties of the mobile phone. The subsystem corresponds to the *Signalling Info* output table in the main menu *IS 136 900/1800-MS Overview.* The mobile phone properties do not actually represent measured values, they are provided by the mobile phone during registration.

Note:

> *If no mobile is connected, or if the mobile under test is not registered (signalling states* SOFF, SON)*, the queries in this section will return the default values* INV*. Most true mobile properties are available in the REG and CEST states, the* `DNUMber` *and* `VCODer` *in the CEST state only. They are overwritten by* INV *as soon as registration is lost (transtion from* REG *or* CEST *to* SON *or* SOFF).

[SENSe:]MSSinfo:MSID:TYPE? MSID Type

<Returned Value>>	Description of parameters	Def. val.	Def. unit	Unit ring
ID20 | **ID24 |** **MIN |** **IMSI**	20-bit TMSI (temporary mobile station identity) 24-bit TMSI (temporary mobile station identity) 34-bit MIN (mobile identification number) 50-bit IMSI (international mobile subscriber identity)	MIN	–	

Description of command	Sig. State	FW vers.
This command is always a query and determines by which code number the mobile phone is identified.	all	V2.41

[SENSe:]MSSinfo:MSID:NUMBer? MSID

<Returned Value>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 2^{50} – 1	20-bit TMSI, 24-bit TMSI, 34-bit MIN, or 50-bit IMSI, depending on mobile type	INV	–	

Description of command	Sig. State	FW vers.
This command is always a query and returns the mobile station identification number.	all	V2.41

[SENSe:]MSSinfo:ESN? ESN

<Returned Value>	Description of parameters	Def. value	Def. unit	Unit ring
0 to 2^{32} – 1	32-bit Electronic Serial Number (ESN)	INV	–	

Description of command	Sig. State	FW vers.
This command is always a query and returns the Electronic Serial Number (ESN) of the mobile phone.	all	V2.41

[SENSe:]MSSinfo:PCLass? Power Class

<Returned Value>	Description of parameters	Def. value	Def. unit	Unit ring
1 to 4	Power class of the mobile phone	INV	–	

Description of command	Sig. State	FW vers.
This command is always a query and returns the power class of the mobile phone. For a list of IS-136 power classes and mobile attenuation codes refer to chapter 4.	all	V2.41

<table>
<tr><th colspan="4">[SENSe:]MSSinfo:DTX?</th><th>DTX Capability</th></tr>
<tr><td><i><Returned Value></i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>SUPP | NSUP</td><td>DTX mode supported or not supported</td><td>INV</td><td>–</td><td></td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command is always a query and returns the DTX <i>(Discontinuous Transmission)</i> capability of the mobile phone.</td><td>all</td><td>V2.41</td></tr>
</table>

<table>
<tr><th colspan="4">[SENSe:]MSSinfo:BANDwidth?</th><th>Bandwidth</th></tr>
<tr><td><i><Returned Value></i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>MH20 | MH25</td><td>20 MHz or 25 MHz bandwidth</td><td>INV</td><td>–</td><td></td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command is always a query and returns the width of the whole RF band used.</td><td>all</td><td>V2.41</td></tr>
</table>

<table>
<tr><th colspan="4">[SENSe:]MSSinfo:PVERsion?</th><th>Protocol Version</th></tr>
<tr><td><i><Returned Value></i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>PV0 |</td><td>EIA-553 or IS-54-A</td><td>INV</td><td>–</td><td></td></tr>
<tr><td>PV1 |</td><td>TIA/EIA 627</td><td></td><td></td><td></td></tr>
<tr><td>PV2 |</td><td>IS-136 Rev 0</td><td></td><td></td><td></td></tr>
<tr><td>PV3 |</td><td>Permanently reserved</td><td></td><td></td><td></td></tr>
<tr><td>PV4 |</td><td>TIA/EIA-136-0 PV0</td><td></td><td></td><td></td></tr>
<tr><td>PV5 |</td><td>TIA/EIA-136-A PV1</td><td></td><td></td><td></td></tr>
<tr><td>PV6 |</td><td>TIA/EIA-136-A PV2</td><td></td><td></td><td></td></tr>
<tr><td>PV7 |</td><td>TIA/EIA-136-A PV3</td><td></td><td></td><td></td></tr>
<tr><td>PV8 |</td><td>TIA/EIA-136-A PV4</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command is always a query and returns the width of the whole RF band used.</td><td>all</td><td>V2.41</td></tr>
</table>

<table>
<tr><th colspan="4">[SENSe:]MSSinfo:DNUMber?</th><th>Dialed Number</th></tr>
<tr><td><i><Returned Value></i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>"Max. 16 digits"</td><td>Number dialed at the mobile</td><td>INV</td><td>–</td><td></td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command is always a query and returns the number dialed at the mobile station (Call from MS). The current value is available in the CEST signalling state only.</td><td>all</td><td>V2.41</td></tr>
</table>

<table>
<tr><th colspan="4">[SENSe:]MSSinfo:VCODer?</th><th>Voice Coder</th></tr>
<tr><td><i><Returned Value></i></td><td>Description of parameters</td><td>Def. value</td><td>Def. unit</td><td>Unit ring</td></tr>
<tr><td>ACELp | VSELp</td><td>Specific voice coder type
Voice coder preferred by the mobile</td><td>INV</td><td>–</td><td></td></tr>
<tr><td colspan="3">Description of command</td><td>Sig. State</td><td>FW vers.</td></tr>
<tr><td colspan="3">This command is always a query and returns the voice coder of the mobile station. The current value is available in the CEST signalling state only.</td><td>all</td><td>V2.41</td></tr>
</table>

[SENSe]:MSSinfo:ACAPability:ENHanced?				Add. Capabilities
<Returned Values>	Description of parameters	Def. value	Def. unit	Unit ring
<dep. on MS manufacturer>,	Software vintage no.	INV	–	
<dep. on MS manufacturer>,	Firmware vintage no.	INV	–	
<dep. on MS manufacturer>,	Model no.	INV	–	
<dep. on MS manufacturer>,	Manufacturer code	INV	–	
1 to 8,	Max. supported PFC	INV	–	
ON | OFF,	SOC support	INV	–	
ON | OFF,	BSMC support	INV	–	
ON | OFF,	Async. data support	INV	–	
ON | OFF,	G3 Fax support	INV	–	
ON | OFF,	SMS broadcast support	INV	–	
ON | OFF,	Subaddressing support	INV	–	
ON | OFF,	800 MHz A and B band supp.	INV	–	
ON | OFF,	1900 MHz A band supp.	INV	–	
ON | OFF,	1900MHz B band support	INV	–	
ON | OFF,	1900MHz C band support	INV	–	
ON | OFF,	1900MHz D band support	INV	–	
ON | OFF,	1900MHz E band support	INV	–	
ON | OFF,	1900MHz F band support	INV	–	
ON | OFF,	IRA support	INV	–	
ON | OFF,	User group support	INV	–	
ON | OFF,	800 MHz analog speech supp.	INV	–	
ON | OFF,	Halfrate DTC support	INV	–	
ON | OFF,	Double rate DTC support	INV	–	
ON | OFF,	Triple rate DTC support	INV	–	
ON | OFF,	STU3 support	INV	–	
ON | OFF,	VSELP voice coder support	INV	–	
ON | OFF,	Alternate voice coder support	INV	–	
ON | OFF,	Alternate SOC support	INV	–	
<dep. on MS manufacturer>	Complete model number	INV	–	
ON | OFF,	ACELP CC1 voice coder support	INV	–	
ON | OFF,	ACELP CC2 voice coder support	INV	–	
ON | OFF,	Alternate US1 voice coder support	INV	–	
ON | OFF,	Multilingual supp. map ISO-8859-1	INV	–	
ON | OFF,	Multilingual supp. map ISO-10646	INV	–	
ON | OFF,	Multilingual supp. map ISO-8859-8	INV	–	
ON | OFF,	FACCH/SACCH ARQ map support	INV	–	
ON | OFF,	DADS support	INV	–	
ON | OFF,	Encryption and privacy map dom. A	INV	–	
ON | OFF,	Encryption and privacy map dom. B	INV	–	
ON | OFF	Advice support	INV	–	
Description of command			Sig. State	FW vers.
This command is always a query and returns the capability report (additional capabilities) of the mobile station. To obtain valid results, the capability report must be enabled via `CONFigure:NETWork:REQuest:CAPability ON`.			all	V3.05

Symbolic Status Event Register Evaluation

The following commands are used to retrieve the events reported in function group *IS 136 800/1900-MS Signalling*; see section *Symbolic Status Event Register Evaluation* in Chapter 5 of the CMU operating manual.

STATus:OPERation:SYMBolic:ENABle <Event>{,<Event>}	Symbolic status evaluation			
Parameter list	Parameter description	Def. Value[1]	Default Unit	Unit Ring
<Event>{,<Event>} | **NONE**	List of symbols for events to be reported No event reported	NONE	–	
Command description				FW vers.
This command enables event reporting for one or several events in the current *IS 136 800/1900-MS* function group, i.e. it sets the corresponding bits in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:ENABle` register (`<nr> = 1 | 2, <nr_event>` denotes the current function group) and in all sum registers up to the status byte. The events and the corresponding symbols for the function group are listed in Chapter 5 (see section *Status Registers).* The symbols may be entered in arbitrary order.				V3.05

STATus:OPERation:SYMBolic[:EVENt]?	Symbolic status evaluation			
Response	Parameter description	Def. Value[2]	Default Unit	Unit Ring
NONE | **<Event>{,<Event>}**	No event in the *RF* function group List of reported events	NONE	–	
Command description				FW vers.
This command is always a query. It lists the events reported in the current *IS 136 800/1900-MS* function group and deletes these events in the `STATus:OPERation:CMU:SUM<nr>:CMU<nr_event>:EVENt` register as well as in all sum registers.				V3.05

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[1] The default values quoted in this command are achieved after a `STATus:PRESet` command. `*RST` does not supersede the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

[2] The default values quoted in this command are achieved after a `*CLS` command. `*RST` does not supersede the entries in the status registers; see section *Reset Values of the Status Reporting Systems* in chapter 5.

List of Commands

In the following, all remote-control commands of the function groups IS 136 800/1900-MS are listed with their parameters and page numbers. They are arranged alphabetically according to the **second** keyword of the command so that related commands belong to the same group. The commands for the two test modes *Non Signalling* and *Signalling* are listed separately.

Commands for IS 136 800/1900-MS Module Tests

Table 6-1 Remote-control commands: Non Signalling

Command	Parameter	Remark	Page
Inputs and outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.7
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.7
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.8
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.8
SOURce:DM:CLOCk:FREQuency	1.219 MHz to 39.000 MHz	with query	6.8
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.8
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.7
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.7
RF Input Level			
[SENSe:]LEVel:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.2
[SENSe:]LEVel:DEFault	ON | OFF	with query	6.2
[SENSe:]LEVel:MAXimum	<Level>	with query	6.2
[SENSe:]LEVel:MODE	MANual | AUTomatic	with query	6.1
Modulation Measurements			
INITiate:MODulation:EVMagnitude[:DQPSk]	–	no query	6.33
ABORt:MODulation:EVMagnitude[:DQPSk]	–	no query	6.33
STOP:MODulation:EVMagnitude[:DQPSk]	–	no query	6.33
CONTinue:MODulation:EVMagnitude[:DQPSk]	–	no query	6.33
CONFigure:SUBarrays:MODulation:EVMagnitude[:DQPSk]	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.36
READ:ARRAy:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.38
FETCh:ARRAy:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.38
SAMPle:ARRAy:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.38
READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.39
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.39
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.39
CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.34
CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.35
DISPlay:MODulation:EVMagnitude[:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.35
CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.34

Command	Parameter	Remark	Page
READ:ARRAy:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.38
FETCh:ARRAy:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.38
SAMPle:ARRAy:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.38
READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.39
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.39
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.39
CONFigure:MODulation:EVMagnitude[:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.33
READ:ARRAy:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.38
FETCh:ARRAy:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.38
SAMPle:ARRAy:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.38
READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.39
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.39
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.39
FETCh:MODulation:EVMagnitude[:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.33
READ[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.37
FETCh[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.37
SAMPle[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.37
CALCulate[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:MATChing:LIMit:FTSYmbols?	<Result>	query only	6.38
CALCulate[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:MATChing:LIMit[:WBURst]?	<Result>	query only	6.38
READ[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.37
FETCh[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.37
SAMPle[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.37
INITiate:MODulation:MERRor[:DQPSk]	–	no query	6.47
ABORt:MODulation:MERRor[:DQPSk]	–	no query	6.47
STOP:MODulation:MERRor[:DQPSk]	–	no query	6.47
CONTinue:MODulation:MERRor[:DQPSk]	–	no query	6.47
CONFigure:SUBarrays:MODulation:MERRor[:DQPSk]	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.49
READ:ARRAy:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.51
FETCh:ARRAy:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.51
SAMPle:ARRAy:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.51
READ:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.52
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.52
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.52
CONFigure:MODulation:MERRor[:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.48
CONFigure:MODulation:MERRor[:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.49
DISPlay:MODulation:MERRor[:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.48
CONFigure:MODulation:MERRor[:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.48
READ:ARRAy:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.51
FETCh:ARRAy:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.51
SAMPle:ARRAy:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.51
READ:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.52
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.52
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.52
CONFigure:MODulation:MERRor[:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.47
READ:ARRAy:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.51
FETCh:ARRAy:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.51

Command	Parameter	Remark	Page
SAMPle:ARRAy:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.51
READ:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.52
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.52
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.52
FETCh:MODulation:MERRor[:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.47
READ[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.50
FETCh[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.50
SAMPle[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.50
CALCulate[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:MATChing :LIMit:FTSYmbols?	<Result>	query only	6.51
CALCulate[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:MATChing :LIMit[:WBURst]?	<Result>	query only	6.51
READ[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.50
FETCh[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.50
SAMPle[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.50
CONFigure:MODulation:OEMP[:DQPSk]:AVERage:LIMit:FTSYmbols	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.30
CONFigure:MODulation:OEMP[:DQPSk]:AVERage:LIMit[:WBURst	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.29
CONFigure:MODulation:OEMP[:DQPSk]:CMMax:LIMit:FTSYmbols	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.29
CONFigure:MODulation:OEMP[:DQPSk]:CMMax:LIMit[:WBURst	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.28
CONFigure:MODulation:OEMP[:DQPSk]:LIMit:DEFault	ON | OFF	with query	6.30
INITiate:MODulation:PERRor[:DQPSk]	–	no query	6.40
ABORt:MODulation:PERRor[:DQPSk]	–	no query	6.40
STOP:MODulation:PERRor[:DQPSk]	–	no query	6.40
CONTinue:MODulation:PERRor[:DQPSk]	–	no query	6.40
CONFigure:SUBarrays:MODulation:PERRor[:DQPSk]	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.43
READ:ARRAy:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
FETCh:ARRAy:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
SAMPle:ARRAy:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45

Command	Parameter	Remark	Page
READ:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
CONFigure:MODulation:PERRor[:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.41
CONFigure:MODulation:PERRor[:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.42
DISPlay:MODulation:PERRor[:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.42
CONFigure:MODulation:PERRor[:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.41
READ:ARRAy:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
FETCh:ARRAy:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
SAMPle:ARRAy:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
READ:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
CONFigure:MODulation:PERRor[:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.40
READ:ARRAy:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
FETCh:ARRAy:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
SAMPle:ARRAy:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
READ:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
FETCh:MODulation:PERRor[:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.40
READ[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.44
FETCh[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.44
SAMPle[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.44
CALCulate[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:MATChing :LIMit:FTSYmbols?	<Result>	query only	6.45
CALCulate[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:MATChing :LIMit[:WBURst]?	<Result>	query only	6.45
READ[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.44
FETCh[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.44
SAMPle[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.44
INITiate:MODulation[:OVERview][:DQPSk]	–	no query	6.26
ABORt:MODulation[:OVERview][:DQPSk]	–	no query	6.26
STOP:MODulation[:OVERview][:DQPSk]	–	no query	6.26
CONTinue:MODulation[:OVERview][:DQPSk]	–	no query	6.26
CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.27
CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.28
CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.27
CONFigure:MODulation[:OVERview][:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.26
FETCh:MODulation[:OVERview][:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.26
READ[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.31
FETCh[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.31
SAMPle[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.31
CALCulate[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:MATChing :LIMit:FTSYmbols?	<Result>	query only	6.32
CALCulate[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:MATChing :LIMit[:WBURst]?	<Result>	query only	6.32

Command	Parameter	Remark	Page
READ[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.31
FETCh[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.31
SAMPle[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.31
Power Measurements			
INITiate:POWer[:NBURst][:DQPSk]	–	no query	6.17
ABORt:POWer[:NBURst][:DQPSk]	–	no query	6.17
STOP:POWer[:NBURst][:DQPSk]	–	no query	6.17
CONTinue:POWer[:NBURst][:DQPSk]	–	no query	6.17
CONFigure:SUBarrays:POWer[:NBURst][:DQPSk]	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.21
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:AVERage[:RESult] :MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.25
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:AVERage[:RESult] :MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.23
READ:ARRAy:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
SAMPle:ARRAy:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
READ:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
CONFigure:POWer[:NBURst][:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.18
CONFigure:POWer[:NBURst][:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.19
DISPlay:POWer[:NBURst][:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.18
CONFigure:POWer[:NBURst][:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.18
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult] :MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.25
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:CURRent[:RESult] :MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.23
READ:ARRAy:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
SAMPle:ARRAy:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
READ:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
CONFigure:POWer[:NBURst][:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.17
CONFigure:POWer[:NBURst][:DQPSk]:LIMit:DEFault	ON | OFF	with query	6.20
CONFigure:POWer[:NBURst][:DQPSk]:LIMit:POINt[:ASYMmetrical] :LPOWer	–80 dBm to 0 dBm	with query	6.20
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical] :LOWer:AREA1	<LevelRel>, <EnableArea>	with query	6.20
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical] :LOWer:AREA1:ENABle	ON | OFF	with query	6.20
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical] :UPPer:AREA<nr>:ENABle	ON | OFF	with query	6.19
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical] :UPPer:AREA<nr>	<LevelRel>, <EnableArea>	with query	6.19
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:MAXimum[:RESult] :MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.25
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:MAXimum[:RESult] :MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.23
READ:ARRAy:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24

Command	Parameter	Remark	Page
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
SAMPle:ARRAy:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
READ:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB dB to +20.0 dB	query only	6.25
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:MINimum[:RESult] :MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.25
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:MINimum[:RESult] :MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.23
READ:ARRAy:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
SAMPle:ARRAy:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
READ:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:POWer[:NBURst][:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.17
CONFigure:POWer[:NBURst][:DQPSk]:TIME:OVERsampling	1 | 8	with query	6.20
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]:MATChing:RAMP?	BurstMatching	query only	6.23
READ[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?	<Result>	query only	6.22
FETCh[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?	<Result>	query only	6.22
SAMPle[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?	AvgBurstPower, PeakBurstPower, BurstsOutOfTol, BurstMatching	query only	6.22
RF Generator and Analyzer Settings			
[SENSe:]RFANalyzer:EMSSync	OFF | IS1 to IS6 | ALL	with query	6.4
[SENSe:]RFANalyzer:FREQuency	0.2 MHz to 2,700 MHz	with query	6.3
[SENSe:]RFANalyzer:FREQuency:OFFSet	–15 kHz to 15 kHz	with query	6.4
[SENSe:]RFANalyzer:FREQuency:UNIT	Hz | KHz | MHz | GHz | CH	with query	6.4
INITiate:RFGenerator	–	no query	6.4
ABORt:RFGenerator	–	no query	6.4
SOURce:RFGenerator:FREQuency	0.2 MHz to 2700 MHz	with query	6.5
SOURce:RFGenerator:FREQuency:OFFSet	–15 kHz to 15 kHz	with query	6.6
SOURce:RFGenerator:FREQuency:UNIT	Hz | KHz | MHz | GHz | CH	with query	6.6
SOURce:RFGenerator:LEVel	<Level>	with query	6.5
SOURce:RFGenerator:MODulation:RFS:TYPE	BER | CW | PRBS	with query	6.6
FETCh:RFGenerator:STATus?	OFF | RUN | ERR	query only	6.5
RX Quality Measurement			
INITiate:RXQuality:BER	–	no query	6.10
ABORt:RXQuality:BER	–	no query	6.10
STOP:RXQuality:BER	–	no query	6.10
CONTinue:RXQuality:BER	–	no query	6.10
CONFigure:RXQuality:BER:CONTrol:TSETup<nr>:FRAMes	1 to 500 | NONE	with query	6.12
CONFigure:RXQuality:BER:CONTrol:TSETup<nr>:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.11
CONFigure:RXQuality:BER:CONTrolTSETup<nr>[:DTC]:LEVel	<Level>	with query	6.12
CONFigure:RXQuality:BER:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.10
CONFigure:RXQuality:BER:LIMit:DEFault	ON | OFF	with query	6.13
CONFigure:RXQuality:BER:LIMit:TSETup<nr>:ABITs	0 % to 100 %	with query	6.12

Command	Parameter	Remark	Page
FETCh:RXQuality:BER:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 500 | NONE	query only	6.11
CONFigure:RXQuality:BER:TSETup	T1 | T2 | T3 | T4 | T5	with query	6.11
CALCulate[:SCALar]:RXQuality:BER[:RESult]:MATChing?	<Result>	query only	6.14
READ[:SCALar]:RXQuality:BER[:RESult]?	<Result>	query only	6.13
FETCh[:SCALar]:RXQuality:BER[:RESult]?	<Result>	query only	6.13
SAMPle[:SCALar]:RXQuality:BER[:RESult]?	<Result>	query only	6.13
Spectrum Measurement			
INITiate:SPECtrum[:ACPower]	–	no query	6.53
ABORt:SPECtrum[:ACPower]	–	no query	6.53
STOP:SPECtrum[:ACPower]	–	no query	6.53
CONTinue:SPECtrum[:ACPower]	–	no query	6.53
CONFigure:SPECtrum[:ACPower]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.54
CONFigure:SPECtrum[:ACPower]:CONTrol:ACHannel	-3 to –1 | +1 to +3	with query	6.55
CONFigure:SPECtrum[:ACPower]:CONTrol:DEFault	ON | OFF	with query	6.55
DISPlay:SPECtrum[:ACPower]:CONTrol:GRID	ON | OFF	with query	6.55
CONFigure:SPECtrum[:ACPower]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.54
CONFigure:SPECtrum[:ACPower]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.53
CONFigure:SPECtrum[:ACPower]:LIMit:CHN<nr>	<LevelPeak>, <LevelRMS>, ON | OFF	with query	6.56
CONFigure:SPECtrum[:ACPower]:LIMit:CHN<nr>:ENABle	ON | OFF	with query	6.56
CONFigure:SPECtrum[:ACPower]:LIMit:CHP<nr>	<LevelPeak>, <LevelRMS>, ON | OFF	with query	6.57
CONFigure:SPECtrum[:ACPower]:LIMit:CHP<nr>:MODE	ON | OFF	with query	6.57
CONFigure:SPECtrum[:ACPower]:LIMit:DEFault	ON | OFF	with query	6.57
FETCh:SPECtrum[:ACPower]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.53
READ:ARRAy:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
FETCh:ARRAy:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
SAMPle:ARRAy:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
READ:ARRAy:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
FETCh:ARRAy:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
SAMPle:ARRAy:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
READ:ARRAy:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
FETCh:ARRAy:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
SAMPle:ARRAy:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–100.0 dB dB to +20.0 dB	query only	6.61
READ:ARRAy:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
FETCh:ARRAy:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
SAMPle:ARRAy:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61

Command	Parameter	Remark	Page
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
CONFigure:SUBarrays:SPECtrum[:ACPower]:TDOMain[:DQPSk]	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.58
CALCulate[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult] :MATChing:LIMit?	<Result>	query only	6.60
READ[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?	–100 dBm to 50 dBm, INV | MATC | NMAT | OUT | NTR | BNF | OFF	query only	6.59
FETCh[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?	–100 dBm to 50 dBm, INV | MATC | NMAT | OUT | NTR | BNF | OFF	query only	6.59
SAMPle[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?	–100 dBm to 50 dBm, INV | MATC | NMAT | OUT | NTR | BNF | OFF	query only	6.59
Symbolic Status Register Evaluation			
STATus:OPERation:SYMBolic:ENABle	<Event>{,<Event>}	with query	6.9
STATus:OPERation:SYMBolic[:EVENt]?	NONE | <Event>{,<Event>}	query only	6.9
Trigger			
TRIGger[:SEQuence]:DEFault	ON | OFF	with query	6.3
TRIGger[:SEQuence]:SOURce	FRUN | RFPower | IFPower | EXTern	with query	6.2
TRIGger[:SEQuence]:THReshold	LOW | MEDium | HIGH	with query	6.3
Wideband Power Measurement			
INITiate:WPOWer	–	no query	6.15
ABORt:WPOWer	–	no query	6.15
STOP:WPOWer	–	no query	6.15
CONTinue:WPOWer	–	no query	6.15
CONFigure:WPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.16
CONFigure:WPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.15
FETCh:WPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.16
READ[:SCALar]:WPOWer[:RESult]?	–30 dBm to 30 dBm	query only	6.16
FETCh[:SCALar]:WPOWer[:RESult]?	–30 dBm to 30 dBm	query only	6.16
SAMPle[:SCALar]:WPOWer[:RESult]?	–30 dBm to 30 dBm	query only	6.16

Commands for IS 136 800/1900-MS Mobile Tests

Table 6-2 Remote-control commands: Signalling mode

Command	Parameter	Remark	Page
RF Signals of the CMU (Base Station)			
CONFigure:BSSignal:DCCH:CHANnel	<Channel>	with query	6.86
CONFigure:BSSignal:DCCH:LEVel	<Level>	with query	6.86
CONFigure:BSSignal:OCHandoff[:DTC]:CHANnel	<DTCChannel>	with query	6.88
CONFigure:BSSignal:OCHandoff[:DTC]:LEVel	<Level>	with query	6.88
CONFigure:BSSignal:SPEech	ECHO | LOOP | HSET	with query	6.88
CONFigure:BSSignal:VCODer	VSELp | ACELp | MSELected	with query	6.87
CONFigure:BSSignal[:DTC]:CHANnel	<DTCChannel>	with query	6.87
CONFigure:BSSignal[:DTC]:LEVel	<Level>	with query	6.87
PROCedure:BSSignal[:DTC]:LEVel	<Level>	with query	6.87
CONFigure:BSSignal[:DTC]:SLOTconfig	C14 | C25 | C36	with query	6.87
CONFigure:BSSignalOCHandoff[:DTC]:SLOTconfig	C14 | C25 | C36	with query	6.88
Channel Unit			
UNIT:CHANnel	CH | Hz | KHz | MHz | GHz	with query	6.80
Inputs and Outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.96
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.96
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.96
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +50 dB	with query	6.96
SOURce:DM:CLOCk:FREQuency	1.219 MHz to 39.000 MHz	with query	6.97
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.97
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.95
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.95
Handoff Target			
CONFigure:HANDoff:TARGet	<Target>	with query	6.86
STATus:HANDoff:TARGet:LIST?	<List>	query only	6.85
RF Input Level			
[SENSe:]LEVel:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.81
[SENSe:]LEVel:DEFault	ON | OFF	with query	6.81
[SENSe:]LEVel:MAXimum	<Level>	with query	6.81
[SENSe:]LEVel:MODE	MANual | DMAC | AUTomatic	with query	6.81
Modulation Measurements			
INITiate:MODulation:EVMagnitude[:DQPSk]	–	no query	6.33
ABORt:MODulation:EVMagnitude[:DQPSk]	–	no query	6.33
STOP:MODulation:EVMagnitude[:DQPSk]	–	no query	6.33
CONTinue:MODulation:EVMagnitude[:DQPSk]	–	no query	6.33

Command	Parameter	Remark	Page
CONFigure:SUBarrays:MODulation:EVMagnitude[:DQPSk]	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.36
READ:ARRAy:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.38
FETCh:ARRAy:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.38
SAMPle:ARRAy:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.38
READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.39
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.39
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:AVERage[:RESult]?	0.0% to 100.0%	query only	6.39
CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.34
CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.35
DISPlay:MODulation:EVMagnitude[:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.35
CONFigure:MODulation:EVMagnitude[:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.34
READ:ARRAy:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.38
FETCh:ARRAy:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.38
SAMPle:ARRAy:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.38
READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.39
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.39
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:CURRent[:RESult]?	0.0% to 100.0%	query only	6.39
CONFigure:MODulation:EVMagnitude[:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.33
READ:ARRAy:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.38
FETCh:ARRAy:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.38
SAMPle:ARRAy:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.38
READ:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.39
FETCh:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.39
SAMPle:SUBarrays:MODulation:EVMagnitude[:DQPSk]:MMAX[:RESult]?	0.0% to 100.0%	query only	6.39
FETCh:MODulation:EVMagnitude[:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.33
READ[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.37
FETCh[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.37
SAMPle[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.37
CALCulate[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult] :MATChing:LIMit:FTSYmbols?	<Result>	query only	6.38
CALCulate[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult] :MATChing:LIMit[:WBURst]?	<Result>	query only	6.38
READ[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.37
FETCh[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.37
SAMPle[:SCALar]:MODulation:EVMagnitude[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.37
INITiate:MODulation:MERRor[:DQPSk]	–	no query	6.47
ABORt:MODulation:MERRor[:DQPSk]	–	no query	6.47
STOP:MODulation:MERRor[:DQPSk]	–	no query	6.47
CONTinue:MODulation:MERRor[:DQPSk]	–	no query	6.47
CONFigure:SUBarrays:MODulation:MERRor[:DQPSk]	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.49
READ:ARRAy:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.51
FETCh:ARRAy:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.51
SAMPle:ARRAy:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.51
READ:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.52
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.52

Command	Parameter	Remark	Page
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:AVERage[:RESult]?	0.0% to +100.0%	query only	6.52
CONFigure:MODulation:MERRor[:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.48
CONFigure:MODulation:MERRor[:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.49
DISPlay:MODulation:MERRor[:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.48
CONFigure:MODulation:MERRor[:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.48
READ:ARRAy:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.51
FETCh:ARRAy:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.51
SAMPle:ARRAy:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.51
READ:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.52
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.52
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:CURRent[:RESult]?	0.0% to +100.0%	query only	6.52
CONFigure:MODulation:MERRor[:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.47
READ:ARRAy:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.51
FETCh:ARRAy:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.51
SAMPle:ARRAy:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.51
READ:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.52
FETCh:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.52
SAMPle:SUBarrays:MODulation:MERRor[:DQPSk]:MMAX[:RESult]?	0.0% to +100.0%	query only	6.52
FETCh:MODulation:MERRor[:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.47
READ[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.50
FETCh[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.50
SAMPle[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.50
CALCulate[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:MATChing :LIMit:FTSYmbols?	<Result>	query only	6.51
CALCulate[:SCALar]:MODulation:MERRor[:DQPSk][:RESult]:MATChing :LIMit[:WBURst]?	<Result>	query only	6.51
READ[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.50
FETCh[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.50
SAMPle[:SCALar]:MODulation:MERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.50
CONFigure:MODulation:OEMP[:DQPSk]:AVERage:LIMit:FTSYmbols	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.30
CONFigure:MODulation:OEMP[:DQPSk]:AVERage:LIMit[:WBURst	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.29
CONFigure:MODulation:OEMP[:DQPSk]:CMMax:LIMit:FTSYmbols	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.29

Command	Parameter	Remark	Page
CONFigure:MODulation:OEMP[:DQPSk]:CMMax:LIMit[:WBURst	<PhaseErrorPeak>, <PhaseErrorRMS>, <MagnErrorPeak>, <MagnErrorRMS>,<EVMErrorPeak>, <EVMErrorRMS>, <OriginOffset>, <IQImbalance>, <FreqError>	with query	6.28
CONFigure:MODulation:OEMP[:DQPSk]:LIMit:DEFault	ON | OFF	with query	6.30
INITiate:MODulation:PERRor[:DQPSk]	–	no query	6.40
ABORt:MODulation:PERRor[:DQPSk]	–	no query	6.40
STOP:MODulation:PERRor[:DQPSk]	–	no query	6.40
CONTinue:MODulation:PERRor[:DQPSk]	–	no query	6.40
CONFigure:SUBarrays:MODulation:PERRor[:DQPSk]	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.43
READ:ARRAy:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
FETCh:ARRAy:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
SAMPle:ARRAy:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
READ:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:AVERage[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
CONFigure:MODulation:PERRor[:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.41
CONFigure:MODulation:PERRor[:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.42
DISPlay:MODulation:PERRor[:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.42
CONFigure:MODulation:PERRor[:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.41
READ:ARRAy:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
FETCh:ARRAy:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
SAMPle:ARRAy:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
READ:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:CURRent[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
CONFigure:MODulation:PERRor[:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.40
READ:ARRAy:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
FETCh:ARRAy:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
SAMPle:ARRAy:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.45
READ:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
FETCh:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
SAMPle:SUBarrays:MODulation:PERRor[:DQPSk]:MMAX[:RESult]?	–100.0 deg to +100.0 deg	query only	6.46
FETCh:MODulation:PERRor[:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.40
READ[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.44
FETCh[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.44
SAMPle[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.44
CALCulate[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:MATChing :LIMit:FTSYmbols?	<Result>	query only	6.45
CALCulate[:SCALar]:MODulation:PERRor[:DQPSk][:RESult]:MATChing :LIMit[:WBURst]?	<Result>	query only	6.45
READ[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.44
FETCh[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.44
SAMPle[:SCALar]:MODulation:PERRor[:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.44
INITiate:MODulation[:OVERview][:DQPSk]	–	no query	6.26

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ABORt:MODulation[:OVERview][:DQPSk]	–	no query	6.26
STOP:MODulation[:OVERview][:DQPSk]	–	no query	6.26
CONTinue:MODulation[:OVERview][:DQPSk]	–	no query	6.26
CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.27
CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.28
CONFigure:MODulation[:OVERview][:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.27
CONFigure:MODulation[:OVERview][:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.26
FETCh:MODulation[:OVERview][:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.26
READ[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.31
FETCh[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.31
SAMPle[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult]:FTSYmbols?	<Result>	query only	6.31
CALCulate[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult] :MATChing:LIMit:FTSYmbols?	<Result>	query only	6.32
CALCulate[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult] :MATChing:LIMit[:WBURst]?	<Result>	query only	6.32
READ[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.31
FETCh[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.31
SAMPle[:SCALar]:MODulation[:OVERview][:DQPSk][:RESult][:WBURst]?	<Result>	query only	6.31
Mobile Info			
[SENSe:]MSSinfo:ACAPability:ENHanced?	<numeric_value>	query only	6.100
[SENSe:]MSSinfo:BANDwidth?	<numeric_value>	query only	6.99
[SENSe:]MSSinfo:DNUMber?	<numeric_value>	query only	6.99
[SENSe:]MSSinfo:DTX?	<numeric_value>	query only	6.99
[SENSe:]MSSinfo:ESN?	<numeric_value>	query only	6.98
[SENSe:]MSSinfo:MSID:NUMBer?	<numeric_value>	query only	6.98
[SENSe:]MSSinfo:MSID:TYPE?	ID20 | IDD24 | MIN | IMSI	query only	6.98
[SENSe:]MSSinfo:PCLass?	<numeric_value>	query only	6.98
[SENSe:]MSSinfo:PVERsion?	PV0 to PV8	query only	6.99
[SENSe:]MSSinfo:VCODer?	<numeric_value>	query only	6.99
Network Parameters			
CONFigure:NETWork:IDENtity:MCC	0 to 1023	with query	6.89
CONFigure:NETWork:IDENtity:SID	0 to 32767	with query	6.89
CONFigure:NETWork:IDENtity:SOC	0 to 4095	with query	6.89
CONFigure:NETWork:OCHandoff[:MS]:DTCMAC	0 to 10	with query	6.95
CONFigure:NETWork:REQuest:Capability	ON | OFF	with query	6.91
CONFigure:NETWork:REQuest:SNUMber	ON | OFF	with query	6.91
CONFigure:NETWork:SMODe:DEReg	ON | OFF	with query	6.90
CONFigure:NETWork:SMODe:ID20	"0" to "1048575"	with query	6.90
CONFigure:NETWork:SMODe:ID24	"0" to "16777215"	with query	6.90
CONFigure:NETWork:SMODe:IDIMsi	"0" to "2^{34} – 1"	with query	6.91
CONFigure:NETWork:SMODe:IDMin	"0" to "2^{50} – 1"	with query	6.91
CONFigure:NETWork:SMODe:IDTYpe	ON | OFF	with query	6.90
CONFigure:NETWork:SMODe:PDReg	ON | OFF	with query	6.89
CONFigure:NETWork:SMODe:PUReg	ON | OFF	with query	6.89
CONFigure:NETWork:SMODe:PUReg	ON | OFF	with query	6.90
CONFigure:NETWork:SYSTem:CCSDvcc	0 to 255	with query	6.94
CONFigure:NETWork:SYSTem:NOESlots	5 to 10	with query	6.94

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CONFigure:NETWork:SYSTem:NOFSlots	5 to 10	with query	6.94
CONFigure:NETWork:TIMeout:LORLINk	4 to 64	with query	6.94
CONFigure:NETWork:TIMeout:RPERiod	0 s to 60 s | OFF	with query	6.94
CONFigure:NETWork[:MS]:DCCMac	0 to 7	with query	6.92
CONFigure:NETWork[:MS]:DELay	0 superframes to 420 superframes	with query	6.93
CONFigure:NETWork[:MS]:DIC	DCCH | DTC	with query	6.93
CONFigure:NETWork[:MS]:DTCMac	0 to 10	with query	6.92
CONFigure:NETWork[:MS]:RAMin	–8, –111 dBm to –51 dBm	with query	6.92
CONFigure:NETWork[:MS]:SBINdicator	NORMal | SHORtened	with query	6.93
CONFigure:NETWork[:MS]:SCANinterval	1 hyperframe to 16 hyperframes	with query	6.93
CONFigure:NETWork[:MS]:SUFF	–8, –111 dBm to –51 dBm	with query	6.92
Other Call Target			
CONFigure:OCALl:TARGet	<Target>	with query	6.85
STATus:OCALl:TARGet:LIST?	<List>	query only	6.85
Power Measurements			
INITiate:POWer[:NBURst][:DQPSk]	–	no query	6.17
ABORt:POWer[:NBURst][:DQPSk]	–	no query	6.17
STOP:POWer[:NBURst][:DQPSk]	–	no query	6.17
CONTinue:POWer[:NBURst][:DQPSk]	–	no query	6.17
CONFigure:SUBarrays:POWer[:NBURst][:DQPSk]	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.21
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:AVERage[:RESult]:MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.25
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:AVERage[:RESult]:MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.23
READ:ARRAy:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
SAMPle:ARRAy:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
READ:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:AVERage[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
CONFigure:POWer[:NBURst][:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.18
CONFigure:POWer[:NBURst][:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.19
DISPlay:POWer[:NBURst][:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.18
CONFigure:POWer[:NBURst][:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.18
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:CURRent[:RESult]:MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.25
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:CURRent[:RESult]:MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.23
READ:ARRAy:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
SAMPle:ARRAy:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
READ:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:CURRent[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
CONFigure:POWer[:NBURst][:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.17

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CONFigure:POWer[:NBURst][:DQPSk]:LIMit:DEFault	ON | OFF	with query	6.20
CONFigure:POWer[:NBURst][:DQPSk]:LIMit:POINt[:ASYMmetrical]:LPOWer	–80 dBm to 0 dBm	with query	6.20
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical]:LOWer:AREA1	<LevelRel>, <EnableArea>	with query	6.20
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical]:LOWer:AREA1:ENABle	ON | OFF	with query	6.20
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical]:UPPer:AREA<nr>:ENABle	ON | OFF	with query	6.19
CONFigure:POWer[:NBURst][:DQPSk]:LIMit[:LINE][:ASYMmetrical]:UPPer:AREA<nr>	<LevelRel>, <EnableArea>	with query	6.19
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]:MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.25
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]:MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.23
READ:ARRAy:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
SAMPle:ARRAy:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
READ:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:MAXimum[:RESult]?	–100.0 dB dB to +20.0 dB	query only	6.25
CALCulate:ARRay:POWer[:NBURst][:DQPSk]:MINimum[:RESult]:MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.25
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk]:MINimum[:RESult]:MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.23
READ:ARRAy:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
FETCh:ARRAy:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
SAMPle:ARRAy:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.24
READ:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
SAMPle:SUBarrays:POWer[:NBURst][:DQPSk]:MINimum[:RESult]?	–100.0 dB to +10.0 dB	query only	6.25
FETCh:POWer[:NBURst][:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.17
CONFigure:POWer[:NBURst][:DQPSk]:TIME:OVERsampling	1 | 8	with query	6.20
CALCulate[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]:MATChing:RAMP?	BurstMatching	query only	6.23
READ[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?	<Result>	query only	6.22
FETCh[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?	<Result>	query only	6.22
SAMPle[:SCALar]:POWer[:NBURst][:DQPSk][:RESult]?	AvgBurstPower, PeakBurstPower, BurstsOutOfTol, BurstMatching	query only	6.22
INITiate:POWer:SBURst[:DQPSk]	–	no query	6.71
ABORt:POWer:SBURst[:DQPSk]	–	no query	6.71
STOP:POWer:SBURst[:DQPSk]	–	no query	6.71
CONTinue:POWer:SBURst[:DQPSk]	–	no query	6.71
CONFigure:SUBarrays:POWer:SBURst[:DQPSk]	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.75
CALCulate:ARRay:POWer:SBURst[:DQPSk]:AVERage[:RESult]:MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.79
CALCulate[:SCALar]:POWer:SBURst[:DQPSk]:AVERage[:RESult]:MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.77
READ:ARRAy:POWer:SBURst[:DQPSk]:AVERage[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
FETCh:ARRAy:POWer:SBURst[:DQPSk]:AVERage[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
SAMPle:ARRAy:POWer:SBURst[:DQPSk]:AVERage[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
READ:SUBarrays:POWer:SBURst[:DQPSk]:AVERage[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79

Command	Parameter	Remark	Page
FETCh:SUBarrays:POWer:SBURst[:DQPSk]:AVERage[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
SAMPle:SUBarrays:POWer:SBURst[:DQPSk]:AVERage[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
CONFigure:POWer:SBURst[:DQPSk]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.72
CONFigure:POWer:SBURst[:DQPSk]:CONTrol:DEFault	ON | OFF	with query	6.73
DISPlay:POWer:SBURst[:DQPSk]:CONTrol:GRID	ON | OFF	with query	6.72
CONFigure:POWer:SBURst[:DQPSk]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.72
CALCulate:ARRay:POWer:SBURst[:DQPSk]:CURRent[:RESult]:MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.79
CALCulate[:SCALar]:POWer:SBURst[:DQPSk]:CURRent[:RESult]:MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.77
READ:ARRAy:POWer:SBURst[:DQPSk]:CURRent[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
FETCh:ARRAy:POWer:SBURst[:DQPSk]:CURRent[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
SAMPle:ARRAy:POWer:SBURst[:DQPSk]:CURRent[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
READ:SUBarrays:POWer:SBURst[:DQPSk]:CURRent[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
FETCh:SUBarrays:POWer:SBURst[:DQPSk]:CURRent[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
SAMPle:SUBarrays:POWer:SBURst[:DQPSk]:CURRent[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
CONFigure:POWer:SBURst[:DQPSk]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.71
CONFigure:POWer:SBURst[:DQPSk]:LIMit:DEFault	ON | OFF	with query	6.74
CONFigure:POWer:SBURst[:DQPSk]:LIMit:POINt[:ASYMmetrical]:LPOWer	–80 dBm to 0 dBm	with query	6.74
CONFigure:POWer:SBURst[:DQPSk]:LIMit[:LINE][:ASYMmetrical]:LOWer:AREA1	<LevelRel>, <EnableArea>	with query	6.74
CONFigure:POWer:SBURst[:DQPSk]:LIMit[:LINE][:ASYMmetrical]:LOWer:AREA1:ENABle	ON | OFF	with query	6.74
CONFigure:POWer:SBURst[:DQPSk]:LIMit[:LINE][:ASYMmetrical]:UPPer:AREA<nr>	<LevelRel>, <EnableArea>	with query	6.73
CONFigure:POWer:SBURst[:DQPSk]:LIMit[:LINE][:ASYMmetrical]:UPPer:AREA<nr>:ENABle	ON | OFF	with query	6.73
CALCulate:ARRay:POWer:SBURst[:DQPSk]:MAXimum[:RESult]:MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.79
CALCulate[:SCALar]:POWer:SBURst[:DQPSk]:MAXimum[:RESult]:MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.77
READ:ARRAy:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
FETCh:ARRAy:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
SAMPle:ARRAy:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
READ:SUBarrays:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
FETCh:SUBarrays:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
SAMPle:SUBarrays:POWer:SBURst[:DQPSk]:MAXimum[:RESult]?	–100.0 dB dB to +20.0 dB	query only	6.79
CALCulate:ARRay:POWer:SBURst[:DQPSk]:MINimum[:RESult]:MATChing:LIMit[:LINE][:ASYMmetrical][:COMBined]?	32-bit field, 32-bit field	query only	6.79
CALCulate[:SCALar]:POWer:SBURst[:DQPSk]:MINimum[:RESult]:MATChing?	BurstPwCurrRMS, LeakPowRMS	query only	6.77
READ:ARRAy:POWer:SBURst[:DQPSk]:MINimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
FETCh:ARRAy:POWer:SBURst[:DQPSk]:MINimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
SAMPle:ARRAy:POWer:SBURst[:DQPSk]:MINimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.78
READ:SUBarrays:POWer:SBURst[:DQPSk]:MINimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
FETCh:SUBarrays:POWer:SBURst[:DQPSk]:MINimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
SAMPle:SUBarrays:POWer:SBURst[:DQPSk]:MINimum[:RESult]?	–100.0 dB to +20.0 dB	query only	6.79
FETCh:POWer:SBURst[:DQPSk]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.71
CONFigure:POWer:SBURst[:DQPSk]:TIME:OVERsampling	1 | 8	with query	6.74
CALCulate[:SCALar]:POWer:SBURst[:DQPSk][:RESult]:MATChing:RAMP?	BurstMatching	query only	6.77
READ[:SCALar]:POWer:SBURst[:DQPSk][:RESult]?	<Result>	query only	6.76
FETCh[:SCALar]:POWer:SBURst[:DQPSk][:RESult]?	<Result>	query only	6.76

Command	Parameter	Remark	Page
SAMPle[:SCALar]:POWer:SBURst[:DQPSk][:RESult]?	AvgBurstPower, PeakBurstPower, BurstsOutOfTol, BurstMatching	query only	6.76
RX Quality Measurement			
CONFigure:RXQuality:EMAHo:CONTrol:DEFault	ON | OFF	with query	6.67
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:BAND	<Band_1>, ..., <Band_22>	with query	6.66
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CELL<nr>	<Band>, <Channel>	with query	6.67
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:CHANnel	<Channel_1>, ..., <Channel_22>	with query	6.66
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:LSORted	ON | OFF	with query	6.67
CONFigure:RXQuality:EMAHo:CONTrol:NCELls:RSELect	ON | OFF	with query	6.67
[SENSe:]RXQuality:EMAHo:CQUality:BER?	EB00 to EB15	query only	6.68
[SENSe:]RXQuality:EMAHo:CQUality:CIR?	CI00 to CI15	query only	6.68
[SENSe:]RXQuality:EMAHo:CQUality:RSSI?	ER00 to ER41	query only	6.68
[SENSe:]RXQuality:EMAHo:CQUality:WER?	WE00 to WE15	query only	6.68
[SENSe:]RXQuality:EMAHo:CQUality?	EB00 to EB15, ER00 to ER41	query only	6.68
[SENSe:]RXQuality:EMAHo:NCELls:BAND?	<Band_1>, ..., <Band_22>	query only	6.70
[SENSe:]RXQuality:EMAHo:NCELls:CELL<nr>?	<Channel>, <RSSI>	query only	6.69
[SENSe:]RXQuality:EMAHo:NCELls:RESult:CELL<nr>?	<Band>, <Channel>, <RSSI>	query only	6.69
[SENSe:]RXQuality:EMAHo:NCELls?	<Channel_1>, <RSSI_1>, ..., <Channel_22>, <RSSI_22>	query only	6.69
CONFigure:RXQuality:MAHO:CONTrol:DEFault	ON | OFF	with query	6.63
CONFigure:RXQuality:MAHO:CONTrol:NCELls:BAND	<Band>, ..., <Band_24>	with query	6.62
CONFigure:RXQuality:MAHO:CONTrol:NCELls:CELL<nr>	<Band>, <Channel>	with query	6.63
CONFigure:RXQuality:MAHO:CONTrol:NCELls:CHANnel	<Channel_1>, ..., <Channel_24>	with query	6.62
CONFigure:RXQuality:MAHO:CONTrol:NCELls:LSORted	ON | OFF	with query	6.63
[SENSe:]RXQuality:MAHO:CQUality:BER?	BER0 to BER7	query only	6.64
[SENSe:]RXQuality:MAHO:CQUality:RSSI?	RS0 to RS31	query only	6.64
[SENSe:]RXQuality:MAHO:CQUality?	BER0 to BER7, RS0 to RS31	query only	6.64
[SENSe:]RXQuality:MAHO:NCELls:BAND?	<Band_1>, ..., <Band_24>	query only	6.65
[SENSe:]RXQuality:MAHO:NCELls:CELL<nr>?	<Channel>, <RSSI>	query only	6.64
[SENSe:]RXQuality:MAHO:NCELls:RESult:CELL<nr>?	<Band>, <Channel>, <RSSI>	query only	6.65
[SENSe:]RXQuality:MAHO:NCELls:RESult?	Band_1>, <Channel_1>, <RSSI_1>, ..., <Band_24>, <Channel_24>, <RSSI_24>	query only	6.65
[SENSe:]RXQuality:MAHO:NCELls:RESult?	Band_1>, <Channel_1>, <RSSI_1>, ..., <Band_22>, <Channel_22>, <RSSI_22>	query only	6.69
[SENSe:]RXQuality:MAHO:NCELls?	<Channel_1>, <RSSI_1>, ..., <Channel_24>, <RSSI_24>	query only	6.65
Signalling			
PROCedure:SIGNalling:ACTion	SOFF | SON | CTM | CRELease | HANDoff | OCALl	with query	6.83
[SENSe:]SIGNalling:STATe?	SOFF | SON | REG | ALER | CEST | CPEN | RPEN | FPEN	query only	6.84

Command	**Parameter**	**Remark**	**Page**
PROCedure:SIGNalling[:DTC]:CHANnel	<Number>	with query	6.84
PROCedure:SIGNalling[:DTC]:MAC	0 to 10	with query	6.84
PROCedure:SIGNalling[:DTC]:SLOTconfig	2 to 6	with query	6.84
Spectrum Measurement			
INITiate:SPECtrum[:ACPower]	–	no query	6.53
ABORt:SPECtrum[:ACPower]	–	no query	6.53
STOP:SPECtrum[:ACPower]	–	no query	6.53
CONTinue:SPECtrum[:ACPower]	–	no query	6.53
CONFigure:SPECtrum[:ACPower]:CONTrol	SCALar | ARRay, 1 to 1000 | NONE	with query	6.54
CONFigure:SPECtrum[:ACPower]:CONTrol:ACHannel	-3 to –1 | +1 to +3	with query	6.55
CONFigure:SPECtrum[:ACPower]:CONTrol:DEFault	ON | OFF	with query	6.55
DISPlay:SPECtrum[:ACPower]:CONTrol:GRID	ON | OFF	with query	6.55
CONFigure:SPECtrum[:ACPower]:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.54
CONFigure:SPECtrum[:ACPower]:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.53
CONFigure:SPECtrum[:ACPower]:LIMit:CHN<nr>	<LevelPeak>, <LevelRMS>, ON | OFF	with query	6.56
CONFigure:SPECtrum[:ACPower]:LIMit:CHN<nr>:ENABle	ON | OFF	with query	6.56
CONFigure:SPECtrum[:ACPower]:LIMit:CHP<nr>	<LevelPeak>, <LevelRMS>, ON | OFF	with query	6.57
CONFigure:SPECtrum[:ACPower]:LIMit:CHP<nr>:MODE	ON | OFF	with query	6.57
CONFigure:SPECtrum[:ACPower]:LIMit:DEFault	ON | OFF	with query	6.57
FETCh:SPECtrum[:ACPower]:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.53
READ:ARRAy:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
FETCh:ARRAy:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
SAMPle:ARRAy:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:AVERage[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
READ:ARRAy:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
FETCh:ARRAy:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
SAMPle:ARRAy:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:CURRent[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
READ:ARRAy:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
FETCh:ARRAy:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
SAMPle:ARRAy:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:MAXimum[:RESult]?	–100.0 dB dB to +20.0 dB	query only	6.61
READ:ARRAy:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
FETCh:ARRAy:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
SAMPle:ARRAy:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.60
READ:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
FETCh:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61
SAMPle:SUBarrays:SPECtrum[:ACPower]:TDOMain:MINimum[:RESult]?	–120.0 dBm to +40.0 dBm	query only	6.61

Command	Parameter	Remark	Page
CONFigure:SUBarrays:SPECtrum[:ACPower]:TDOMain[:DQPSk]	ALL | ARITHmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.58
CALCulate[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]:MATChing:LIMit?	<Result>	query only	6.60
READ[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?	–100 dBm to 50 dBm, INV | MATC | NMAT | OUT | NTR | BNF | OFF	query only	6.59
FETCh[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?	–100 dBm to 50 dBm, INV | MATC | NMAT | OUT | NTR | BNF | OFF	query only	6.59
SAMPle[:SCALar]:SPECtrum[:ACPower][:FDOMain][:RESult]?	–100 dBm to 50 dBm, INV | MATC | NMAT | OUT | NTR | BNF | OFF	query only	6.59
Speech Encoder and Decoder			
ROUTe:SPDecoder:OUTPut	HANDset | ANALyzer | ANA2 | ABOTh	with query	6.96
ROUTe:SPENcoder[:INPut]	HANDset | GENerator	with query	6.96
Symbolic Status Register Evaluation			
STATus:OPERation:SYMBolic:ENABle	<Event>{,<Event>}	with query	6.101
STATus:OPERation:SYMBolic[:EVENt]?	NONE | <Event>{,<Event>}	query only	6.101
Trigger			
TRIGger[:SEQuence]:DEFault	ON | OFF	with query	6.82
TRIGger[:SEQuence]:SOURce	SIGNalling | FRUN | RFPower | IFPower	with query	6.82
TRIGger[:SEQuence]:THReshold	LOW | MEDium | HIGH	with query	6.82
Wide-Band Power			
INITiate:WPOWer	–	no query	6.15
ABORt:WPOWer	–	no query	6.15
STOP:WPOWer	–	no query	6.15
CONTinue:WPOWer	–	no query	6.15
CONFigure:WPOWer:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.16
CONFigure:WPOWer:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.15
FETCh:WPOWer:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.16
READ[:SCALar]:WPOWer[:RESult]?	–30 dBm to 30 dBm	query only	6.16
FETCh[:SCALar]:WPOWer[:RESult]?	–30 dBm to 30 dBm	query only	6.16
SAMPle[:SCALar]:WPOWer[:RESult]?	–30 dBm to 30 dBm	query only	6.16

Alphabetical Command Lists

Table 6-3 Remote-control commands: Non Signalling mode

Table 6-4 Remote-control commands: *Signalling* mode

Index

Supplement to the Operating Manual

for Software Options

TDMA800/1900-MS for R&S CMU-B21

New Features in Firmware V3.07, V3.52, V3.60

Dear CMU Customer,

With the software versions V3.07, V3.52, and V3.60 of options R&S® CMU-K27 and R&S® CMU-K28, *TDMA1800/1900-MS for CMU-B21,* your Universal Radio Communication Tester R&S® CMU200 provides some additional features that could not yet be reported in the current revision of the operating manual *TDMA800/1900-MS for CMU-B21*, stock no. 1115.6688.12-03-.

- A new power measurement using a narrow-band filter is available (subsystem *NPOWer)*.
- In *Signalling* mode, the *MAHO* and extended MAHO *(EMAHo)* tests can be activated or deactivated explicitly (see p. 4).
- *Default, current* and *other call/handoff* parameter values can be coupled or independent (see section *Parameter Coupling* on p. 5.
- Transmission of the R&S CMU's alphanumeric ID to the mobile can be disabled (see p. 6).
- The status registers have been extended (see p. 7).

Many of the new features are accessible via remote control only. The commands are listed and described on the following pages.

NPOWer (Both Test Modes)

The subsystem *NPOWer* measures the power of the signal transmitted by the mobile phone using the RF analyzer configuration of the power vs. time *(POWer)* measurement. In contrast to the *POWer* and the wideband power *(WPOWer)* measurement, *NPOWer* uses a matched filter, i.e. the root-raised cosine filer that the standard specifies for the measurement of modulation parameters. Due to the different filter configurations the results of the three power measurements are slightly different *(NPOWer < POWer < WPOWer).*

The narrow-band *NPOWer* measurement yields the average, maximum and minimum burst power of the current burst (display mode *Current)* and of the averaged measurement curve (display mode *Average)*. The entire measurement curves (arrays) are not available, and no limit check is performed. *NPOWer* is a quick and precise alternative to the *WPOWer* or *POWer* measurements if only scalar results are needed.

Note: *A* Free Run *trigger (*`TRIGger[:SEQuence]:SOURce FRUN`*) should be avoided because it delays the* `NPOWer` *measurement.*

INITiate:NPOWer	Start new measurement	⇒ *RUN*
ABORt:NPOWer	Abort measurement and switch off	⇒ *OFF*
STOP:NPOWer	Stop measurement	⇒ *STOP*
CONTinue:NPOWer	Next measurement step (only *counting mode*)	⇒ *RUN*
Description of command		FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status given in the top right column.		V3.07

CONFigure:NPOWer:EREPorting <*Mode*>		Event Reporting		
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V3.07
Description of command				
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU200 operating manual).				

FETCh:NPOWer:STATus?		Measurement Status		
Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the OFF state (*RST or ABORt) Running (after INITiate, CONTinue or READ) Stopped (STOP) OFF (could not be started) Stepping mode (<stepmode>=STEP) Stopped according to repetition mode and stop condition	OFF	–	V3.07
1 to 10000 | **NONE**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	
Description of command				
This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU operating manual).				

Subsystem NPOWer:CONTrol

The subsystem *NPOWer:CONTrol* defines the repetition mode, statistic count, stop condition, and stepping mode of the *NPOWer* measurement.

CONFigure:NPOWer:CONTrol <*Statistics*>, <*Repetition*>,<*StopCond*>,<*Stepmode*>		Scope of Measurement		
<Statistics>	Description of parameters	Def. value	Def. unit	
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	
<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 ... 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	

<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.07

Description of command

This command defines the statistic count, repetition mode, stop condition, and stepping mode for the measurement.

CONFigure:NPOWer:CONTrol:STATistics <*Statistics*> Statistic Count

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	No. of bursts within a statistics cycle Statistics off	100	–	V3.07

Description of command

This command defines the number of bursts that represent one statistics cycle.

CONFigure:NPOWer:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*> Test cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 ... 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Start measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.07

Description of command

This command determines the repetition mode, the stop condition and the stepping mode for the measurement.

Note: *In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*

Measured Values – Subsystem NPOWer?

The subsystem *NPOWer?* retrieves the results of the narrow-band power measurement.

READ[:SCALar]:NPOWer? **FETCh[:SCALar]:NPOWer?** **SAMPle[:SCALar]:NPOWer?**	Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)			
Returned values	Value range	Def. value	Def. unit	FW vers.
Avg. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	V3.07
Min. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	
Max. Power of Current Burst,	–137 dBm to +53 dBm	NAN	dBm	
Avg. Power of Average Burst,	–137 dBm to +53 dBm	NAN	dBm	
Min. Power of Average Burst,	–137 dBm to +53 dBm	NAN	dBm	
Max. Power of Average Burst	–137 dBm to +53 dBm	NAN	dBm	
Description of command				
These commands are always queries. They start the *NPOWer* measurement and return the results.				

RXQuality:MAHO (Signalling only)

The subsystem *RXQuality:MAHO* tests the capability of the mobile station to provide the mobile-assisted handoff (MAHO) report. Firmware V3.07 provides the following new command:

CONFigure:RXQuality:MAHO:ENAble <*Enable*>	Activate or Deactivate MAHO Test			
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Activate or deactivate MAHO test	ON	–	V3.07
Command description				Sig. State
This command activates or deactivates the MAHO test. In the OFF setting, the CMU does not request the MAHO report from the mobile so that no MAHO results are transferred.				all

RXQuality:EMAHO (Signalling only)

The subsystem *RXQuality:EMAHO* tests the capability of the mobile station to provide the extended mobile-assisted handoff (extended MAHO) report. Firmware V3.07 provides the following new command:

CONFigure:RXQuality:EMAHo:ENAble <*Enable*>	Activate or Deactivate Ext. MAHO Test			
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Activate or deactivate extended MAHO test	ON	–	V3.07
Command description				Sig. State
This command activates or deactivates the extended MAHO test. In the OFF setting, the CMU does not request the extended MAHO report from the mobile so that no extended MAHO results are transferred.				all

Parameter Coupling

Some parameters of the CMU can take on two or three independent values:

- The **default** value is used to set up a connection; it can be modified in the signalling states *Signal Off, Signal On and Registered*.
- The **current** value is valid during the connection (signalling state *Call Established)*. Whenever the CMU enters the *Call Established* state the default value overwrites the current value. The current value can still be changed during the connection, however, modifying this current value does not alter the default value.
- The **other call/handoff** value comes into effect only after an *Other Call* or *Handoff* from another to the current network.

Examples of triple parameters in IS 136 800/900-MS are the *DTC Channel* and the *DTC Slot Configuration*.

In cases where signalling state dependent parameter sets are not needed, it is possible to couple all three values. This is done using the *Parameter Coupling* mechanism in the *Misc.* tab, which is in the second level of the *Connection Control* menu.

Parameter Coupling

Qualifies whether *default, current* and *other call/handoff* parameter values are coupled or independent.

Sign. State Dependent Sets

If the parameter is enabled (box checked), the CMU uses independent parameter sets for *current* and *default* values and for *other call/handoff* values. In particular, changing the current value during a call does not alter the default value used to set up the next call.
If the parameter is disabled (box unchecked), *default, current* and *other call/handoff* values are equal. In particular, changing the default value (in one of the signaling states *Signal Off, Signal On* or *Registered)* affects the current value (used in signalling state *Call Established)* and vice versa.

The reset values for the default parameter set are optimized for a call setup. Selecting *Sign. State Dependent Sets* generally ensures that a subsequent call will not fail after the parameters have been changed in the *Call Established* state.

Remote control `CONFigure:SDSets:ENABle ON | OFF`

CONFigure:SDSets:ENABle <*Enable*> Sign. State Dependent Sets

<*Enable*>	Description of parameters	Def. value	Def. unit	Unit ring
ON |	The CMU uses different *current, default* and *other call/handoff* parameters	ON	–	–
OFF	The three parameter values are coupled and always equal			

Description of command	Sig. State	FW vers.
This command enables or disables the signalling state dependent parameter sets (independent current and default values; see note above). If it is set to *OFF, default, current* and *other call/handoff* values are always equal.	all	V3.52

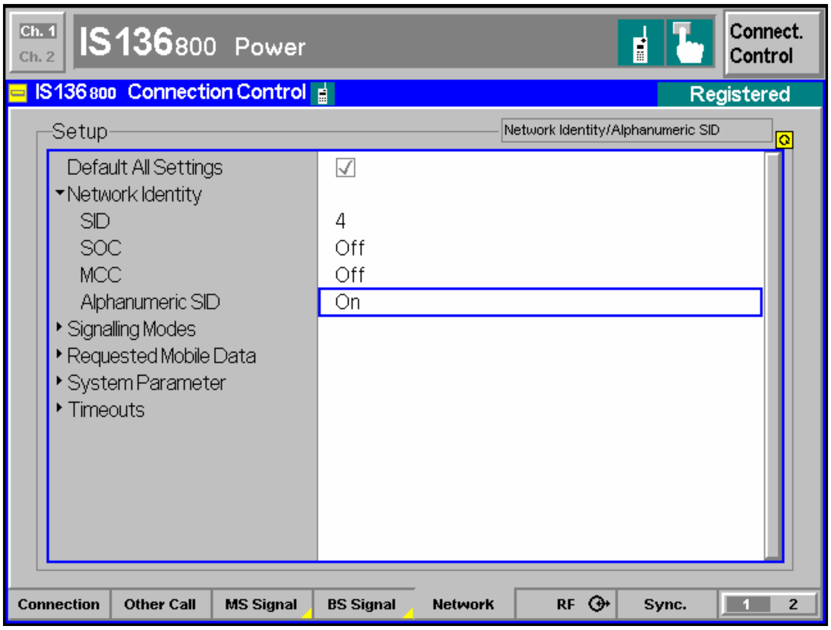
ESN in Hexadecimal Format

A new remote control command returns the Electronic Serial Number (ESN) of the connected mobile phone in hexadecimal format. The command is available in *Signalling* mode.

[SENSe:]MSSinfo:ESN:HEX?				ESN (hex)
<Returned Value>	Description of parameters	Def. value	Def. unit	Unit ring
#H0 to #HFFFFFFFF	32-bit ESN, hex value	INV	–	–
Description of command			Sig. State	FW vers.
This command is always a query and returns the Electronic Serial Number (ESN) of the mobile phone in hexadecimal format.			all	V3.52

Disable Transmission of Alphanumeric SID

In the *Network Identity* section of the *Connection Control – Network* tab (available in *Signalling* mode), it is possible to prevent the transmission of the alphanumeric SID string “CMU 200 IS136” that the R&S CMU 200 broadcasts to the mobile on the DCCH. Transmission should be disabled whenever the alphanumeric SID is undesirable at the mobile.



Default All Settings ☑
Network Identity
SID 4
SOC Off
MCC Off
Alphanumeric SID On

CONFigure:NETWork:IDENtity:ASID *<Enable>*				Alphanumeric SID Transmission
<Returned Value>	Description of parameters	Def. value	Def. unit	Unit ring
ON | OFF	Enable or disable alphanumeric SID transmission	ON	–	–
Description of command			Sig. State	FW vers.
This command qualifies whether the R&S CMU 200 broadcasts the alphanumeric SID string “CMU 200 IS136” on the DCCH.			all	V3.60

Extended Status Registers

Bit no. 4 of the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` registers assigned to the IS 136 function groups (Signalling and Non Signalling) is set if the active measurement could not performed and terminated correctly (e.g. because of a low signal level) so that the measurement results are invalid.

The commands for symbolic status register evaluation (`STATus:OPERation:SYMBolic...`) use the event name *MINV* (measurement invalid).