ROHDE&SCHWARZ

Test and
Measurement Division

Operating Manual

Digital Radiocommunication Tester

CMD52/55

1050.9008.52/.55

Printed in the Federal
Republic of Germany

Data Sheet

Safety Instructions
Certificate of quality
EC Certificate of Conformity
List of R & S Representatives

Different technical data for the CMD55 with modification CMD-U18 (1099.5358.02)

RF generator 1 (TCH)

RF IN/OUT

Output level..-120 dBm to -15/-17* dBm
Level error..≤ 2.0 dB (-15/-17* dBm to -35/-37* dBm)
≤ 1.5 dB (-35/-37* dBm to -120 dBm)
≤ 1.0 dB (at -104 dBm)

RF OUT 2

Not available

RF generator 2 (BCCH)

RF IN/OUT

Output level..-120 dBm to -17/-19* dBm
Level error..≤ 2.0 dB

RF OUT 2

Not available

Analyser

RF IN/OUT

Level range ....0 to 40 dBm
Error peak power meter......................In GSM band: ≤ 0.5 dB + resolution
In DCS bands: ≤ 0.8 dB + resolution

*) DCS1900 frequency range

Different technical data for the CMD55 with modification CMD-U20 (1099.5606.02)

Combined mode (BCCH and TCH in different GSM bands):

Level error of Synthesizer 1

RF IN/OUT .... < 3 dB
RF OUT2 .... < 3 dB

Level error of Synthesizer 2

RF IN/OUT .... < 3 dB
RF OUT2 .... < 3 dB

Remark to technical data in the rated temperature range 0 to 45°C:
With very low ambient temperatures a warmup time up to 30 min. is necessary to achieve thermical balance in the instrument.

CMD-U13 (data differing from CMD55)

CMD55 with CMD-U13 have a 10 dB more sensitive RF input 1.
This results in the following specifications differing from those of an unmodified CMD 55:

Peak Power Meter (RF IN/OUT)

Measurement range	-10 to + 37 dBm
Maximum RF Power	+ 37 dBm
Error in GSM900 band	≤ 0.5 dB + resolution (P> -6 dBm)
Error in GSM1800/1900 band	≤ 0.8 dB + resolution (P> -6 dBm)

Phase and frequency error measurement

Level range (RF IN/OUT)	-10 to + 37 dBm

Burst Power measurement

Reference level range for full dynamic range (RF IN/OUT)	GSM900: 0 to + 37 dBm GSM1800/1900: -10 to + 37 dBm

CMD55 with CMD-U13 have a different output level range at RF OUT2.

RF generator 1

Output level range (RF OUT2)	-35 **(-37*)** ... -120 dBm

RF generator 2

Output level range (RF OUT2)	-37 **(-39*)** ... -120 dBm

*) In GSM1900 band with option CMD-B19 fitted

Safety Instructions

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:

   Pollution severity 2, overvoltage category 2, IP degree of protection 2X, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards.

   (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made (installation and cabling of the unit to be performed only by qualified technical personnel).

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.

   If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.

   Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.

   If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

   Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.

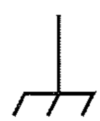
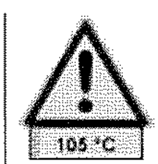
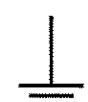
   Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.

   Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.

   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

10. Any additional safety instructions given in this manual are also to be observed.

Safety-related symbols used on equipment and documentation from R&S:

						
Observe operating instructions	Weight indication for units >18 kg	PE terminal	Ground terminal	Danger! Shock hazard	Warning! High temperatures Warning! Hot surfaces	Ground

ROHDE&SCHWARZ
EC Certificate of Conformity

CE

Certificate No.: 9502038

This is to certify that:

Equipment type	Order No.	Designation
CMD52	1050.9008.52	Digital Radio Communication Tester
CMD55	1050.9008.55	

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits (73/23/EEC revised by 93/68/EEC)

- relating to electromagnetic compatibility (89/336/EEC revised by 91/263/EEC, 92/31/EEC, 93/68/EEC)

Conformity is proven by compliance with the following standards:

EN61010-1 : 1991
EN50081-1 : 1992
EN50082-1 : 1992

Affixing the EC conformity mark as from 1995

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich, 1995-06-26

Central Quality Management FS-QZ / Becker

ROHDE&SCHWARZ
EC Certificate of Conformity

CE

Certificate No.: 9502043

This is to certify that:

Gerätetyp	Identnummer	Benennung
CMD-B1	1051.6002.02/.04	Reference Oscillator OCXO
CMD-B19	1059.6201.02	PCS1900
CMD-B2	1059.8604.02	OCXO Reference Oscillator
CMD-B3	1051.6202.02	Multi Reference Frequency In-/Outputs
CMD-B4	1051.6654.02	DSP Option Carrier
CMD-B41	1051.6902.02	Audio Measurem. w. Freq. Counter
CMD-B42	1051.7150.02	High Dynamic Burst Analysis
CMD-B43	1059.6001.02	GSM/DCS1800 specific Spectrum Measurem.
CMD-B5	1051.8657.02	Real Time Speech Coder/Decoder
CMD-B6	1051.7409.02	Adapter for CMD-B..-Options
CMD-B60	1059.5405.02	Adapter for CMD-B..-Options
CMD-B61	1051.7609.02	IEEE 488 BUS Interface
CMD-B62	1051.8205.02/.04	Memory Card Interface
CMD-B7	1051.8357.02/.04/.06	ABIS Interface
CMD-B8	1059.8204.02	Testmobile Functionality
CMD-B81	1059.7508.02/.04	AWGN Generator
CMD-B82	1059.4344.02/.04	AMPS Option
CMD-B84	1099.5806.02	IS 136
CMD-B9	1051.6402.04	Second RF Synthesizer

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electromagnetic compatibility
  (89/336/EEC revised by 91/263/EEC, 92/31/EEC, 93/68/EEC)

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Mühldorfstr. 15, D-81671 München

Munich, 1997-05-22

Central Quality Management FS-QZ / Becker

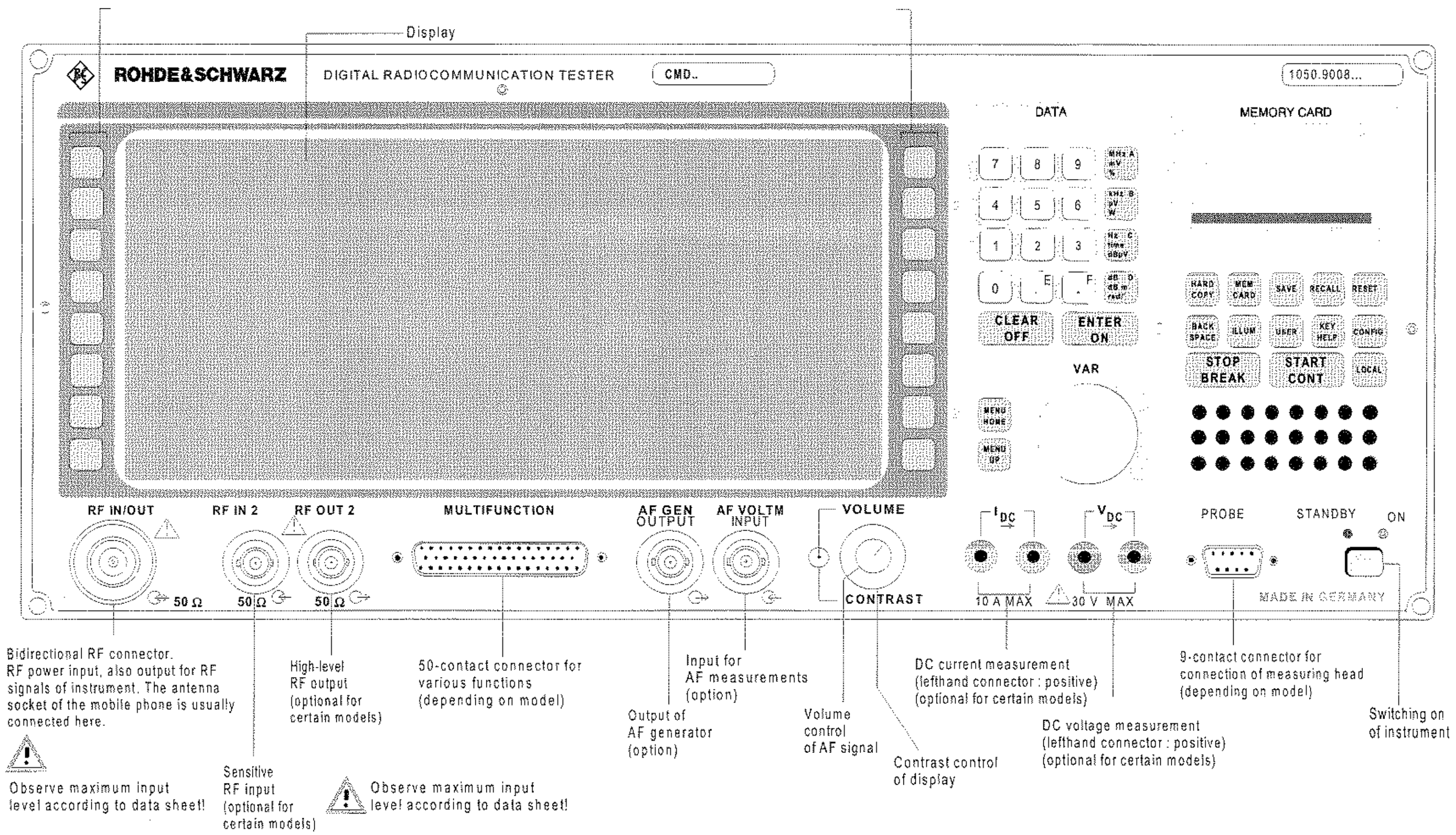
Contents

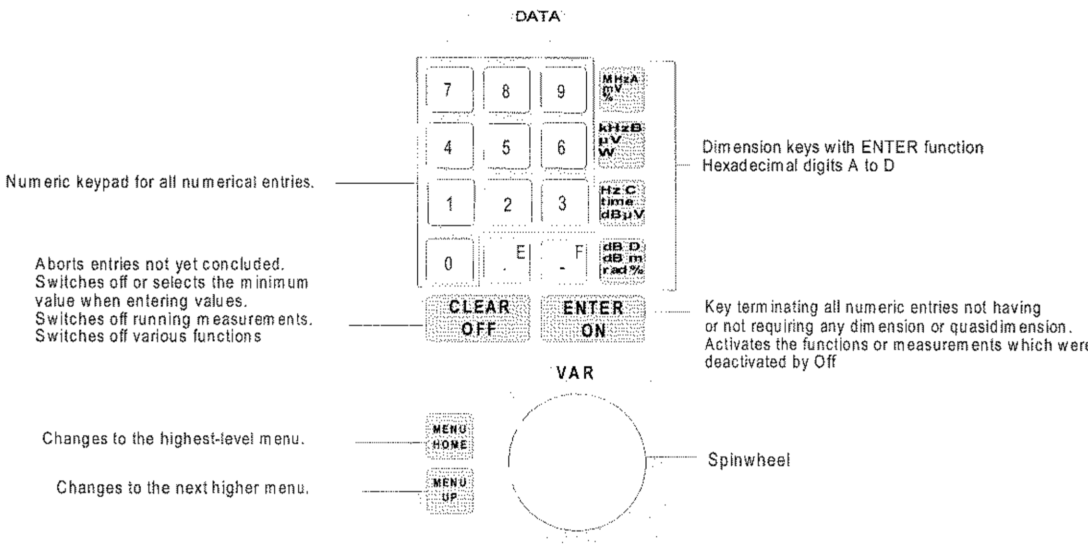
1 Preparation for Use

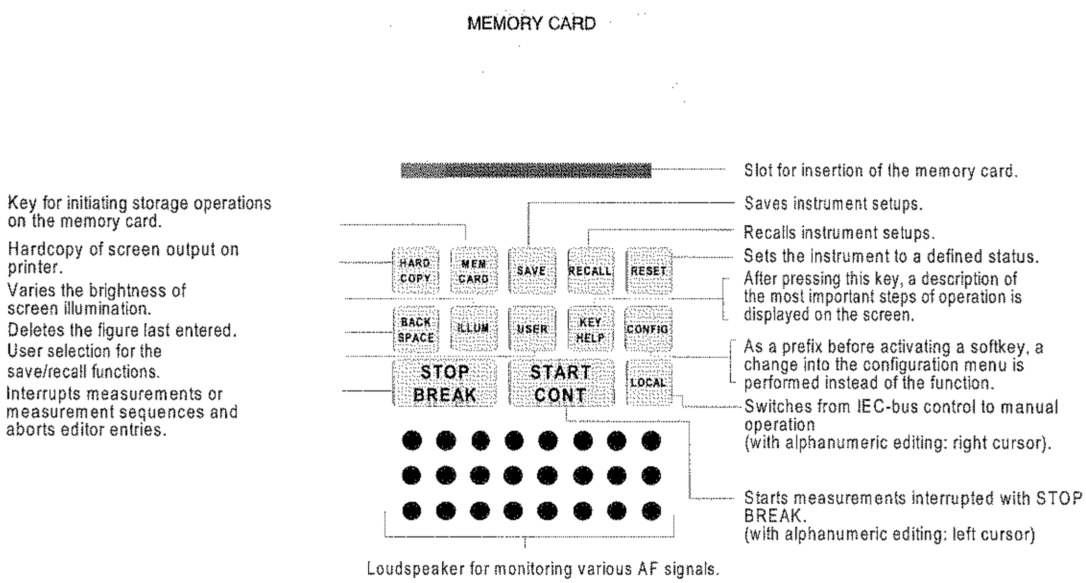
- Take the instrument out of the shipping box and check whether the items listed are all included.
- Carefully check the instrument for mechanical damage. Should the instrument be damaged, immediately notify the forwarder which shipped the instrument to you. Therefore make sure to keep the box and packing material.
- For further transport or shipment of the instrument, the original packing should also be used. It is urgently recommended to use the protective caps included in the shipping box for protection of the front and rear panel. This serves to prevent damage e.g. to the controls on the front panel.

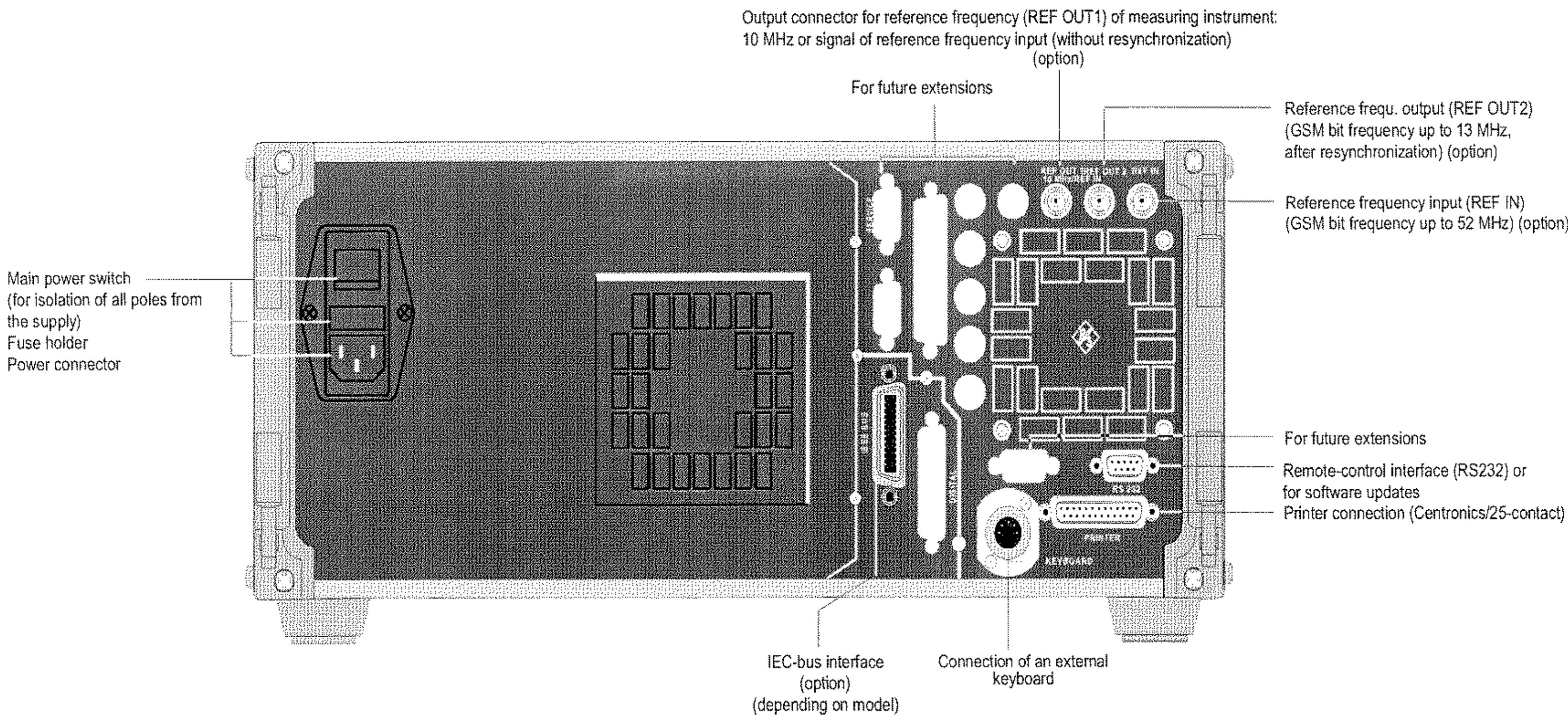
1.1 Explanation of Front and Rear Views

The next pages show the front and rear views of the instrument, each with brief explanations of the controls and connectors.

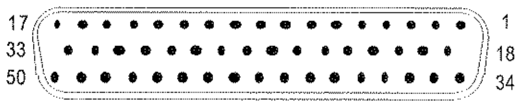

Display
ROHDE&SCHWARZ
DIGITAL RADIOCOMMUNICATION TESTER
CMD..
1050.9008...
DATA
MEMORY CARD
7 8 9
4 5 6
1 2 3
0
CLEAR OFF
ENTER ON
HARD COPY
MEM CARD
SAVE
RECALL
RESET
BACK SPACE
ILLUM
USER
KEY HELP
CONFIG
STOP BREAK
START CONT
LOCAL
VAR
MENU HOME
MENU UP
RF IN/OUT
RF IN 2
RF OUT 2
MULTIFUNCTION
AF GEN OUTPUT
AF VOLTM INPUT
VOLUME
CONTRAST
I_{DC}
V_{DC}
10 A MAX
30 V MAX
PROBE
STANDBY
ON
MADE IN GERMANY
50 Ω
50 Ω
50 Ω
Bidirectional RF connector.
RF power input, also output for RF signals of instrument. The antenna socket of the mobile phone is usually connected here.
Observe maximum input level according to data sheet!
Sensitive RF input (optional for certain models)
High-level RF output (optional for certain models)
Observe maximum input level according to data sheet!
50-contact connector for various functions (depending on model)
Output of AF generator (option)
Input for AF measurements (option)
Volume control of AF signal
Contrast control of display
DC current measurement (lefthand connector : positive) (optional for certain models)
DC voltage measurement (lefthand connector : positive) (optional for certain models)
9-contact connector for connection of measuring head (depending on model)
Switching on of instrument


DATA
7
8
9
MHz A
mV
%
4
5
6
kHz B
µV
W
1
2
3
Hz C
time
dBµV
0
. E
- F
dB D
dB m
rad %
CLEAR
OFF
ENTER
ON
VAR
MENU
HOME
MENU
UP
Numeric keypad for all numerical entries.
Aborts entries not yet concluded.
Switches off or selects the minimum value when entering values.
Switches off running measurements.
Switches off various functions
Changes to the highest-level menu.
Changes to the next higher menu.
Dimension keys with ENTER function
Hexadecimal digits A to D
Key terminating all numeric entries not having or not requiring any dimension or quasidimension.
Activates the functions or measurements which were deactivated by Off
Spinwheel


MEMORY CARD
HARD
COPY
MEM
CARD
SAVE
RECALL
RESET
BACK
SPACE
ILLUM
USER
KEY
HELP
CONFIG
STOP
BREAK
START
CONT
LOCAL
Key for initiating storage operations on the memory card.
Hardcopy of screen output on printer.
Varies the brightness of screen illumination.
Deletes the figure last entered.
User selection for the save/recall functions.
Interrupts measurements or measurement sequences and aborts editor entries.
Slot for insertion of the memory card.
Saves instrument setups.
Recalls instrument setups.
Sets the instrument to a defined status.
After pressing this key, a description of the most important steps of operation is displayed on the screen.
As a prefix before activating a softkey, a change into the configuration menu is performed instead of the function.
Switches from IEC-bus control to manual operation
(with alphanumeric editing: right cursor).
Starts measurements interrupted with STOP BREAK.
(with alphanumeric editing: left cursor)
Loudspeaker for monitoring various AF signals.


Output connector for reference frequency (REF OUT1) of measuring instrument: 10 MHz or signal of reference frequency input (without resynchronization) (option)
For future extensions
Reference frequ. output (REF OUT2) (GSM bit frequency up to 13 MHz, after resynchronization) (option)
Reference frequency input (REF IN) (GSM bit frequency up to 52 MHz) (option)
Main power switch (for isolation of all poles from the supply)
Fuse holder
Power connector
For future extensions
Remote-control interface (RS232) or for software updates
Printer connection (Centronics/25-contact)
IEC-bus interface (option) (depending on model)
Connection of an external keyboard

(only for certain models)



Pin assignment front-panel top view

1)
Handset Out (low-impedance):
Nominal output level: 492 mV_{rms}
Full output level: 700 mV_{rms}

Handset In (high-impedance):
Nominal input level: 50.8 mV_{rms}
Full output level: 70 mV_{rms}

2)
Important notes:
These external I/Q modulation signals are added to the internal signals. The transmit level is not affected.

Normal application:
Internal modulation, pin 16 and pin 32 not connected (open).

Special application:
External modulation at pin 16 and pin 32:
DC offset: -2.5 V
Level: +2.5 Vp to -2.5 Vp
Internal modulation must be switched off (eg RF GENERATOR menu).

Pin	Signal designation	Function
1 18 34	HANDSET OUT Ground HANDSET IN	**1)** Handset connection (Function only with option CMD-B5)
2 3 19 35 36	Ground DPG HFF DPG EXTRST DPG EXTD DPG EXTW	Data pattern generator (Function only with particular instrument configurations)
4 5 6 7 20 21 22 23 37 38 39	SER DSR SER TXDATA SER RXDATA SER RTS Ground SER RLSD SER TXCLK SER RXCLK SER DTR SER RI SER CTS	Ser. data interface (I/O) (Function only with particular instrument configurations)
8 24 40 41	BICLK BIDATA Ground BIFRAME	Bit interface (Function only with particuar instrument configurations)
9 10 11 25 26 27 42 43	FRAME 51 MULTIFRAME Ground BITCLK 26 MULTIFRAME USERTRIGGER SLOTOUT SUPERFRAME	GSM-specific clock outputs (USERTRIGGER is input). Time reference is CMD transmitter (only with option CMD-B6)
12 13 14 28 29 30 31 44 45 46 47	SER DUTRLSD SER DUTTXCLK SER DUTRXCLK SER DUTDTR SER DUTRI SER DUTCTS Ground SER DUTDSR SER DUTTXDATA SER DUTRXDATA SER DUTRTS	Serial data interface (I/O). (Function only with particular instrument configurations)
15 48	vacant vacant	
16 32 49	PRI EXTQ PRI EXTI Ground	**2)** I/Q modulation inputs (Synthesizer 1)
17 33 50	AQ EXT AI EXT Ground	I/Q demodulator outputs (Level is adjusted via the software to max. ± 2.5 Vp, AC coupling)

1.2 Putting into Operation

1.2.1 Setting up the Instrument

For bench measurements, it is recommended to fold out the feet at the bottom of the instrument.

For convenient operation of the instrument note the following:

- Do not cover the ventilation openings!
- Ambient temperature 0 to 45 °C.
- Avoid moisture condensation. If it however occurs, the instrument must be wiped dry before switching on.
- Note the warm-up time of the temperature-controlled OCXO reference oscillator (option).

1.2.2 Mounting into an 19" Rack

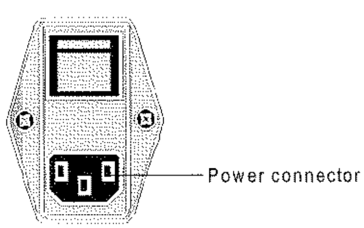
Using the rack adapter of the tye ZZA-94 (order number 396.4905.00) the instrument can be mounted into a 19" rack according to the mounting instructions supplied.

As the power switch is situated at the rear of the instrument, an all-pole mains disconnection must be near at hand for safety reasons when the instrument is mounted in a rack!

1.2.3 Connecting the Instrument to the AC Supply

The CMD is equipped with an AC voltage detection, i.e. it is automatically set to the respective AC supply voltage. (Range: AC voltage 90 to 132 V and 180 to 265 V; 47 to 440 Hz).

➢ Plug the supplied power cable into the rear power connector and connect the CMD to the current supply.



1.2.4 How to Ensure EMC

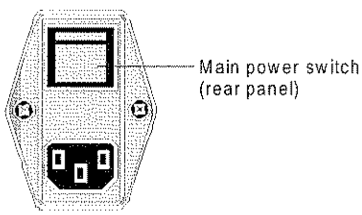
In order to avoid electromagnetic interference, the instrument may only be operated in the closed state and with all shielding covers. Only appropriate shielded signal and control cables may be used.

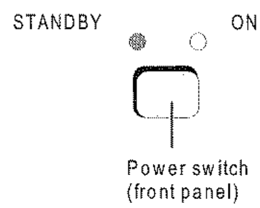
1.2.5 Switching on the Instrument

As soon as the main power switch at the rear of the instrument is in the OFF position, the complete instrument is disconnected from the power supply. If it is set to the ON position, the instrument is in standby mode or in operation, depending on the position of the power switch at the front of the instrument.

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

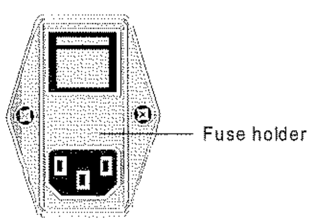
ON position:
The green LED (ON) is illuminated, all modules of the instrument are supplied with operating voltage.





1.2.6 Power Fuses

The CMD is equipped with two fuses complying with the label of the power supply. The fuses are located in the extendable fuse holder, which is inserted between power connector and main power switch.



1.2.7 Input Level

Observe the maximum input levels at connectors RF IN/OUT and RF IN2 specified in the data sheet!

Contents

2 Manual Operation

Despite its many facilities, the Digital Radiocommunication Tester CMD permits easy and convenient operation, which is also supported by the use of menus.

The clear front-panel layout permits fast access to the controls and connectors.

If you are not yet familiar with the CMD and want to get a fast overview of its capabilities, you should first read section 2.1, which will lead step by step through a complete test on a GSM mobile phone.

Section 2.4 describes the complete functions of manual operation. Starting from the selection menu, all menus are explained completely one after the other.

2.1 Getting Started

Section 2.1 has been designed mainly for the newcomer to the CMD. It leads the operator step by step through the most common tests which are performed on GSM mobile phones.

It includes connection of the phone, the steps location update and call setup as well as the individual tests.

Each individual step additionally includes pointers e.g.① to more detailed information on the opposite page.

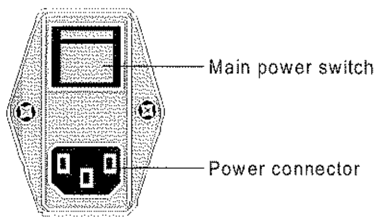
The layout and contents of this section are application-oriented and contain, in addition to information specific to the CMD, information relating to the GSM system.

In order to quickly become aquainted with the CMD and its numerous features we suggest to read through this section whilst at the same time operating the CMD together with a mobile phone.

The user will thus quickly and easily get to know the extremely user-friendly concept of the CMD and will therefore very soon achieve correct and usable measurement results.

For further information on the individual menu illustrations and keys kindly refer to the reference part starting with section 2.2.

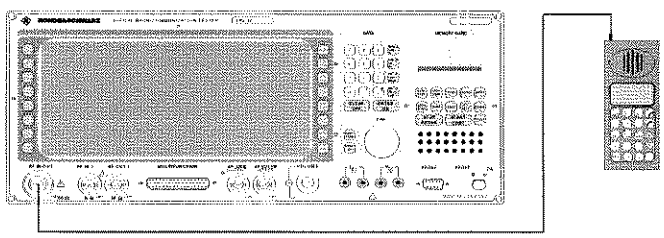
2.1.1 Manual Tests: Connecting the Phone to the CMD



Step 1

Plug the power cable into the power connector at the rear of the instrument and connect the CMD to the current supply.①

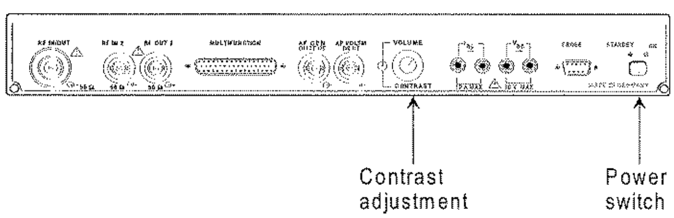
Switch the CMD to standby mode using the main power switch at the rear. ②



Step 2

Connect the N-type connector RF IN/OUT of the CMD to the antenna connector of the mobile phone. ③

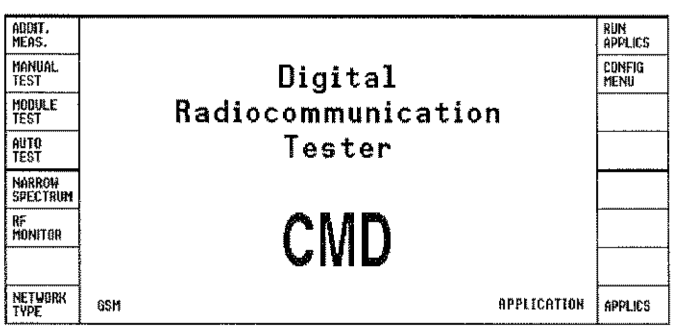
Supply the mobile phone with the correct operating voltage (battery or power supply).④



Step 3

Switch on the CMD by means of the power switch on the front panel. ⑤

Adjust the display contrast as desired.⑥



The CMD now shows the opposite display and is ready to test the mobile phone.

Additional information

Step 1

① **Power supply**
The CMD is equipped with a supply voltage identification facility and automatically adjusts itself to the supply voltage applied. (Range: AC voltage 90 to 132 V and 180 to 265 V; 47 to 440 Hz).

② **Main power switch on the rear panel**
When the power switch at the rear is set to the OFF position, the complete instrument is disconnected from the power supply. When the main power 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.

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 GSM mobile phones generate pulse-like RF signals, they often feature a pulse-shaped current consumption. Problems may arise if power supplies are used which cannot provide such currents with a constant voltage.

Step 3

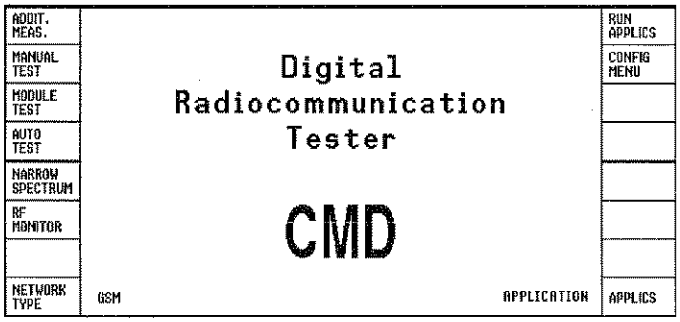
⑤ **Power switch on the front panel**
The power switch at the front of the instrument determines whether the instrument is in standby mode or in operation.

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.

⑥ **Contrast**
The display contrast can be adjusted using the rotary knob CONTRAST on the front panel. The contrast adjustment depends on the viewing angle of the user and can be readjusted if the viewing angle changes.

2.1.2 Manual Tests: Setting up a Call to the Mobile Phone



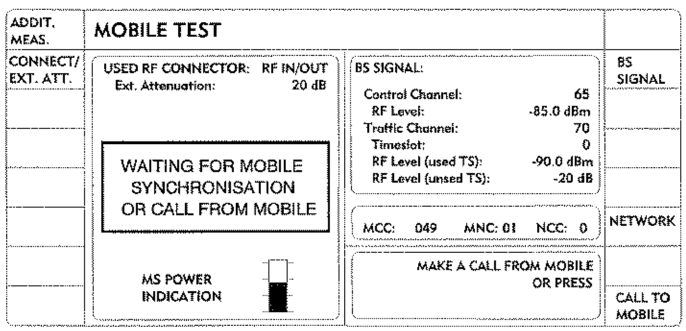
Step 1

Set the instrument to the default status:
To this end, press the "RESET" hardkey and then the "ALL DATA" softkey.

Select

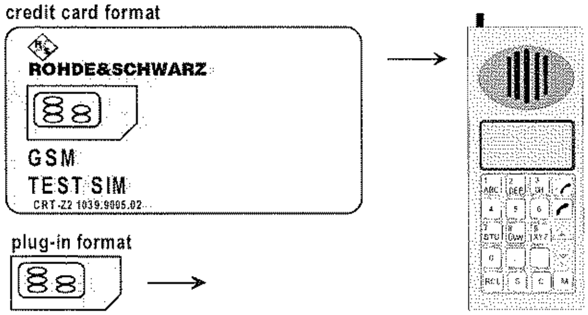
MANUAL TEST

to perform a manual test. ①



The CMD is now transmitting and is waiting for the mobile phone to synchronise with the signal (Text "WAITING FOR MOBILE SYNCHRONISATION OR CALL FROM MOBILE" blinks).② ③

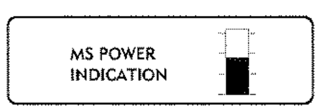
Step 2



Insert a test SIM card of the appropriate size into the phone and switch on. ④ ⑤

If requested, enter the PIN number followed by #.
(PIN No. of Rohde & Schwarz test SIM card: 0000). ⑥

The blinking text indicates that a location update is taking place between the CMD and the mobile phone. ⑦



The vertical bar indicates that the CMD is receiving an RF signal from the mobile phone. ⑧

Additional information

Step 1

① **Manual test**
After selecting Manual Test the CMD changes the display and, after a few seconds, starts to transmit a control channel. In the GSM specifications, this is known as a C0 carrier, containing a Broadcast Channel or BCCH. In this case, the term "control channel" is used for the sake of simplicity, in particular if the user is familiar with testing mobile phones of analog cellular networks.

② **Control Channel**
The control channel is used by GSM to handle the first communication between the base station and the mobile phone. After switching on, the mobile phone searches for the control channel, synchronises to it and decodes the information transmitted.

③ **Changing control channel parameters**
The control channel is transmitted by the CMD on the RF channel and with the power indicated at the top right of the display. These parameters can be changed by pressing the "BS SIGNAL" softkey and entering the new parameters. For example press "RF CHAN", enter a new channel number on the numerical keypad and press the ENTER key. Pressing of the MENU UP key permits to return to the initial menu again.

Step 2

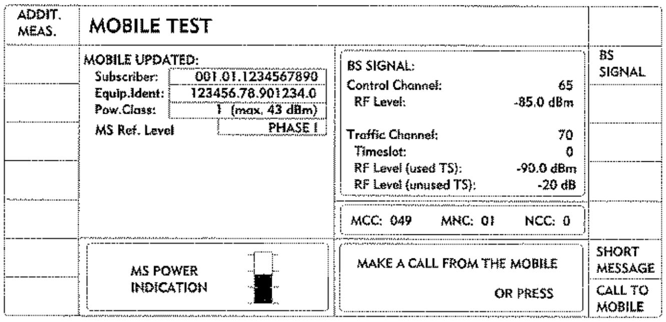
④ **SIM card**
Two types of SIM card are specified for use in the GSM system, one the size of a credit card and the considerably smaller plug-in SIM of about 15 x 20 mm. One SIM card must be inserted in the mobile phone in order to set up a call. However, it is also possible to make an emergency call without any card by entering 112.

⑤ **TEST SIM card**
Most mobile phones require a so-called test SIM card in order to test the sensitivity (BER, Bit Error Rate) in a test mode. A test SIM card is available from Rohde & Schwarz with the designation CRT-Z2 (ident no. 1039.9005.02). It features credit card size and can be easily converted to "plug-in" format.

⑥ **PIN number**
Be very careful when entering the PIN number as only three false tries are allowed before the card is automatically blocked. It can be unblocked by entering the PUK number which is either known or can be obtained from the company that issued the card. See also the appropriate section in the operating manual of your mobile phone.

⑦ **Location update**
The information transmitted by the CMD on the control channel requests the mobile phone to perform a location update procedure after switching-on. This is similar to a registration procedure in analog networks and serves to inform the base station that a certain mobile has been switched on now and is available for calls. If the mobile phone is already switched on and updated, it will indicate "Service" and wait. In this case, either switch off the mobile phone or continue a call setup. The CMD will react accordingly.

⑧ **Analog RF power indicator**
The analog bar in the CMD display indicates whether the CMD is receiving RF power of the mobile phone. The indicator features a fast response time and a hold function so that even short pulses are detected reliably and indicated. This is particularly useful if the mobile phone does not perform a location update or a call setup. In this case, it is possible to determine immediately whether the mobile is transmitting or not; e.g. there may be a problem in signalling or in the modulation.



As soon as a location update has been completed successfully, the display will automatically change to the next menu level.
①

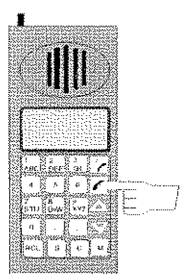
MOBILE UPDATED:

Subscriber:	001.01.1234567890
Equip.Id:	123456.78.901234.0
Pow.Class:	1 (max. 43 dBm)

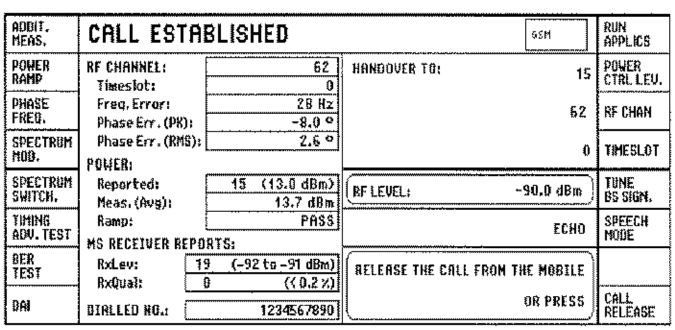
Information on the mobile phone is displayed to the left of the display.
②③④

Step 3

It is now possible to call the mobile phone by pressing the appropriate key.⑤⑥



Alternatively, a call can be set up from the mobile phone. The CMD will react accordingly.
⑤⑥



In both cases, the display will change to the next menu.

Additional information

① **Location update not successful**
If the mobile does not attempt to perform a location update, it is possible that the network simulated by the CMD does not correspond to that searched for by the mobile phone according to the SIM card used. In this case, the parameters can be matched.

Changing the CMD network parameters
By pressing the NETWORK softkey, the "Mobile Country Code" (MCC) and the "Mobile Network Code" (MNC) transmitted by the CMD on the control channel can be changed. To enter the value for Germany, e.g., select "MCC", enter 262 on the numerical keypad and press ENTER. The MENU UP key permits to return to the initial menu. When using the Rohde & Schwarz test SIM card, enter MCC = 1 and MNC = 1.

Network selection in the mobile phone
It is also possible that the mobile phone automatically accepts all MCC and MNC codes transmitted, irrespective of the SIM card (automatic network selection). However, manual selection is also possible. To this end, the mobile phone displays a list of all available networks and waits to be instructed which to use. The procedure used varies from mobile to mobile. Please read the appropriate section of the operating manual for more details.

② **Subscriber number**
The international subscriber number or IMSI (International Mobile Subscriber Identity) is read from the SIM card. It consists of three fields:

- A three-digit Mobile Country Code (MCC) used to indicate the "HOME" country of the card.
- A two-digit Mobile Network Code (MNC) used to indicate the "HOME" network.
- The Mobile Subscriber Identification Number (MSIN), which may be up to ten digits long, used to clearly identify a subscriber within a network.
  The values for the Rohde & Schwarz test SIM card are: 001 01 0000000001.

③ **Equipment Id.**
The Equipment Id. or IMEI (International Mobile Equipment Identity) is stored in the mobile hardware. It consists of four fields.

- Type Approval Code (TAC), six digits, allocated by type approval authorities.
- Final Assembly Code (FAC), two digits, identifies the manufacturer.
- Serial Number (SNR), six digits, unique number within TAC and FAC.
- Spare (SP), one digit, not yet used.

④ **Mobile power class**
All mobile phones belong to a particular power class which indicates the maximum output power of the mobile:

Power class 1 = 43 dBm	Power class 2 = 39 dBm	Power class 3 = 37 dBm
Power class 4 = 33 dBm	Power class 5 = 29 dBm	

Step 3

⑤ **Changing traffic channel parameters**
A call is set up on a traffic channel. The RF channel and the transmitter level of the CMD can be seen on the right; these values can be changed. For example, select "BS SIGNAL" and "TIMESLOT", enter the digit 7 and press ENTER to change the timeslot to 7.

⑥ **Used and Unused Time Slot Levels**
The levels of the used and unused timeslots can be set separately in order that base stations can be simulated with constant or different output levels. In the GSM test "Adjacent Timeslot Rejection", the adjacent time slot level is set to a higher value than the used time slot level in order to test whether the mobile receiver can adapt quickly to fast level changes.

2.1.3 Manual Tests: Transmitter Measurements (incl. Measurements with Option CMD-B4)

Step 1

RF CHANNEL:	70
Timeslot:	0
Freq. Error:	-47 Hz
Phase Err. (PK):	11.6°
Phase Err. (RMS):	3.2°

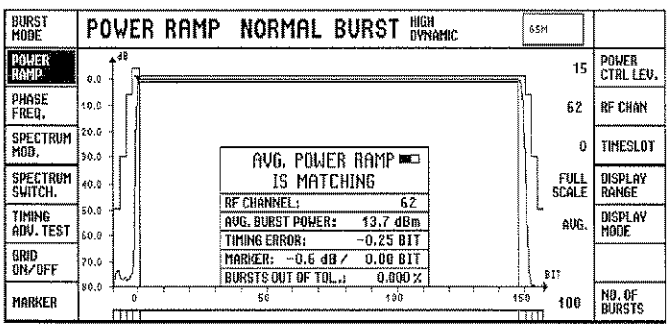
The currently set RF channel and the timeslot used are displayed together with measurements of the transmitter frequency and phase error. ①

RF CHANNEL:	70
Timeslot:	0
Freq. Error:	-130 Hz
Phase Err. (PK):	11.6°
Phase Err. (RMS):	3.2°

If any measurements are out of tolerance they are displayed with inverse video. ②

POWER:	
Reported:	15 (13 .0 dBm)
Meas. (Avg):	13.8 dBm
Ramp:	OK

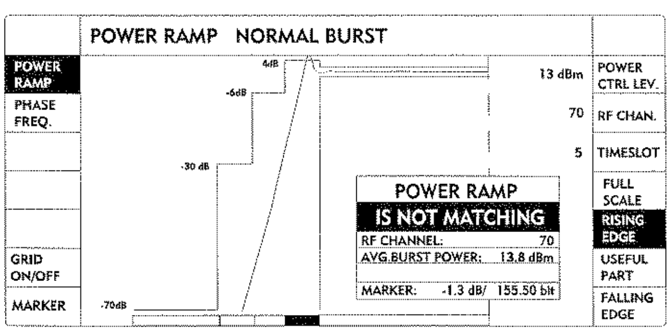
The power reported by the mobile phone and that measured by the CMD are displayed together with a power ramp pass/fail indication. ③



Press the softkey

POWER RAMP

The RF burst of the mobile phone is indicated graphically. ④



Using the three softkeys at the bottom right of the display, parts of the curve may be expanded (zoom).

If the ramp is out of tolerance, the faulty section is highlighted at the bottom of the display. ⑤

Additional information

Step 1

① **Frequency and phase error**
GSM mobile phones must synchronise themselves to the frequency of the base station. The CMD therefore measures the frequency error (frequency offset) and not the absolute transmitter frequency. The phase error is calculated by comparing the expected phase of the RF signal (calculated from the decoded bits) with the phase measured by the CMD. Two values are defined in GSM: the absolute maximum (peak) error in a burst and the average (RMS) error in a burst.

② **Tolerances**
The tolerances may be changed by pressing the "CONFIG" hardkey, followed by the "PHASE FREQ" softkey. Tthis sub-menu also permits to specify that the measurement shall be stopped if any values are out of tolerance (see Step 2).

③ **Power level**
GSM900 mobiles transmit one of 16 power levels; they are in 2-dB steps as follows:

Power level 0	43 dBm
Power level 1	41 dBm
...	...
...	...
Power level 15	13 dBm

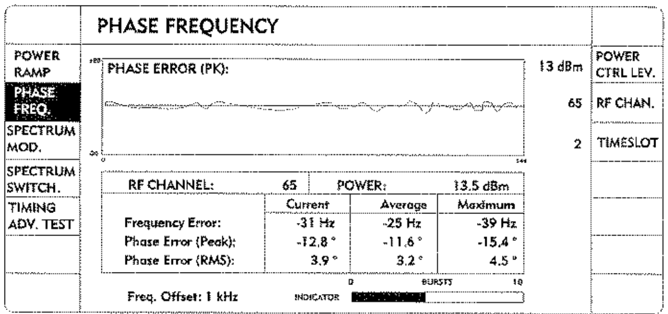
GSM1800/1900 mobiles transmit using one of 14 defined power levels. They are in 2-dB steps as follows:

Power level 0	30 dBm
Power level 1	28 dBm
...	...
...	...
Power level 13	4 dBm

④ **Power Ramp**
The power ramp is displayed with a dynamic range of approximately 75dB (40dB if the CMD-B42 option is not fitted).

Please note that it is possible for the average power to be out of tolerance whilst the power ramp is in tolerance, and vice-versa. This may occur as the power ramp, according to GSM specifications, is not calculated with absolute values but based on the variations of the average power.

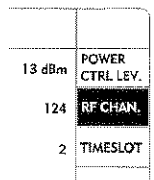
⑤ **Power ramp tolerances**
The tolerance values correspond to the values defined in the GSM specifications and can be seen in detail by pressing the "CONFIG" hardkey followed by the "POWER RAMP" softkey (see Step 2).



Press the softkey

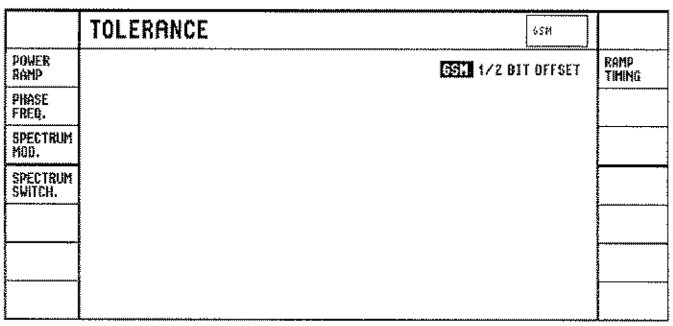
PHASE FREQ.

Additional information relating to this measurement is displayed. ①



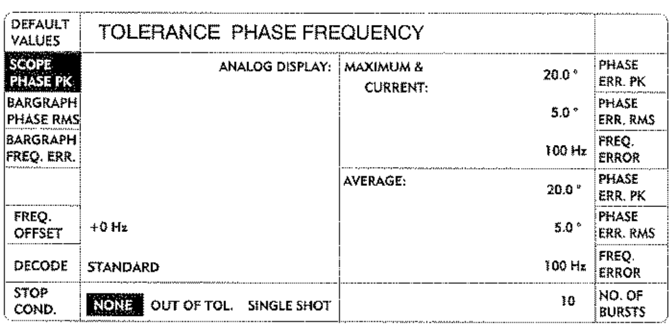
The mobile power level, RF channel and timeslot may be changed at any time. Simply press the relevant softkey, enter a number and press the "ENTER" hardkey.

The opposite example shows the RF channel change. ②



Step 2

The measurement tolerances may be changed by pressing the CONFIG hardkey, followed by the relevant softkey. ③④



The tolerances may now be changed as desired or reset to those specified by GSM by pressing the softkey

DEFAULT VALUES

③④

MENU UP

Press the MENU UP key to change to the previous menu.

Additional information

① **Maximum and average values**
This menu displays the current, average and maximum phase and frequency error for a given number of bursts. This number can be set in the configuration menu of phase and frequency error measurement. It is possible to choose between scope display for the phase error and bargraph, which facilitates adjustment of the phase error if the transmitter requires servicing.

② **Error messages**
Only values defined in the specifications are allowed. If an invalid number is input, an error message indicates in clear text how to proceed.

Step 2

③ **Measurement modes**
In the configuration menus it is also possible to define the measurement mode:

- *Continuous*
  The measurement is continued regardless of whether or not it is in tolerance.
- *Stop*
  Stop whenever a measurement is out of tolerance.
- *Single shot*
  The measurement is repeated once when the softkey POWER RAMP or PHASE FREQ. is pressed.

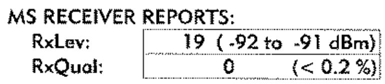
④ **Out-of-tolerance power measurements**
If a power measurement is out of tolerance, please ensure that the attenuation of any cables and/or antenna coupler used is being taken into account by the CMD. As some GSM power levels must be within +/-2dB of the nominal value given in the specifications, even a small attenuation can result in an out-of-tolerance measurement.
External attenuation values for each input/output may be entered in the CONNECTOR EXTERNAL ATTENUATOR configuration menu. This menu may be accessed either via the main CONFIG menu or from the MANUAL TEST menu.

Please note that any attenuation values entered are also used by the autotest.

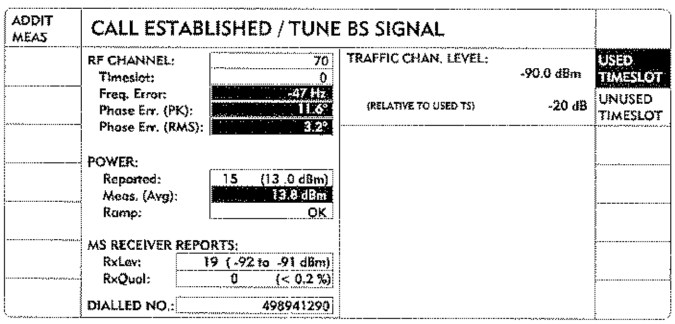
The cables, RF connections and antenna couplers must also be in good condition for satisfactory measurements. Dirty or broken RF connections can easily cause problems, especially at the high frequencies used by GSM networks.

2.1.4 Manual Tests: Receiver Measurements (incl. Option CMD-B4)

Step 1



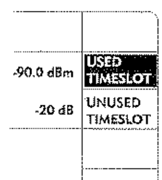
The RxLev and RxQual values measured by the mobile phone and reported to the CMD are displayed and continuously updated. ①



Press the softkey

TUNE BS SIGN.

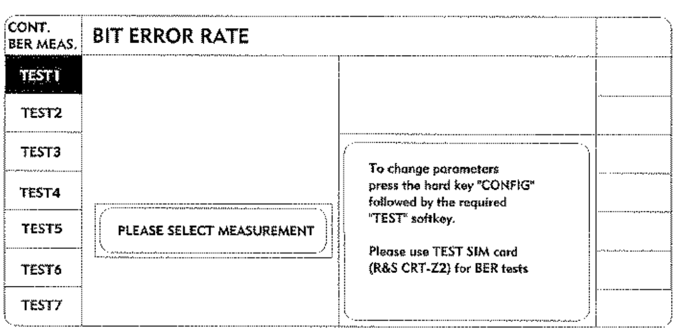
You can now change the transmitter level of the CMD by entering a number and subsequently pressing the ENTER key. ②



The level of both used and unused timeslots can be entered separately. ③

Press the MENU UP key to return to the previous menu.

Step 2



Press the softkey

BER TEST

Bit error rate tests can now be performed. ④

Additional information

Step 1

① **RxLev and RxQual**
GSM mobiles continuously measure the signal strength and quality of several nearby base stations. The measured values are regularly transmitted to the base station in so-called "measurement reports". The most important values are those relating to the base station being used for the call and these are continuously displayed and updated by the CMD.

The values can be interpreted as follows:

RXLev value	Received signal strength
63	greater than -48 dBm
62	-49 dBm to -48 dBm
61	-48 dBm to -47 dBm
...	...
...	...
02	-109 dBm to -108 dBm
01	-110 dBm to -109 dBm
0	smaller than 110 dBm

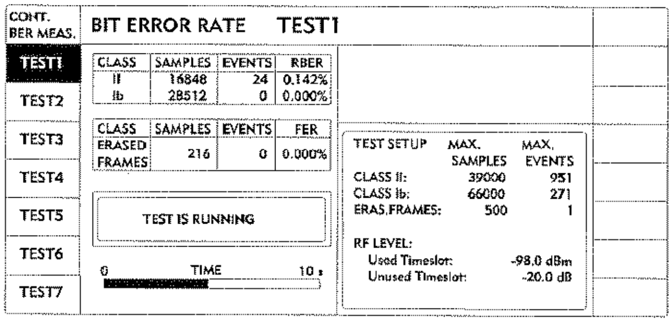
RXQual value	Received signal quality
0	BER < 0.2%
1	0.2% < BER < 0.4%
2	0.4% < BER < 0.8%
3	0.8% < BER < 1.6%
4	1.6% < BER < 3.2%
5	3.2% < BER < 6.4%
6	6.4% < BER < 12.8%
7	12.8% < BER

② **CMD output level**
By changing the CMD output level whilst monitoring the RxLev and RxQual values a quick check of the mobile phone receiver can be made.

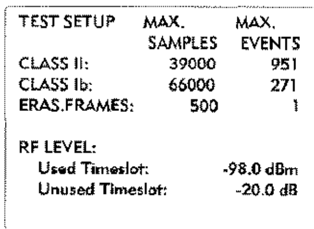
③ **Used/unused timeslot)**
This is useful for certain tests specified by GSM. In one test, for example, the level of the signal in the unused timeslots is set higher than that in the used timeslot in order to test automatic level matching of the mobile receiver.

Step 2

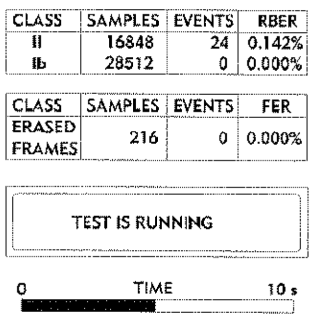
④ **Test SIM Card**
Most, but not all, mobiles require a test SIM card to be used before bit error rate tests can be performed. The test SIM card enables the mobile phone to enter loopback mode when commanded to do so by the CMD. In this mode, bits sent by the CMD to the mobile are looped back in the mobile and retransmitted. The CMD is then able to compare the bits received with those sent and can thus determine the percentage of faulty to correct bits.



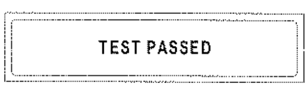
Each of the TEST softkeys is preprogrammed and a test may be run simply by pressing the appropriate key. ①



The test parameters and tolerances are presented on the right of the display. ②③



Whilst a test is running the status of the test is continuously updated. ②③



oder

At the end of the test the result is clearly shown. ④⑤

Additional information

① **Default values**
The default values have been chosen as shorter versions of those found in GSM specification 11.10 (which need up to one hour to run). The levels used correspond to those specified for the different classes of mobile phones i.e.:

-104 dBm for GSM900 mobile phones
-102 dBm for GSM900 portable phones
-100 dBm for GSM1800/1900 portable phones

② **Bit classes**
The speech bits transmitted within GSM systems are separated into classes. Class II bits have no error protection and therefore produce errors relatively easily. Class Ib bits have a certain amount of protection and Class 1a bits are very well protected. The bits are transmitted in speech frames of 260 bits (without error protection bits).The mobile phone itself can recognise errors in Class Ia bits and upon doing so signals the CMD that a complete frame is in error. The percentage of false frames to good frames is known as the "frame erasure rate" or FER.

③ **Samples and Events**
A given test is to send a certain number of frames containing a certain number of bits of the various classes. These are the "samples" to be sent.
It is then acceptable, at a certain (low) RF level, to receive a given number of frames or bits in error. These are the "events" which can be tolerated.
At any time during or at the end of a test, the percentage error (BER) (events/samples x 100) is also displayed.

④ **Test Result**
As the details of a BER test can be quite complicated the actual pass/fail result is clearly indicated. If required the test may be repeated simply by pressing the relevant TEST softkey.

⑤ **Failed BER Test**
If a BER test fails check the following:

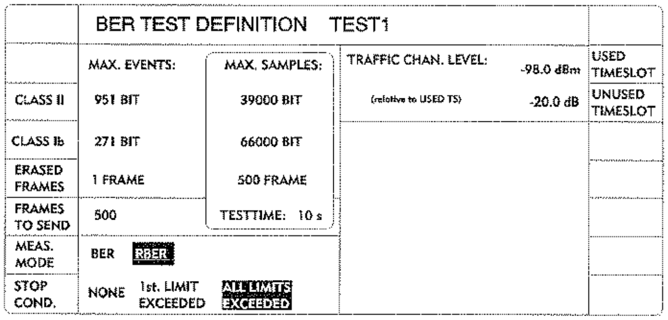
1. Ensure that the attenuation of any antenna coupler and/or cables used is being taken into account by the CMD. External attenuations for each input/output may be entered in the CONNECTOR/EXTERNAL ATTENUATION configuration menu. This menu can be accessed either from the main configuration menu or from the MANUAL TEST menu.

   During the test the mobile receiver is being tested with very low RF signal levels, and even a small attenuation can cause the CMD to show a fail indication.

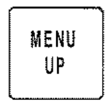
   The cables, RF connection and antenna coupler (if used) must also be in good condition. Dirty or broken RF connections can easily cause problems, especially at the high frequencies used by GSM networks.

   Please note that the above attenuation values are also used in the autotest.

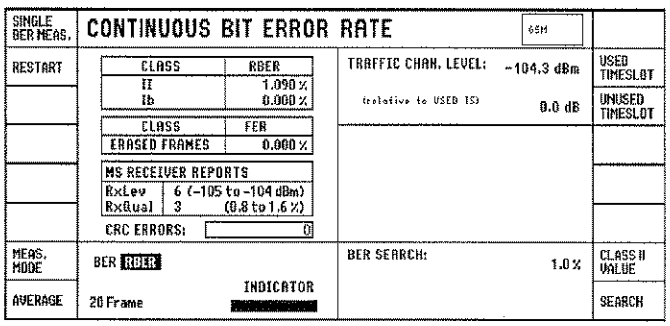
2. It may be that interference is being received by the mobile phone on or near the channel being used for the BER test. Tests have shown that signals from real networks, whatever type of modulation they use (or even if the signal has no modulation) can cause interference problems. The external signals may interfere with the signal sent from the CMD to the mobile, in particular during BER tests where the output level of the CMD is reduced to as low as -104 dBm. The BER test should ideally be performed in a shielded room, however, if this is not possible, the channel(s) used for the test should be changed. If different results are obtained on neighbouring channels, the problem is likely to be due to external interference.



Press the CONFIG hardkey followed by one of the TEST softkeys. The test configuration can then be changed. ①



Press the MENU UP key. A change is made to the previous menu.



Step 3

Press the softkey

CONT. BER MEAS.

to enter a further BER menu.

CLASS	RBER
II	0.705%
Ib	0.000%

CLASS	FER
ERASED FRAMES	0.000%

MS RECEIVER REPORTS		
RxLev	8	(-103 to -102 dBm)
RxQual	2	(0.4 to 0.8 %)

In this menu it is possible to vary the CMD signal level whilst continually measuring the BER, FER, RxLev and RxQual. ②

Press the MENU UP key again to change to the previous menu.

Additional information

① **BER test configuration**
By entering the number of frames to be sent, the number of samples and the test duration are automatically displayed.

The stop condition may also be specified in order, for example, to stop a test after the first tolerance limit has been exceeded. Thus, the test is kept to the shortest possible duration.

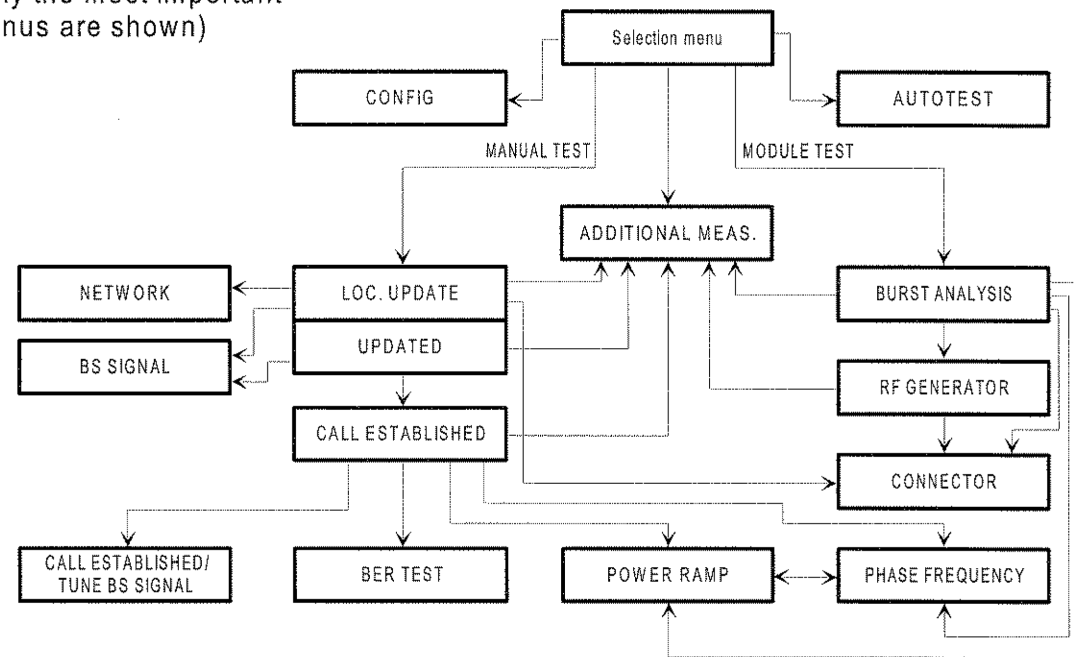
Step 3

② **Continuous BER**
This method is useful during fault finding where an exact BER test is less important than the ability to vary the CMD output level whilst continuously measuring the receiver BER.

A comparison may also be made between the BER measured by the CMD and that reported by the mobile (RxQual).

2.2 Menu Structure

(only the most important menus are shown)



2.3 Basic Steps of Operation

Numerical entry (VAR spinwheel permissible)

With the softkey displayed on bright background, no entry is possible. Pressing of the softkey causes the softkey to be displayed on dark background and a small VAR symbol to appear, indicating that the VAR spinwheel can be used.

1) Rotation of the VAR spinwheel directly increases or reduces the setting value.

2) Pressing the first numerical key causes an input window to be opened, which already displays the first digit. The small VAR symbol is masked, the spinwheel variation can no longer be used. Then further digits can be entered. BACKSPACE deletes the last digit, CLEAR is used to clear the complete entry, STOP BREAK causes the input window to be closed without recording the value. Terminating the entry with ENTER or a unit key causes the desired value to be set, the input window to be closed and leaves a softkey labelled in inverted form and featuring the VAR symbol. Spinwheel variation is now possible again. Press any other softkey or the ENTER key or the same softkey to render this softkey inactive, which is shown by the softkey being displayed on bright background.

3) Units:

a) The entry of numerical values can be terminated by pressing the unit key.
$\boxed{1}$ $\boxed{5}$ $\boxed{\text{dBm}}$ $\Rightarrow$ 15 dBm

b) When using the ENTER key, the currently provided unit is used again.
$\boxed{1}$ $\boxed{7}$ $\boxed{\text{ENTER}}$ $\Rightarrow$ 17 dBm

c) For parameters without units, e.g. "power levels", there are no specific unit keys. Either the ENTER key or a forbidden unit key can be used to terminate the entry.

[1] [4] [Hz or kHz or MHz] ⇒ Power level 14

forbidden unit keys

[1] [5] [ENTER] ⇒ Power level 15

d) Conversion of units is accomplished by pressing the respective (forbidden) unit key.

Power level 15	[dBm]	⇒ 13 dBm
13 dBm	[Hz]	⇒ Power level 15
5000 Hz	[kHz]	⇒ 5.000 kHz

1 out of n selection with softkeys

n Softkeys describe n different operating modes.
One of the n possibilities is always active, marked by inverse display.

Loop Toggle

Two (or several) operating states are faded in next to a softkey. The softkey being active is marked by inverse display. Changing of the operating state is effected by (repeated) pressing of the softkey.

Selection with confirmation

After activating the softkey, the variation spinwheel can be used to select all possible settings. The setting is activated by confirmation using the ENTER key.

Input of alphanumeric characters without external AT keyboard

After opening an input window proceed as follows:

Positioning the cursor:

Hardkey [LOCAL] to the right

Hardkey [START] to the left

Variation of the alphanumeric character:

Rotating the VAR spinwheel

The entry is terminated using the [ENTER] key.

Hardkeys

[CONFIG]

In addition to the measurement menus, a number of configuration menus are provided, which permit to specify and vary parameters for measurements as well as default settings. These configuration menus can be selected directly via the "CONFIG menu tree" on the one hand; on the other hand, it is possible to press the CONFIG key in a measurement menu and subsequently press a softkey to call the configuration menus associated with this measurement menu.

[MENU UP]

This key permits to change to the next higher menu. For example, it is thus possible to leave configuration menus or partial submenus.

[MENU HOME]

This key permits to return directly to the selection menu.

[HARD COPY]

Print mode

After pressing the HARD COPY key, the current screen display is output to a connected printer. As the printout is made in graphics mode, it is necessary to call the printer configuration menu in the configuration menu using the PRINTER softkey in order to select the appropriate printer driver there.

RESET

After pressing the RESET key, the menu shown in Fig. 2.3-1 is called up.

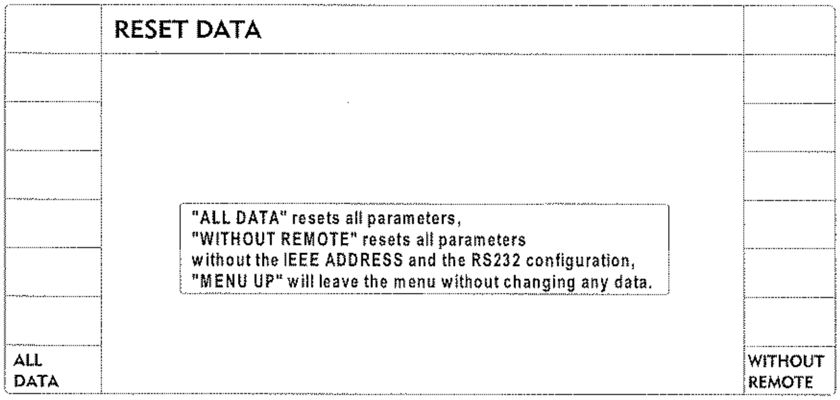


Fig. 2.3-1 RESET DATA menu

The functions offered in this menu permit the user to set the CMD to a defined default status specified by Rohde & Schwarz.

ALL DATA	All device-internal parameters including the remote-control registers are reset.
WITHOUT REMOTE	All device-internal parameters, except the remote-control registers and the selected printer driver, are reset. This function is to be used preferably in remote-control mode so that the remote-control connection is not interrupted.

If no reset is to be performed, the menu can be left using the keys MENU HOME or MENU UP.

After the two reset functions have been performed, the Home menu is entered.

User selection

After pressing the USER key, the menu shown in Fig.2.3-2 is called up.

	USER		
USER 1	MUSTERMANN	MUSTERFRAU	USER 8
USER 2	MUELLER	MY DATA	USER 9
USER 3	MAYER		USER 10
USER 4	SCHMIDT		USER 11
USER 5	UNKNOWN		USER 12
USER 6	NOT KNOWN		USER 13
USER 7	NOBODY		USER 14

Fig. 2.3-2 USER menu

The SAVE/RECALL functions in the CMD can be utilized by several users (max. 14) independently of each other. Every user may save his own settings under his own names on his own directory.

This user directory is selected by pressing one of the softkeys in the USER menu. The menu can be left using the keys MENU UP or MENU HOME.

The user name is entered in a separate configuration menu (see Fig. 2.3-3). This is possible from the USER menu (Fig. 2.3-2) by pressing the CONFIG key..

	CONFIGURATION		
USER 1	MUSTERMANN	MUSTERFRAU	USER 8
USER 2	MUELLER	MY DATA	USER 9
USER 3	MAYER		USER 10
USER 4	SCHMIDT MUELLER		USER 11
USER 5	UNKNOWN		USER 12
USER 6	NOT KNOWN		USER 13
USER 7	NOBODY		USER 14

Fig. 2.3-3 CONFIGURATION menu

After activating the associated softkey, the user name can be entered numerically via the keypad and confirmed using the ENTER key. If an external AT keyboard is connected (instrument rear) or by means of variation as described on page 2.19, the entry can also be made alphanumerically.

The MENU UP key permits to return to the USER menu (Fig. 2.3-2).

SAVE/RECALL function

This function permits to save instrument setups like eg configurable BER tests, RF generator settings or tolerance values. This instrument setup can be recalled at a later point in time.

SAVE

By pressing the SAVE key, the menu shown in Fig. 2.3-4 is called up.

	SAVE USER 4 SCHMIDT		
1	FILE_XYZ	FREE	8
2	SETTING 1	FREE	9
3	FREE		10
4	FREE	FREE	11
5	FREE	FREE	12
6	SETTING 5	SPECIAL	13
7	FREE	MEMCARD INTERN	MEMORY

Fig. 2.3-4 SAVE menu

MEMORY

If "INTERN" is selected, the settings are saved on the CMD-internal hard disk. This is done separately for the different user directories. The currently set USER is indicated in the upper status line.

If "MEMCARD" is selected, the instrument setup is saved on a memory card (only with Option CMD-B6 and CMD-B62). Saving is card-specific and independent of the user selected (USER).

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to

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By pressing one of these softkeys, the current instrument setup is saved under the name indicated opposite to the softkey. The name can be entered in a configuration menu (see Fig. 2.3-5).

The menu can be left using the keys MENU UP or MENU HOME.

After pressing the CONFIG key in the SAVE menu (Fig. 2.3-4), the configuration menu for entering the memory name is called up (see Fig. 2.3-5).

	CONFIGURATION		
1	FILE_XYZ	FREE	8
2	SETTING 1	FREE	9
3	FREE		10
4	FREE Test 13.11 - 13.12	FREE	11
5	FREE	FREE	12
6	SETTING 5	SPECIAL	13
7	FREE		

Fig. 2.3-5 CONFIGURATION menu

The name of the memory location can be entered numerically via the keypad and confirmed using the ENTER key after activating the associated softkey. If an external AT keyboard is connected (rear of instrument) or by means of variation as described on page 2.19, the entry can also be made alphanumerically.

Hinweis:
If setups are saved on the memory card, the configured name is also written on the memory card.

To return to the SAVE menu (Fig. 2.3-4) press the MENU UP key.

After pressing the RECALL key, the menu shown in Fig. 2.3-6 appears.

DEFAULT VALUES	RECALL USER 4 SCHMIDT		
1	FILE_XYZ	FREE	8
2	SETTING 1	FREE	9
3	FREE		10
4	FREE	FREE	11
5	FREE	FREE	12
6	SETTING 5	SPECIAL	13
7	FREE	MEMCARD INTERN	MEMORY

Fig. 2.3-6 RECALL menu

MEMORY

If "INTERN" is selected, the setups are loaded from the CMD-internal hard disk. This is done separately for the different user directories. The currently set USER is indicated in the upper status line.

If "MEMCARD" is selected, the instrument setup is loaded from a memory card (only with Option CMD-B6 and CMD-B62). Loading is card-specific and independent of the user selected (USER).

Note:
Reading of the memory card is started when the menu is entered. To make sure that the file name and the file data correspond to each other, leave the menu and call it up again when the card is changed.

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By pressing one of these softkeys, the instrument setup saved under the name indicated opposite to the softkey is loaded. The instrument then uses the setting values and tolerance values that have been saved under this name.

The menu can be left using the keys MENU UP or MENU HOME.

2.4 Description of the Menus

After switching on of the instrument, the selection menu is displayed. After selecting the operating mode, the main topics for measurements provided by the instrument can be selected.

2.4.1 Selection Menu

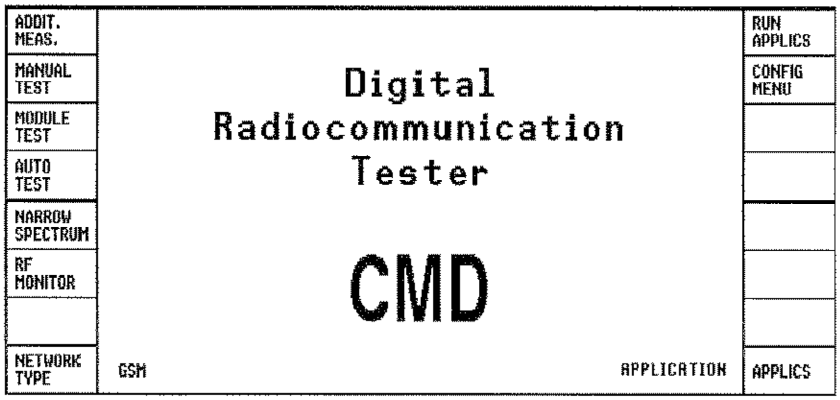


Fig. 2.4-1 Selection menu

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

MANUAL TEST

Selection of the MOBILE TEST menu. In this menu, the GSM mobile phone test is started (manual operation). The CMD simulates a base station (full signalling), (see section 2.4.2).

MODULE TEST

This main menu permits to perform measurements on modules and measurements on GSM mobile phones in service mode (see section 2.4.5).

AUTO TEST

Selection of the AUTO TEST menu. Automatically running measurements on GSM mobile phones can be performed here (see section 2.4.7).

NARROW SPECTRUM

Selection of the NARROW SPECTRUM menu. This menu permits RF signals to be analyzed by means of a narrowband spectrum analyzer (only with option CMD-K43). This may for instance be used for the adjustment of I/Q modulators (see section 2.4.8).

RF MONITOR

(only with Option CMD-B4)

Change to the RF MONITOR menu (see section 2.4.9).

NETWORK TYPE

(only for model 55)

Switchover between GSM900 and GSM1800.

With the Option CMD-B19 installed, it is also possible to switch to GSM1900.

The switchover is effected by softkey activation, spinwheel selection and final confirmation using the ENTER key. The mode presently selected is indicated in the menu heading.

In the case of dual or multimode devices, it is also possible to select DECT.

Specifications of GSM900, GSM1800 and GSM1900

	GSM900	GSM1800	GSM1900
Frequency range MS ⇒ BS Frequency range BS ⇒ MS	890 to 915 MHz 935 to 960 MHz	1710 to 1785 MHz 1805 to 1880 MHz	1850 to 1910 MHz 1930 to 1990 MHz
Duplex spacing	45 MHz	95 MHz	80 MHz
Channels	1 to 124	512 to 885	512 to 810
Channel spacing	200 kHz	200 kHz	200 kHz

RUN APPLICS

Start of or change to an application program
(this requires at least 8 Mbyte memory).

CONFIG MENU

Selection of the configuration menus (see section 2.4.6.1).

APPLICS

The spinwheel can be used to select an application program stored on the CMD.

Application programs can be copied to the CMD using the PC program FTRANS. FTRANS is supplied with every application and is described there.

2.4.2 Manual Test

2.4.2.1 MOBILE TEST Menu (Wait Location Update)

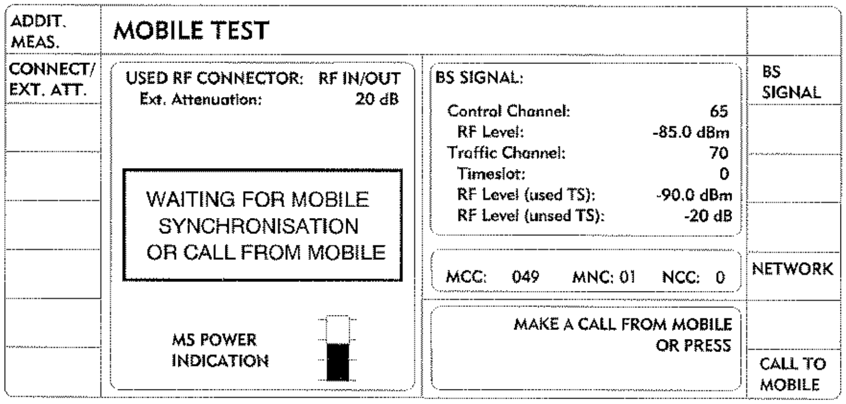


Fig. 2.4-2 MOBILE TEST menu (Wait Location Update)

After selection of the main menu Manual Test, the CMD starts transmission on a control channel and attempts to establish a call to the mobile station. On the left side of the display, the CMD indicates with the blinking text that it is transmitting and waiting for the mobile station to respond. The power indicator below detects any activity of the mobile station and indicates it dynamically in the display. At the top right of the display, the CMD indicates the frequency channel number of the current control channel and that of the voice channel, the major parameters contained being indicated below.

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

CONNECT/ EXT. ATT.

Using this softkey, a configuration menu can be entered which permits to select the RF inputs and outputs of the CMD. If external attenuator pads are used or the test setup includes a path attenuation, attenuation values can be entered in this menu (see section 2.4.6.8).

BS SIGNAL

This softkey permits to enter a configuration menu where the physical parameters of the base station signal can be defined. This includes frequencies and levels of the common control channel and the traffic channel. In the case of the traffic channel, the level of the unused timeslot can be selected in addition to the level of the used timeslot (see section 2.4.6.7).

NETWORK

- Input of the network parameters:
    - MCC (Mobile Country Code)
    - MNC (Mobile Network Code)
    - NCC (National Colour Code)
    - BA LIST (neighbouring cells)
    - LOC. AREA (Location Area)
- Inputs defining the operating mode of the location update.
- Input of the mobile power used for the location update and the call setup.
- Activating the DTX mode.

(see also section 2.4.6.5).

CALL TO MOBILE

This softkey and the message in the associated field appear only if, in the NETWORK menu, the AUTO mode was selected for the location update. The mobile can be called using the IMSI entered in the NETWORK menu.

2.4.2.2 MOBILE TEST Menu (After Location Update)

After the CMD has established a call to the mobile station by way of a location update of the mobile station, this menu is displayed differently. On the left side of the display, the essential signalling data from the mobile station are displayed. Any time the power indicator recognises an activity of the mobile station, it is indicated on the display. The information field on the right with the physical parameters of the BS signal is supplemented by the physical parameters of the traffic channel. At the bottom right, controls and hints as to the call to be established are displayed.

After pressing the BS SIGNAL softkey (change to BS signal menu), the BCCH is switched off. It is thus possible that some mobiles lose synchronization if you stay in this menu too long.

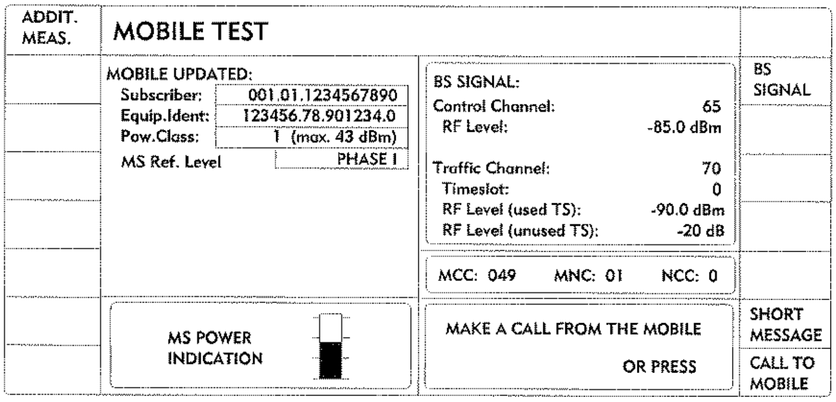


Fig. 2.4-3 MOBILE TEST menu (After Location Update)

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

BS SIGNAL

Using this softkey, a configuration menu can be entered, which permits to define the parameters of the base station signal. This includes frequencies and levels of the common control channel and the traffic channel. In the case of the traffic channel, the level of the unused timeslots can be selected in addition to the level of the used timeslot (see section 2.4.6.7).

SHORT MESSAGE

After pressing this softkey, an alphanumeric message is sent to the mobile, which will then appear on the display of the mobile if this supports SMS (Short Message Service).

Note:
If a message is sent from the mobile to the CMD, a window is opened and the text displayed.

CALL TO MOBILE

Pressing of this softkey causes the CMD to establish a call to the mobile station. However, the CMD is also always prepared to establish a call when the mobile station initiates the call. In this case, the mobile station is served.

Pressing the CONFIG hardkey and then the CALL TO MOBILE softkey provides access to a menu where the DTX mode and mobile power for call setup can be selected (see section 2.4.6.5).

After the call has been established, the CMD enters the CALL ESTABLISHED menu.

2.4.2.3 CALL ESTABLISHED Menu

The CALL ESTABLISHED menu is the central menu in the mobile station test. It displays the most important RF measurement results and signalling parameters received by the mobile station (left half of display). In addition, the results of power ramp, phase and frequency error measurement are indicated (only with Option CMD-B4). For experiments carried out primarily on the receiver of the mobile station, various parameters of the signal sent by the CMD can be varied (softkey TUNE BS SIGN.). Besides, it is possible to vary the traffic channel frequency used, the timeslot used and the transmitter power of the mobile station (softkeys POWER CTRL LEV., RF CHAN, TIMESLOT). By pressing the POWER RAMP softkey, the power ramp measurement is started, pressing of the PHASE FREQUENCY softkey starts the phase and frequency error measurement (only with Option CMD-B4). The transmitter power of the mobile station can be varied by pressing the POWER CTRL LEV softkey. Finally, this menu permits to release the call again (CALL RELEASE softkey).

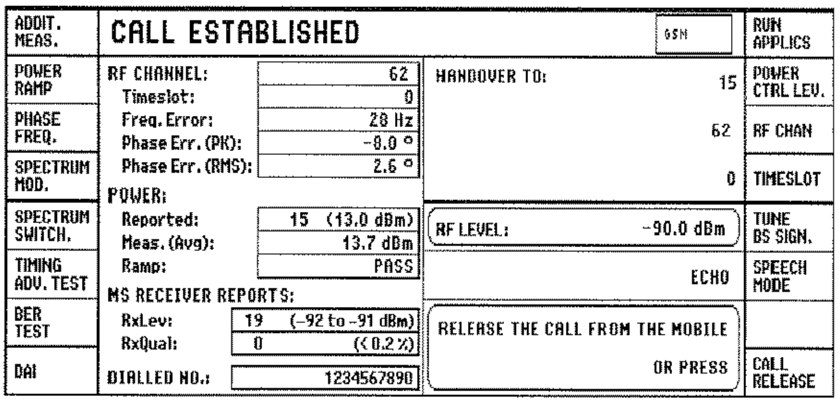


Fig. 2.4-4 CALL ESTABLISHED menu

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

POWER RAMP

(only with Option CMD-B4)

By pressing this softkey, the power ramp measurement is started. The menu changes to the display of measurement results (see section 2.4.3.1).

PHASE FREQ.

(only with Option CMD-B4)

By pressing this softkey, the phase and frequency error measurement is started. The menu changes to the display of measurement results (see section 2.4.3.2).

SPECTRUM MOD.

(only with Options CMD-B4, B42 and B43)

Change to the menu SPECTRUM due to MODULATION (see section 2.4.3.3).

SPECTRUM SWITCH.

(only with Options CMD-B4, B42 and B43)

Change to the menu SPECTRUM due to SWITCHING (see section 2.4.3.3).

TIMING ADV. TEST	*(only with Option CMD-B4)* Pressing of this softkey starts the TIMING ADVANCE measurement. The menu will be changed (see section 2.4.3.4).
BER TEST	*(only with Option CMD-B4)* This softkey permits to select a measurement menu that offers 7 different predefined bit error rate tests. These tests are characterized by statistical test parameters and physical setting parameters of the base station (CMD). Both can be influenced by the user so as to generate different predefined tests which can then be selected and started. It is also possible to select a continuous BER measurement and a BER search routine (see also section 2.4.3.5).
DAI	Change to the menu DAI (see section 2.4.2.3.1).
RUN APPLICS	Start of or change to an application program.
POWER CTRL LEV.	Pressing of this softkey informs the instrument on the transmitter power required by the mobile station. This transmitter power is signalled to the mobile station.
RF CHAN	Pressing of this softkey informs the instrument on a new channel traffic number. This number is signalled to the mobile station and a change to this channel number is effected. Entry of A, B, C or D causes the mobile to change the traffic channel continuously (frequency hopping function). The keys A, B, C or D can be used to select one of four fixed hopping sequences.

Hopping sequences for CMD52/CMD55

GSM900 Sequence A

5	9	16	23	28	30	34	39	44	48
51	54	59	64	69	73	75	79	82	86
89	92	96	98	101	106	109	113	117	121

GSM900 Sequence B

4	12	17	19	23	25	29	33	36	41
45	47	53	61	63					

GSM900 Sequence C

65	68	72	76	79	81	84	88	91	93
98	102	105	112	118					

GSM900 Sequence D

1	62	124

GSM1800 Sequence A

533	559	568	592	604	617	631	642	678	697
722	743	759	796	811	824				

GSM1800 Sequence B

513	518	527	533	541	545	553	562	570	577
585	597								

GSM1800 Sequence C

755	761	773	777	788	796	801	807	816	824
829	833	847							

GSM1800 Sequence D

512	698	885

GSM1900 Sequence A

533	559	568	592	604	617	631	642	678	697
722	743	759	796						

GSM1900 Sequence B

513	518	527	533	541	545	553	562	570	577
585	597								

GSM1900 Sequence C

755	761	773	777	788	796	801	807

GSM1900 Sequence D

512	660	810

UIC Sequence A

2	4	6	8	10	12	14	16	18

UIC Sequence B

1	3	6	7	10

UIC Sequence C

10	11	13	16	17	18	19

UIC Sequence D

3	8	13	18

TIMESLOT

Pressing of this softkey informs the instrument on a new channel traffic number. This number is signalled to the mobile station and a change to this channel number is effected.

TUNE BS SIGNAL

The information field next to this softkey displays the most important setting parameters of the CMD. Pressing of this softkey causes the display on the right to be replaced by operating possibilities for the signal sent by the CMD (used and unused timeslot).

SPEECH MODE

The SPEECH MODE softkey allows the following modulation signals to be set:

ECHO (Default):	echo with a delay of approx. 1 s	
LOOP:	loopback with minimum delay	
PR9:	PSR9-1	pseudo-random sequence
PR11:	PSR11-1	pseudo-random sequence
PR15:	PSR15-1	pseudo-random sequence
PR16:	PSR16-1	pseudo-random sequence
Handset:	(only with option CMD-B5) speech coder/decoder mode (depending on model)	

Note:
When the handset mode is selected, the handset connector is normally used (multifunction connector on the front panel, pin 34 for handset IN, pin 1 for handset OUT). However, with AF option CMD-B41 fitted, it is also possible to connect the voltmeter and/or the AF generator to the speech coder. This is done in the configuration menus for the AF voltmeter and the AF generator. The said connection will be activated only when the ADDIT. MEAS. menu is called during an established call.

CALL RELEASE

Pressing of this softkey causes the CMD to release the call to the mobile station. However, it is prepared at any time to release a call even if this is initiated by the mobile station. In this case, the mobile station is served. After the call has been released, the CMD changes to the previous menu MOBILE TEST, from where a new call can be established.

2.4.2.3.1 DAI Menu

In this menu, the digital audio interface (DAI) can be controlled by means of layer-3 messages provided the mobile in question supports control of the digital audio interface via layer-3 messages. Pressing of the respective softkey sets the DAI to the desired function. The selected softkey briefly flashes. The DAI position of the last layer-3 message is displayed in the center of the screen. After a call has been set up, the DAI of a mobile is always in the NORMAL mode.

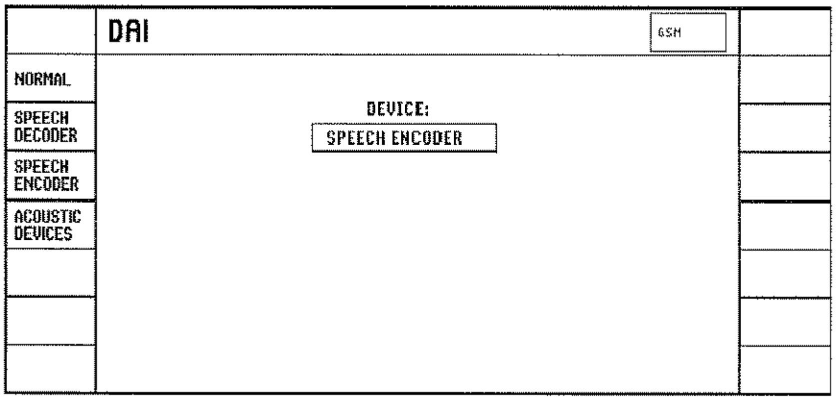


Fig. 2.4-5 DAI menu

2.4.2.4 CALL ESTABLISHED/TUNE BS SIGNAL Menu

The previous menu CALL ESTABLISHED is the starting point for most measurements. The information field next to the TUNE BS SIGN. softkey indicated the most important setting parameters of the CMD. Pressing of this softkey caused the righthand screen display to be replaced by a complete selection of operating possibilities for the signal mixture output by the CMD, which was then displayed in this menu. The used signal is the level of the used timeslot and that of the unused timeslots.

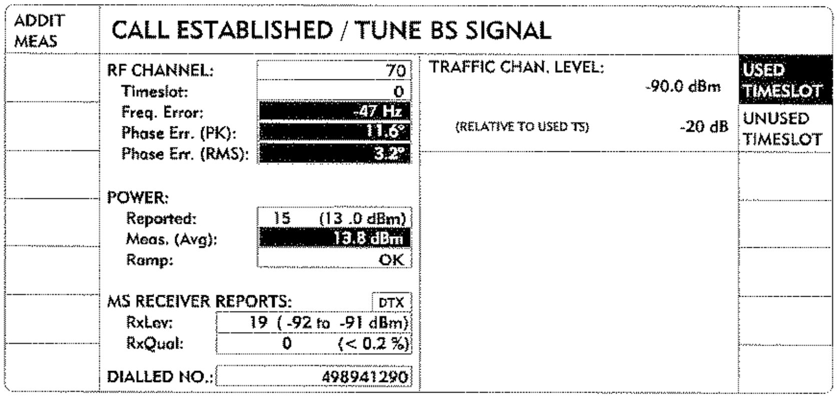


Fig. 2.4-6 CALL ESTABLISHED/TUNE BS SIGNAL menu

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

USED TIMESLOT

Communication between CMD and mobile station is effected on one of the 8 timeslots. (CALL ESTABLISHED menu; TIMESLOT softkey). Using this softkey the RF level of the CMD in the used timeslot is set to its absolute value.

When changing measurement parameters using the USED TIMESLOT softkey, these modifications are displayed on the left side of the screen. The mobile station measures the signal sent by the CMD and outputs the results in a test report which is displayed on the left in the field MS RECEIVER REPORTS.

UNUSED TIMESLOT

This softkey is used to set a uniform level for the remaining timeslots. It is a relative level and refers to the level of the used timeslot. The unused timeslot level can be switched off with the CLEAR/OFF hardkey and then switched on again with ENTER/ON.

MENU UP permits to return to the main menu CALL ESTABLISHED.

2.4.3 GSM Measurements

2.4.3.1 POWER RAMP Menu (only with Option CMD-B4)

For entering tolerances, a configuration menu is provided (see section 2.4.6.3.1).

The initial menu for measurements is the menu CALL ESTABLISHED or BURST ANALYSIS (module test).
Here, the power ramp is represented as a function of time.

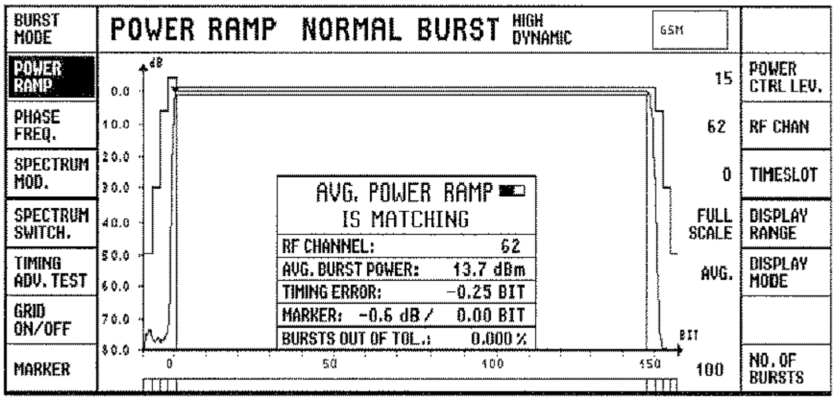


Fig. 2.4-7 POWER RAMP menu

The display in this measurement menu consists of the following items:

- Tolerance mask. The graphically displayed tolerance mask must not be exceeded by the measurement curve. The position of the tolerance mask in the direction of the power coordinate can be changed in the configuration menu.
- Reference line: It runs through the center of the horizontal center part of the tolerance mask (useful part). The average value of maximal power and minimal power during the "useful part" in the burst results in the reference line, wheras with "BURST POWER" in the text part the average is taken from all measured values during the useful part of the burst. Thus both measured values are usually similar, but not necessarily equal.
- Text part. Indicates the frequency channel on which the measurement was made as well as the value for BURST POWER. In addition, the time (measured with a resolution 0.25 bit) by which the mobile replies too late (positive) or too early (negative) is indicated (timing error) in the manual test.
- Overall judgement. Unless all tolerances are observed, the message "POWER RAMP IS NOT MATCHING" is displayed. The tolerance limits are exceeded if the tolerance mask is exceeded or fallen below by the measurement curve or if the timing of the entire measurement curve is not observed. To this end, the transferred data contents is demodulated from the measured values and the training sequence (midamble) searched for. The measurement curve is then matched into the tolerance mask referred to the middle of the training sequence (bit 13/14) and checked for exceeding of the tolerance. 4 measured values are recorded for every data bit and evaluated. This corresponds to a sampling rate of approx. 1 MHz. Below the measurement curve, the segments in which the tolerance has been exceeded are marked (see also configuration tolerance mask).
- Title line. With Option CMD-B42 fitted, the power ramp is measured with a high dynamic range (>72 dB). The message „HIGH DYNAMIC“ is displayed. The tolerance limits of the power time template are changed then.

Averaging:
The power ramp versus time can be measured and averaged during several bursts. Each of the ¼ bit measurement results forming the measurement curve is averaged with the measurement results of the previous bursts. Depending on the display mode, the maximum, minimum or averaged ¼ bit results of this calculation are displayed in a curve.

Any averaging calculations (incl. MIN/MAX HOLD) refer to the curve already normalized with respect to time and average absolute power (ie the curve that can be seen on the display with averaging switched off).

Tolerance analysis:
The number of bursts that were out of tolerance during the averaging period (in %, referred to the total number of weighted bursts) is displayed in addition to the results under BURSTS OUT OF TOL.

Note:
As the calculated AVG curve displayed is related to past events, there may be a delayed approximation to the correct measurement result in the display if the input signals are subject to sudden changes.

BURST MODE	*(only when selected from the manual test)* Switchover between NORMAL BURST and ACCESS BURST measurement (see section 2.4.3.1.1).
POWER RAMP	The power ramp measurement is started in single-shot operation or after a stop because of exceeded tolerance. Measurement stop and start in continuous mode.
PHASE FREQ.	Change to the phase/frequency error measurement menu (see section 2.4.3.2).
SPECTRUM MOD.	Change to the menu SPECTRUM due to MODULATION (see section 2.4.3.3).
SPECTRUM SWITCH.	Change to the menu SPECTRUM due to SWITCHING (see section 2.4.3.3).
TIMING ADV. TEST	*(only when selected from the manual test)* Change to the menu TIMING ADV. TEST (see section 2.4.3.4).
GRID ON/OFF	This softkey permits to fade in a grid to facilitate reading of the measurement curve.
MARKER	This softkey allows a marker to be shifted on the measurement curve as required by means of the spinwheel or via the keypad. The time and the associated measured value are additionally displayed in the text part.

POWER CTRL LEV.

RF CHAN

TIMESLOT

When selected from manual test
The softkeys POWER CTRL LEV., RF CHAN and TIMESLOT have the same function as in the CALL ESTABLISHED menu (see section 2.4.2.3).

EXP. POWER

FREQ./ RF CHAN

When selected from module test:
The softkeys EXP. POWER and FREQU./RF CHAN have the same function as in the BURST ANALYSIS menu (see section 2.4.5.1).

DISPLAY RANGE

Selection of display range:

FULL SCALE	Display of the complete power ramp
RISING EDGE	The rising edge of the power burst is displayed
USEF. PART	The useful part of the timeslot is displayed
FALL. EDGE	The falling edge of the power burst is displayed
LEFT CORNER	Detailed display of the left corner of the useful part
RIGHT CORNER	Detailed display of the right corner of the useful part

DISPLAY MODE

Selection of displayed result:

CURR:	The currently measured curve is displayed
MIN.	MIN HOLD display
MAX.	MAX HOLD display
AVG.	Average display

NO. OF BURSTS

Setting of the time period during which averaging is performed:
1 to 2000

2.4.3.1.1 Access Burst Measurement

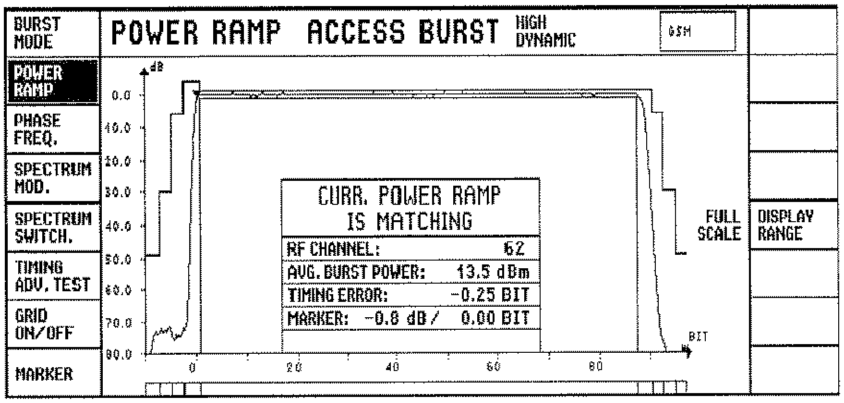


Fig. 2.4-8 POWER RAMP ACCESS BURST menu

For measurement of the access burst, an intercell handover is performed on the same channel. Older mobiles sometimes do not support the intercell handover. Change of power, channel and timeslot cannot be performed during the access burst measurement. No averaging calculation (incl. MIN/MAX HOLD) can be performed due to the low number of access bursts.

2.4.3.2 PHASE FREQUENCY Menu (only with Option CMD-B4)

For entering tolerances, a configuration menu is provided (see section 2.4.6.3.2).

In this measurement menu, the phase error of the modulation is displayed as a function of the time and the peak phase error, the RMS phase error and the frequency offset are indicated in measured values.

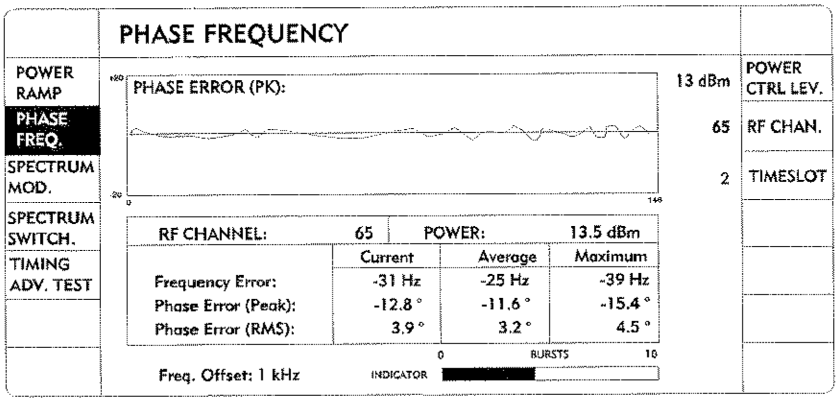


Fig. 2.4-9 PHASE FREQUENCY menu

The display is divided into several fields:

The upper field indicates the phase error during the burst. In continuous mode, the graphics is continuously updated, ie a quasi-real-time measurement is available for adjusting purposes.

Instead of using scope display for the phase, an analog-bar display can also be selected for the averaged frequency or phase error/RMS (configuration menu) for adjustment purposes.

The centre field contains the parameters frequency channel and power. The associated measurement results are the frequency error and the phase error, indicated as peak value and average value. The GSM specifications define +/-20° peak phase error and +/-5° average phase error. The maximum frequency error may be 0.05 ppm referred to the transmitter frequency. A maximum value of 45 Hz is set on the CMD. These values are the default values for the tolerances, however, they can be varied as required in the configuration menus.

As soon as a measured value is out of tolerance, it is displayed on black background.

To this end, the real phase characteristic is recorded and stored during the total burst. The transferred data contents is demodulated from the measured values and the training sequence (midamble) searched for.

The complete data contents of the burst is arithmetically modulated using an ideal modulator and the resulting ideal phase characteristic compared with the measured one. By calculating a regression line, the frequency error is obtained. The deviations of the phase characteristic result in the phase error, which is both peak and rms weighted.

The measurement curve (phase error curve) is then matched in the tolerance mask as to the time referred to the midamble (bit 13/14) and checked for exceeding of the tolerance. 4 measured values are recorded for every data bit and evaluated. This corresponds to a sampling rate of approx. 1 MHz.

The measured value display for frequency error, phase error/peak and phase error/RMS is divided into three columns for current measured value, averaged measured value and poorest measured value (maximum), the number of bursts used for averaging may be indicated. An analog bar indicates the current degree of averaging after restart of the measurement.

If a frequency offset ≠ 0 Hz has been set in the configuration menu, it is displayed in the menu.

POWER RAMP

Change to the POWER RAMP menu. (see section 2.4.3.1).

PHASE FREQ.

The phase/frequency error measurement is started in single-shot operation or after a stop because of exceeded tolerance. Stop and start of the measurement are in continuous mode.

SPECTRUM MOD.

Change to the menu SPECTRUM due to MODULATION (see section 2.4.3.3).

SPECTRUM SWITCH.

Change to the menu SPECTRUM due to SWITCHING (see section 2.4.3.3).

TIMING ADV. TEST

Only when selected from the Manual Test:
Change to the menu TIMING ADV. TEST (see section 2.4.3.4).

POWER CTRL LEV.

RF CHAN.

TIMESLOT

When selected from the manual test:
The softkeys POWER CTRL LEV., RF CHAN and TIMESLOT have the same function as in the CALL ESTABLISHED menu (see section 2.4.2.3).

EXP. POWER

FREQ./ RF CHAN.

When selected from the module test:
The softkeys EXP. POWER and FREQU./RF CHAN have the same function as in the BURST ANALYSIS menu (see section 2.4.5.1).

2.4.3.3 SPECTRUM MOD. / SPECTRUM SWITCH. Menu (only with Options CMD-B4, B42 and B43)

For entering tolerances, a configuration menu is provided.

The menus of the measurements "Spectrum due to Modulation" and "Spectrum due to Switching" can be selected from the manual test or module test.

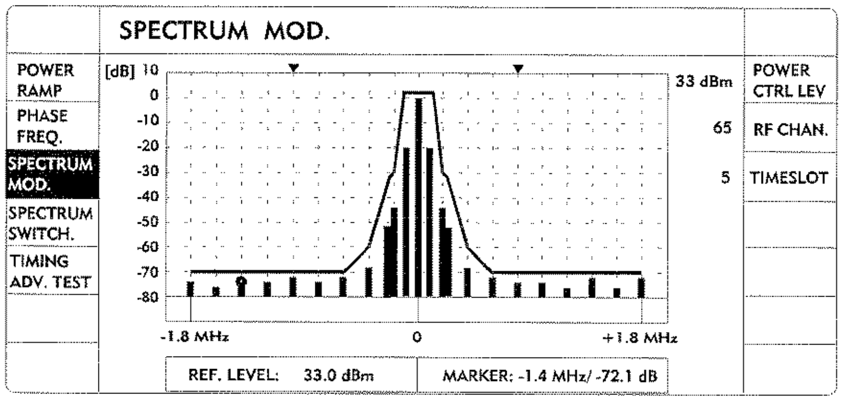


Fig. 2.4-10 SPECTRUM MOD. menu

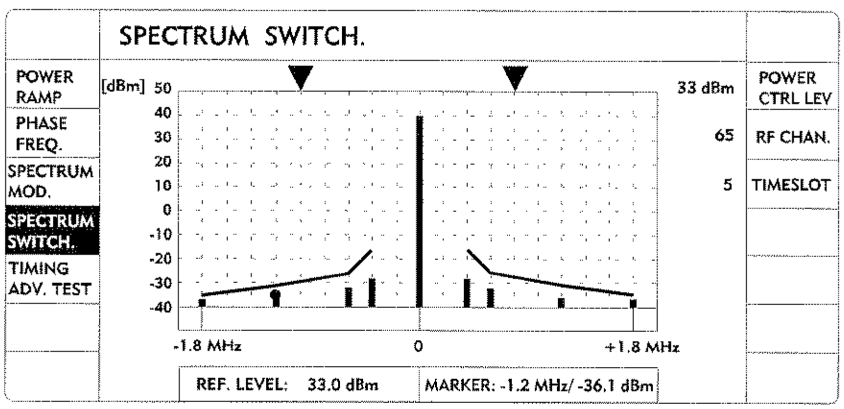


Fig. 2.4-11 SPECTRUM SWITCH. menu

These menus permit to measure the spectrum produced either by the modulation with the data stream or by the rising or falling edges (switching) of the RF burst.

Complying with the GSM specifications, a particular number of bursts is taken into account in the calculation of the measured value for each offset frequency. The number of bursts per offset frequency can be set in the configuration menu. In the case of a large number, the measurement may take longer. The marks in the illustration above indicate exactly which offset frequency is being calculated at the moment. The measured values outside the marked area are results of a previous measurement, the measured values inside the marked area are results of the currently running measurement.

A marker can be set to the individual measured value using the spinwheel. The measurement result in question is indicated as numerical value (if measurement lines extend above the upper edge of the screen, the marker symbol (triangle) is not visible).

POWER RAMP	Change to the POWER RAMP menu (see section 2.4.3.1).
PHASE FREQ.	Change to the PHASE FREQUENCY menu (see section 2.4.3.2).
SPECTRUM MOD.	Change to the Spectrum due to Modulation menu (see section 2.4.3.3).
SPECTRUM SWITCH.	Change to the Spectrum due to Switching menu (see section 2.4.3.3).
TIMING ADV. TEST	***Only when selected from the module test.*** Change to the TIMING ADV. TEST menu (see section 2.4.3.4).
EXPECTED POWER	***When selected from the module test:*** After pressing this key, enter the expected power of your test item on the numerical keypad. To be on the safe side, enter a level that is about 2 to 3 dB higher, e.g. transmitter level -20 dBm--> setting -18 dBm or transmitter level 40 dBm --> setting 42 dBm.
FREQ./ RF CHAN	After pressing this key, enter the channel number or the frequency of the carrier to be measured on the numerical keypad.
POWER CTRL LEV.	***When selected from the manual test:*** The softkeys POWER CTRL LEV., RF CHAN and TIMESLOT have the same function as in the CALL ESTABLISHED menu (see section 2.4.2.3).
RF CHAN.	
TIMESLOT	

2.4.3.4 TIMING ADVANCE TEST Menu (only with Option CMD-B4)

This menu can be selected with the call to the mobile established. The mobile is informed of the time by which it is to send earlier or later (timing advance or delay). The CMD measures the time difference in bits.

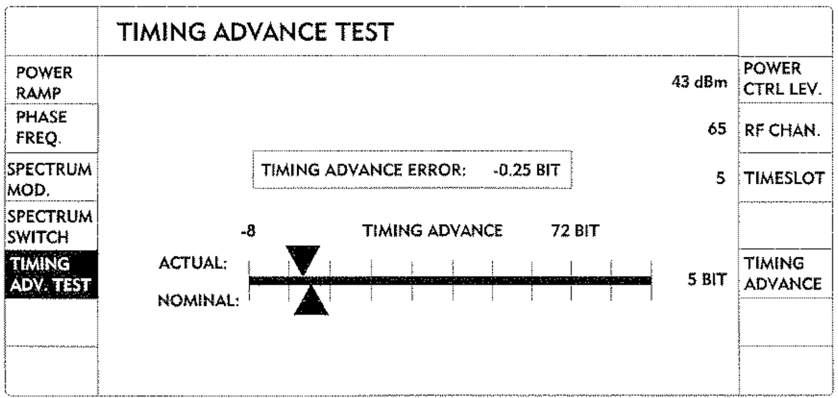


Fig. 2.4-12 TIMING ADVANCE TEST menu

POWER RAMP	Change to the POWER RAMP menu (see section 2.4.3.1).
PHASE FREQ.	Change to the PHASE FREQUENCY menu (see section 2.4.3.2).
SPECTRUM MOD.	Change to the SPECTRUM due to MODULATION menu (see section 2.4.3.3).
SPECTRUM SWITCH	Change to the SPECTRUM due to SWITCHING menu (see section 2.4.3.3).
TIMING ADV. TEST	For switching the measurement on/off.
POWER CTRL LEV.	The softkeys POWER CTRL LEV., RF CHAN. and TIMESLOT have the same functions as in the CALL ESTABLISHED menu (see section 2.4.2.3).
RF CHAN.	
TIMESLOT	
TIMING ADVANCE	Input of the time in bits by which the mobile is to send earlier.

2.4.3.5 BIT ERROR RATE Menu (only with Option CMD-B4)

Test parameters can be set in the configuration menus (see section 2.4.6.4).

This measurement menu is selected by pressing the BER TEST softkey in the CALL ESTABLISHED menu. Various receiver tests based on the bit error rate test are selected in this menu. This test requires a special SIM CARD (R&S GSM test SIM CRT-Z2), which allows the RF loopback at the mobile station (bits sent by the CMD are received by the mobile station, demodulated and sent back on the RF path). Otherwise, the RF loopback is automatically set by calling this test. The 7 different tests to be selected here differ by different stimuli (RF signals sent by the CMD) and by different analysis criteria. These is mainly the number of frames during which the bit errors that have occurred or the number of erased frames are weighted. The stimuli and the analysis criteria used in this test can be selected in the CONFIG menu. This menu permits to start the different tests only with softkeys USER 1 to USER 7. These tests all have a finite measuring time, do not permit parameter variations during the test and supply a pass/fail result at the end. The test under softkey CONT.BER MEAS is an exception. It allows variation of test parameters and the measured values are indicated continuously (see CONTINUOUS BIT ERROR RATE).

A BER search routine is also possible.

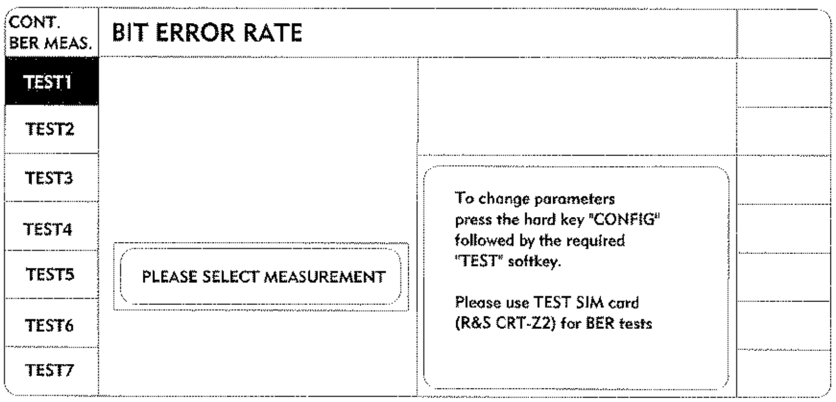


Fig. 2.4-13 BIT ERROR RATE menu

2.4.3.6 BIT ERROR RATE Menu (TEST 1...TEST 7)

One of these menus is entered after selection of one of the 7 user-specific test menus.

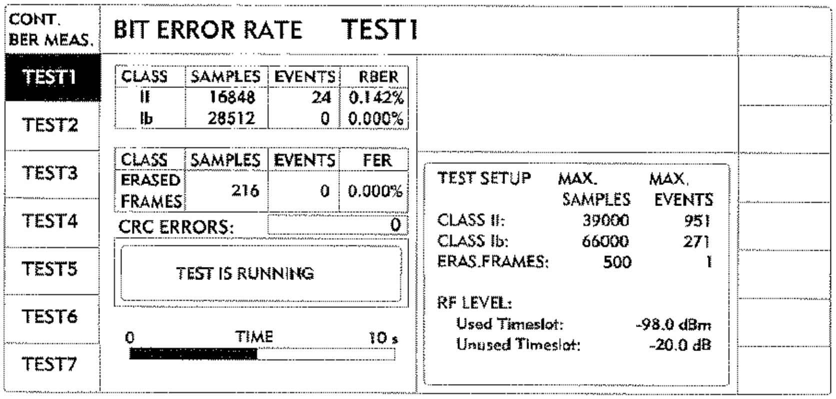


Fig. 2.4-14 BIT ERROR RATE TEST 1 menu

CONT. BER MEAS. — Selection of the continuous bit error rate test.

TEST 1 to TEST 7 — Selection and start of a user-specific measurement menu.

Display

The measurement results are recorded at the top left of the display. A box is displayed there in the bit error rate measurement. It contains a line each for the unprotected bits (class II) and for the protected bits (Class Ib). The bits sent by the CMD are referred to as samples and are counted. A bit which has been received wrongly is designated as an event, the events are also counted. The percentage of bits in error to all received bits is called bit error rate (BER) and indicated in % in the last column, separated according to class II und Ib.

If the test is a residual bit error rate test (RBER), the bits sent are additionally combined in frames. In this case, two boxes containing measured values are visible. The frames sent are again designated as samples and also counted. The frames that cannot be corrected are referred to as events and also counted. The ratio of erased frames) to all frames sent is the frame erasure rate (FER), indicated in % in the last column. In the case of an RBER test, the numbers of the first box must be interpreted in a somewhat different way. The bits belonging to erased frames are neither counted with the samples nor with the events so that the ratio of events to samples with respect to the bits is not concerned by the faulty frames; hence the name residual bit error rate.

The elapsed as well as the remaining test time are indicated at the bottom left. At the end of the test, the result is commented with a pass/fail result. This pass/fail criterion is defined in the CONFIG menu.

Display of the "CRC error" (Cyclic Redundancy Code):
Normally, no bit errors may occur on the transmission path from the mobile (high level) to the CMD. If bit errors occur nevertheless, the number of destroyed frames is counted (CRC). These destroyed frames are not taken into account in the analysis of the mobile BER.

Notes:
At the beginning of the BER measurement, the mobiles require some time to set to the new RF level. For remote-control programs optimized in terms of time, this mobile-specific wait time can be reduced individually (see configuration menu).

Remote-control mode
After a BER measurement has been started, the CMD simultaneously calculates the BER and RBER values. These measurement results can be picked up separately for BER and RBER.

As to the abort criiterions of the BER measurement, a remote-control command can be used to define for each of the 7 settings whether the BER or RBER limit values are used.

2.4.3.7 CONTINUOUS BIT ERROR RATE Menu

Contrary to the 7 bit error rate tests mentioned before, which were limited in duration and supplied a definite result at the end, the continuous bit error rate test test is a bit error rate test of arbitrary length. It can be used to observe the dependency of the bit error rate on the stimuli, that is to say on the signals the CMD sends to the mobile station, in an experiment.

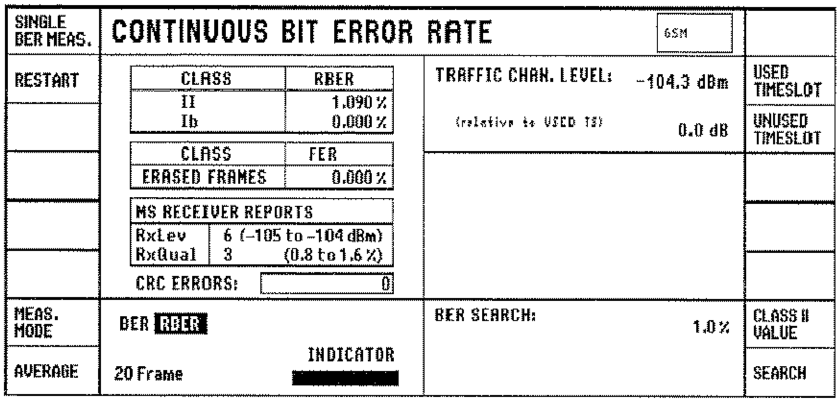


Fig. 2.4-15 CONTINUOUS BIT ERROR RATE menu

SINGLE BER MEAS. This softkey permits to return to a bit error rate measurement limited in time.

RESTART This softkey can be used to restart a bit-error-rate test. Due to an averaging period selected using the AVERAGE softkey the measurement results in the result field contain many previous components. On pressing RESTART, the test immediately forgets the previous values and starts anew.

MEAS. MODE This softkey permits to switch between the two measurement modes BER and RBER.

AVERAGE This softkey is used to enter the averaging period in frames.

USED TIMESLOT Communication with the radiophone is effected on one of 8 timeslots (CALL ESTABLISHED menu; TIMESLOT softkey). Using this softkey, the RF level of the CMD in the used timeslot is set to its absolute value.

UNUSED TIMESLOT This softkey is used to set a uniform level for the remaining timeslots. It is relative and related to the level of the used timeslot. The levels selectable for the used and the unused timeslot are to some extent dependent on other parameters. The unused-timeslot level can be switched off with the CLEAR/OFF hardkey and then switched on again with ENTER/ON.

Display of the "CRC errors" (cyclic redundancy code):
Normally, no bit errors may occur in the transmission path from the mobile (high level) to the CMD. If bit errors occur nevertheless, the number of destroyed frames is counted (CRC). These destroyed frames are not taken into account in the analysis of the mobile BER.

Class II bit error search routine

The bit error search routine permits the RF level at which the test item features a particular bit error rate to be determined automatically. The search routine starts at the currently set RF level, using the following search algorithm:

Resulting class II bit error			Variation of the RF level (USED TIMESLOT)	Frame number for averaging in the next weighting interval
0 %	...	< 0.05 %	-5.0 dB	25
	...	< 0.50 * lower limit	-2.0 dB	50
	...	< 0.75 * lower limit	-0.5 dB	AVERAGE value set
	...	< lower limit	-0.1 dB	AVERAGE value set
	...	< upper limit	Value found	-
	...	< 1.25 * upper limit	+0.1 dB	AVERAGE value set
	...	< 1.50 * upper limit	+0.5 dB	AVERAGE value set
	...	< 2.00 * upper limit	+2.0 dB	50
	...	100 %	+5.0 dB	25

The lower limit is the value set under CLASS II VALUE.
The upper limit is equal to 1.2 *the lower limit, if the value for CLASS II VALUE is greater than 0.5 %. If the value is smaller than 0.5 %, the upper limit in percent is equal to the value for CLASS II VALUE + 0.1.

Further abort criteria of the search routine:

- RF level smaller than -120 dBm.
- Maximum number of weighting cycles reached (20 cycles), ie the value searched for could not be found within 20 search steps.

CLASS II VALUE

Input of the desired search value.

SEARCH

The search procedure is started. During the search procedure, this key is black. The search procedure is terminated when the key is white again. The search procedure can be aborted by pressing any softkey. During the search procedure, the RF level of the USED TIMESLOT cannot be varied manually.

Display

The field at the top left contains the measurement results, which are updated continuously. The uppermost box is to be interpreted similarly as in the BER test described before. The only difference is that no samples and events are counted because these measured values are not interesting due to the infinite duration of this text.

The center box only appears if the operating mode residual bit error rate test is running.

The lower box shows the measurement results of the MS receiver. They are the level received (RX LEVEL) and the signal quality received (RX QUAL). These two values reflect the stimuli the CMD supplies for this test and represents on the right side of the screen at the position of the MS receiver.

The field at the bottom left indicates the operating mode of the test, the number of frames from which the measurement results indicated above are obtained (AVERAGE) and an indicator. The latter can be described as follows: After a start or RESTART, the indicator field is empty and begins to fill. As long as it has not been completely filled, the measured values indicated above do not relate to the full number of frames, the degree to which they are filled approximately indicates how high the number has already become. When the indicator is completely filled, the measurements relate to the full number of frames.

The two fields on the righthand side show the setting parameters of the test signals the CMD supplies in this test. They have been written into using softkeys USED and UNUSED TIMESLOT.

2.4.4 Conventional Measurements (Certain Models only)

2.4.4.1 ADDITIONAL MEASUREMENTS Menu

The DC voltage result and several DC current results are displayed in this menu (for certain models only with option CMD-B20). Besides, AF measurements are possible (only with Option CMD-B41). The menu can be entered from different menus (see section 2.2, Menu Structure).

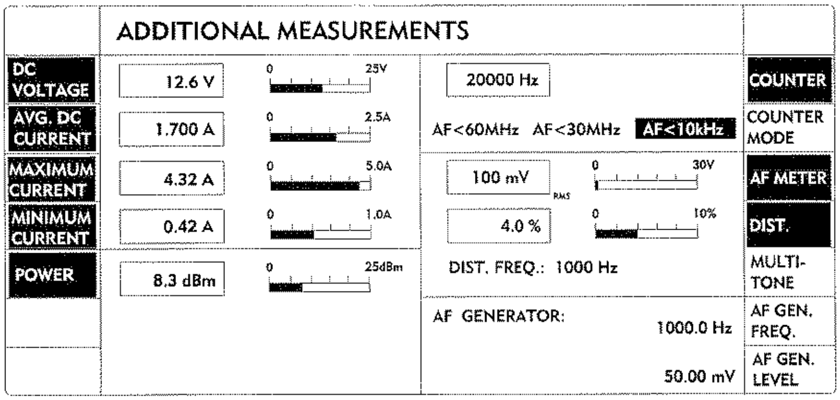


Fig. 2.4-16 ADDITIONAL MEASUREMENTS menu

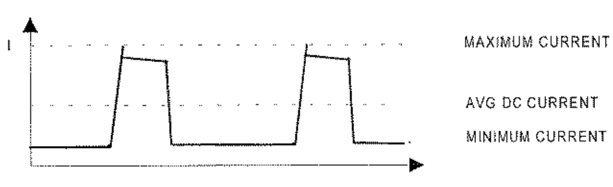
The **lefthand side** of the menu can be used to examine the supply of the mobile station. As the RF power of the mobile station pulses, the operating current pulses as well in general. For this reason the CMD distinguishes between min, max and average value. The function AVG. DC CURRENT permits a real measurement of the current consumption,which is not guaranteed in pulse operation using conventional current meters.

DC VOLTAGE DC voltage result (permits the measurement of the true (thermal) power consumption together with AVG. DC CURRENT).

AVG. DC CURRENT Average DC current drain (permits the measurement of the true (thermal) power consumption together with DC VOLTAGE).

MAXIMUM CURRENT Maximum DC current drain (current consumption during the active burst.

MINIMUM CURRENT Minimum current drain (current consumption while the mobile station is passive)



Graphical representation of the DC current measurement results.

General notes on the current measurements

The physical minimal value (MIN.DC) or maximal value (MAX.DC) of the measured current is weighted. As a result of this, the display is inverted when the polarity is reversed.

Example:	AVG.DC	0.5 A	-0.5 A
	MAX.DC	1.5 A	-0.3 A
	MIN.DC	0.3 A	-1.5 A

The average display uses a time constant adapted to the GSM frame clock. Therefore, single unsynchronized current bursts may cause the average measurement to be delayed with respect to the two other measurements. However, this does not result in a faulty statement on the actual current consumption of the test item.

Example:	AVG.DC	0.5 A
	MAX.DC	0.35 A
	MIN.DC	0.31 A

These displays can be seen shortly after a single current consumption peak.

Note:
The configuration menu permits to perform a zero adjustment of the average current measurement (see section 2.4.6.2).

POWER Power measurement at connector RF IN/OUT or RF IN2.
The frequency used for the measurement is identical with the one used in the manual test or module test. When the menu is called from the selection menu, the frequency of the configuration menu is used (entry see section 2.4.6.2).

The righthand side of the menu permits to perform AF measurements (only with Option CMD-B41).

COUNTER Frequency measurement of input signals at socket "AF VOLTM".

COUNTER MODE Switchover of frequency counter modeCounting of AF signals up to 10 kHz or counting of IF signals up to 30 MHz (gate time 1 s) or 60 MHz (gate time 2 s).

AF METER Level measurements of input signals at the "AF VOLTM" socket.

DIST. Distortion measurement of input signals at the "AF VOLTM" socket.

MULTI TONE *(only with Option CMD-B44)*
Change to the menu "MULTITONE AUDIO ANALYSIS" (see section 2.4.4.2).

AF GEN. FREQ. Setting the frequency of the AF output signal at the "AF GEN" socket.

AF GEN. LEVEL Setting the level of the AF output signal at the "AF GEN" socket. This level can be switched off with the CLEAR/OFF hardkey and then switched on again with ENTER/ON.

Notes on the AF measurements (righthand menu side)

1.) Several configuration menus are provided for setting the parameters of the AF measurements.
2.) The AF measurements cannot be selected in particular signalling states of the measuring instrument.

2.4.4.2 MULTITONE AUDIO ANALYSIS Menu (only with Options CMD-B41/-B44)

With option CMD-B44 up to 14 audio frequencies can be generated and evaluated simultaneously. Fast measurements such as frequency response and intermodulation are possible.

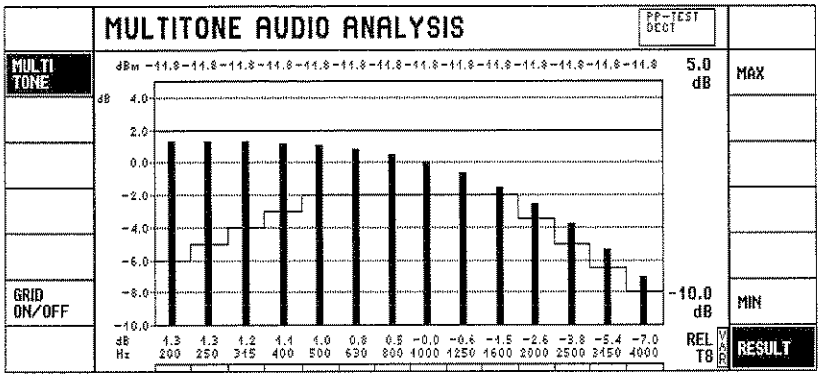


Fig. 2.4-17 MULTITONE AUDIO ANALYSIS menu

Level and frequency of the 14 tones can be varied largely independent of each other. The only limit is that the total generator level should not exceed 5 V. Upper and lower tolerances can also be set for the individual levels. A linear or logarithmic scale can be selected. On the log scale absolute or relative representation can be chosen. Measured values are displayed in the measurement menu as a bargraph, tolerance values as a staircase curve.

The generator levels are displayed above the diagram. The units used are *mV* for linear and *dBm* for logarithmic representation. If the tone or the tone generator is switched off for the measurement, OFF is displayed.

Caution:
When settings in dBm are used for audio analysis, the associated resistance is 600 Ω.

Levels and frequencies are displayed below the diagram. Values are indicated in *mV* for a linear representation, in *dBm* for an absolute logarithmic and in *dB* for a relative logarithmic representation. If the tone has been switched off for the measurement, OFF is displayed in the frequency line. At the bottom of the display tolerance bars indicate whether the results are above or below the tolerance ranges.

Caution:
Since the audio analyzers used for the multitone measurement are coupled to the tone generators, only the built-in tone generators may be used. Phase shifts and delays are considered in the measurement.

Note:
The spectral sensitivity of a tone analyzer has nulls at 1-kHz spacing. This ensures that the individual tones do not affect each other.

MULTI TONE

Start of multitone measurement in the single-shot mode or after the measurement has been stopped due to a tolerance violation. Stop and start of measurements in continuous operation.

GRID ON/OFF

With this softkey a grid is superimposed on the display to simplify reading trace values.

MAX

Setting the upper limit value of the result diagram. The units used are *mV* for linear, *dBm* for absolute logarithmic and *dB* for relative logarithmic measurements.

REF

Setting a selectable reference value to be displayed with the measurement results under REL REF. The softkey is only displayed with this type of measurement. With the aid of the unit keys this value can also be entered in *dBm* or converted from or to *dBm*.

MIN

Setting the lower limit value of the result diagram. The units used are *mV* for linear, *dBm* for absolute logarithmic and *dB* for relative logarithmic measurements.

RESULT

Selection of result display mode. Possible settings are:

- ABS LIN. Display of absolute values in *mV* on a linear scale.
- ABS LOG. Display of absolute values in *dBm* on a logarithmic scale.
- REL GEN. Display of relative values in *dB* on a logarithmic scale, relative to the set generator level. A typical application is the measurement of transmission characteristics of discrete frequencies. Results are correct even if different generator levels are selected (eg artificial mouth). If a generator is switched off, the measurement result is invalid.
- REL REF. Display of results in *dB* on a logarithmic scale, relative to the value set under REF. REF could be the expected level, for instance.
- REL T1 to REL T14. Display of results in *dB* on a logarithmic scale, relative to the measured value of tones 1 to 14. The selected reference tone is 0 dB and the measured results of the other tones are relative to this reference tone. If the reference value is below 1 mV, all results are invalid. Typical applications would be measurements of frequency response, intermodulation and harmonics.

Note:
A configuration menu is provided for multitone measurements *(see section 2.4.6.2.4).*

2.4.5 Module Test

By selecting "MODULE TEST" in the selection menu, the "BURST ANALYSIS" menu can be entered.

2.4.5.1 BURST ANALYSIS Menu

This menu permits to perform GSM-specific measurements on modules or measurements on mobiles in service mode (the Option CMD-B4 is required for a few measurements).

Input fields:
The operator can enter the input socket, the external attenuation, the expected power, the type of midamble as well as the transmitting channel of the test item.

Result fields:
As soon as the parameters of the test item are entered, the CMD triggers on an incoming power burst and subsequently indicates the average burst power, the peak power, the phase/frequency error values as well as an incorrect/correct power ramp as a function of time.

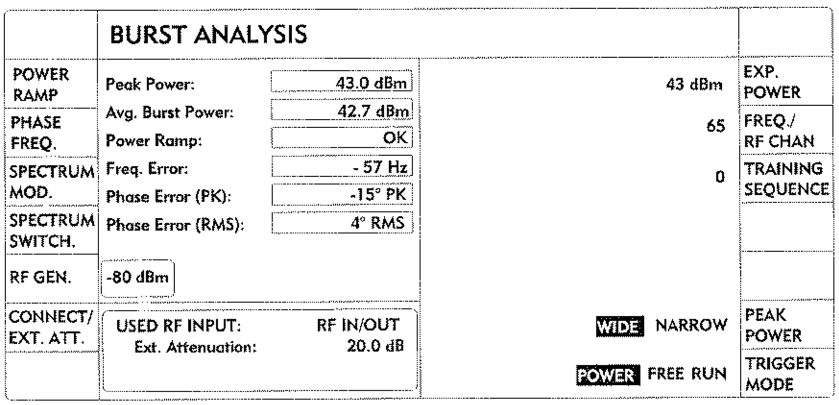


Fig. 2.4-18 BURST ANALYSIS menu

POWER RAMP — Change to the menu "POWER RAMP", where the power ramp versus time is indicated (see section 2.4.3.1).

PHASE FREQ. — Change to the "PHASE FREQUENCY" menu, where the phase versus time is displayed graphically (see section 2.4.3.2).

SPECTRUM MOD. — *(only with Options CMD-B4, B42 and B43)*
Change to the menu SPECTRUM due to MODULATION (see section 2.4.3.3).

SPECTRUM SWITCH. — *(only with Options CMD-B4, B42 and B43)*
Change to the menu SPECTRUM due to SWITCHING (see section 2.4.3.3).

RF GEN.

Change to the RF GENERATOR menu where the RF signal parameters (modulated/unmodulated and pulsed/not pulsed) can be varied (see section 2.4.5.2). If the RF level is switched on, it is indicated next to the softkey.

Important note:

With an unfavourable setting of the RF generator (frequency, level) it is possible that the CMD performs self-measurements. This applies in particular to the common RF IN/OUT input/output (common 20-dB power attenuator for input and output).

CONNECT/ EXT. ATT.

Change to the configuration menu for selecting the connectors and entering the external attenuations (see section 2.4.6.8).

EXP. POWER

Input of the expected transmitter power of the test item.

FREQ./ RF CHAN

Input of RF frequency or RF channel. The resolution is 200 kHz (GSM channel spacing). The conversion of frequencies into channels is effected by means of the unit keys (channel corresponds to "dB"). Possible frequencies are 800 to 1000 MHz or 1697.6 to 1897.6 MHz (depending on model). When converting frequencies that lie outside the defined GSM bands, fictitious channel numbers are indicated.

Overview channel/frequency
800 to 1000 MHz (GSM900)

Frequency	Chan-nel	Band
800 MHz ↓ 876 MHz	574 ↓ 954	fictitious channel numbers
876.2 MHz ↓ 880 MHz	955 ↓ 974	R-GSM band
880.2 MHz ↓ 889.8 MHz 890.0 MHz	975 ↓ 1023 0	E-GSM band
890.2 MHz ↓ 914.8 MHz	1 ↓ 124	GSM band
915 MHz ↓ 1000 MHz	125 ↓ 550	fictitious channel numbers

Overview channel/frequency
1697.6 to 1897.6 MHz (GSM1800)

Frequency	Chan-nel	Band
1697.6 MHz ↓ 1710 MHz	449 ↓ 511	fictitious channel numbers
1710.2 MHz ↓ 1784.8 MHz	512 ↓ 885	DCS 1800 band
1785 MHz ↓ 1897.6 MHz	886 ↓ 1449	fictitious channel numbers

Overview channel/frequency
1816 to 2016 MHz (GSM1900)

Frequency	Chan-nel	Band
1816 MHz ↓ 1850 MHz	341 ↓ 511	fictitious channel numbers
1850.2 MHz ↓ 1909.8 MHz	512 ↓ 810	DCS 1900 band
1910 MHz ↓ 2016 MHz	811 ↓ 1341	fictitious channel numbers

TRAINING SEQUENCE	Selection of the different types of midamble.
PEAK POWER	*(only with input RF IN/OUT selected)* Use of the broadband RF power meter or the narrowband IF power meter.
TRIGGER MODE	*(only with certain hardware versions)* Selection of trigger mode: POWER (default): The signal to be measured must be a burst with midamble. The trigger is set to the incoming power. FREE RUN: The signal to be measured must have a midamble to which the CMD synchronizes.

2.4.5.2 RF SIGNAL GENERATOR Menu

The CMD provides an RF signal. The parameters of this RF signal as well as the desired RF output socket can be set in this menu (lefthand side of menu).

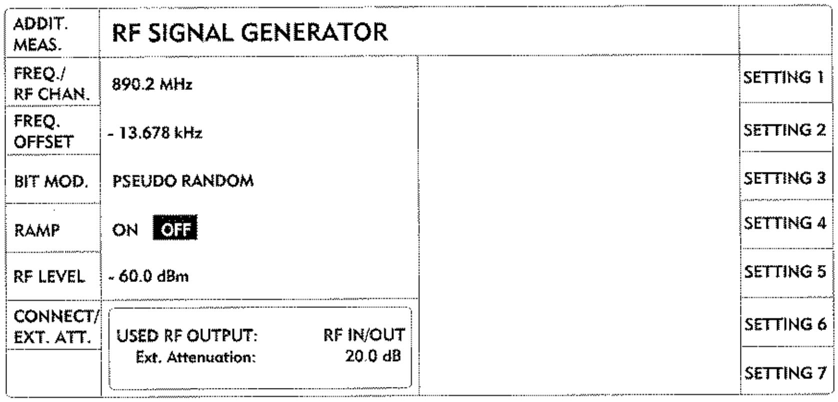


Fig. 2.4-19 RF SIGNAL GENERATOR menu

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. It permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

FREQ./ RF CHAN.

Input of RF frequency or RF channel. The resolution is 200 kHz (GSM channel spacing). The conversion of frequencies into channels is effected by means of the unit keys (channel corresponds to "dB"). Possible frequencies are 800 to 1000 MHz or 1697.6 to 1897.6 MHz (depending on model). When converting frequencies that lie outside the defined GSM bands, fictitious channel numbers are indicated.

Overview channel/frequency
800 to 1000 MHz (GSM900)

Frequency	Chan-nel	Band
800 MHz ↓ 920MHz	349 ↓ 954	fictitious channel numbers
920.2 MHz ↓ 925 MHz	955 ↓ 974	R-GSM band
925.2 MHz ↓ 934.8 MHz 935.0 MHz	975 ↓ 1023 0	E-GSM band
935.2 MHz ↓ 959.8 MHz	1 ↓ 124	GSM band
960 MHz ↓ 1000 MHz	125 ↓ 325	fictitious channel numbers

Overview channel/frequency
1697.6 to 1897.6 MHz (GSM1800)

Frequency	Chan-nel	Band
1697.6 MHz ↓ 1805 MHz	-26 ↓ 511	fictitious channel numbers
1805.2 MHz ↓ 1879.8 MHz	512 ↓ 885	DCS 1800 band
1880 MHz ↓ 1897.6 MHz	886 ↓ 974	fictitious channel numbers

Overview channel/frequency
1816 to 2016 MHz (GSM1900)

Frequency	Chan-nel	Band
1816 MHz ↓ 1930 MHz	-59 ↓ 511	fictitious channel numbers
1930.2 MHz ↓ 1989.8 MHz	512 ↓ 810	DCS 1900 band
1990 MHz ↓ 2016 MHz	811 ↓ 941	fictitious channel numbers

FREQ. OFFSET	For achieving a more accurate fine frequency resolution, the frequency offset can be set here (resolution 33 Hz, max. ± 100 kHz).
BIT MOD.	Selection of bit modulation. OFF: No modulation. PSEUDO RANDOM: Modulation with a pseudo random bit sequence. DUMMY BURST (TSC=0 to TSC=7): Modulation with dummy burst and incorporated midamble (training sequence settable from 0 to 7).
RAMP	Selection between burst or no burst of RF signal.
RF LEVEL	Input of RF level. The level can be switched off with the CLEAR/OFF hardkey and then switched on again with ENTER/ON.
CONNECT/ EXT. ATT.	Change to the configuration menu for selecting the connectors and entering the external attenuations (see section 2.4.6.8).
SETTING 1(7)	These softkeys on the righthand side of the menu permit to activate complete preset RF signal generator parameter setups by pressing only one key. These sets of parameters are preset in the configuration menus of the RF generator menu.

2.4.6 Configuration Menus

These menus offer the following possible configurations:

- Configuration of the measuring instrument only.
- Configuration of the measuring instrument in the test setup including the GSM mobile station to be tested (e.g. consideration of external attenuator pads between test item and instrument).
- Rarely occurring operations.

There are two ways to enter the configuration menus:

- From the selection menu via the "CONFIG menu tree".
- From the different menus by pressing the CONFIG hardkey. Then the configuration menus relevant to this menu can be selected via softkeys.

2.4.6.1 Configuration Selection Menu

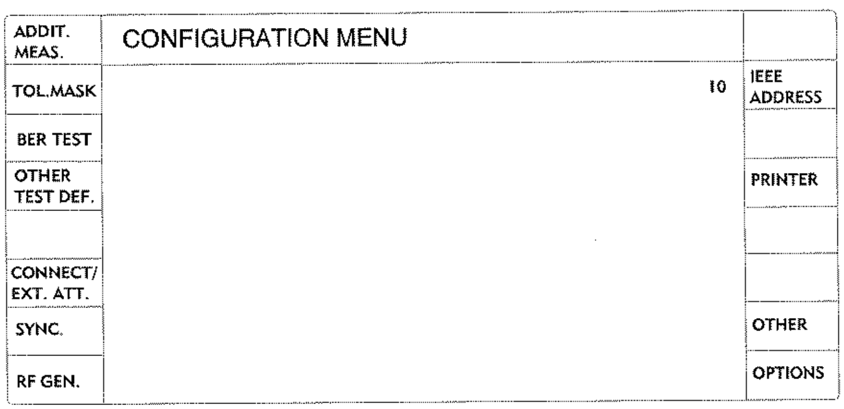


Fig. 2.4-20 CONFIGURATION menu

ADDIT. MEAS.	Change to the configuration menus for the conventional measurements (see section 2.4.6.2).
TOL. MASK	Change to the configuration menus for entering the tolerance values for power ramp and phase/frequency error measurement (see section 2.4.6.3).
BER TEST	Change to the configuration menus for the different BER tests (USER 1 to 7) (see section 2.4.6.4).
OTHER TEST DEF.	Change to the configuration menus for entering the network parameters and for entering the BS signal parameters (see section 2.4.6.5).

CONNECT/ EXT. ATT.
Change to the configuration menu for selecting the connectors and entering the external attenuations (see section 2.4.6.8).

SYNC.
Change to the configuration menu for selecting the synchronization of the CMD with the test item (with Option CMD-B3 installed), (see section 2.4.6.9).

RF GEN.
Change to the configuration menus for entering the parameter sets (setting 1 to 7) of the RF generator
(see section 2.4.6.10).

IEEE ADDRESS
Input of the IEC-bus remote-control address (with Options CMD-B6 and CMD-B61 installed).

PRINTER
Change to the printer configuration menu which permits to select various printer drivers
(see section 2.4.6.11).

OTHER
Change to the configuration menu "OTHER PARAMETERS", which permits various functions to be switched on and off
(see section 2.4.6.13).

OPTIONS
Change to the SW OPTIONS menu where various software options can be activated via code numbers. Upon pressing the HW OPTIONS softkey, the built-in hardware options are indicated.

2.4.6.2 Configuration Menu for ADDITIONAL MEASUREMENTS

For the configuration of conventional measurements the following menu is provided:

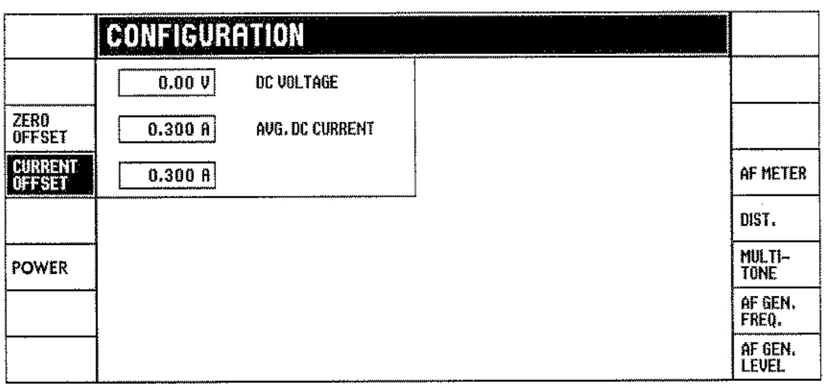


Fig. 2.4-21 CONFIGURATION menu

For current measurements, an offset can be added to the measured values. This offset may be used to perform an accurate zero-adjustment and to provide a reference for measured currents.

ZERO OFFSET	Acceptance of last measured value of the true average current drain (ie not corrected by offset) as an offset for current measurements.
CURRENT OFFSET	Input of a user-selectable value as an offset for current measurements. Offset correction is not performed when the CLEAR/OFF hardkey is pressed or 0 is entered.
POWER	Change to the configuration menu for entering the frequency for the power measurement (see section 2.4.6.2.1).
AF METER	Change to the configuration menu for the AF voltmeter (see section 2.4.6.2.2).
DIST.	Change to the configuration menu for THD measurements (see section 2.4.6.2.3).
MULTI-TONE	Change to the configuration menu for multitone measurements (see section 2.4.6.2.4).
AF GEN. FREQ.	Change to the configuration menu for AF generator (see section 2.4.6.2.5).
AF GEN. LEVEL	

2.4.6.2.1 Configuration Menu POWER

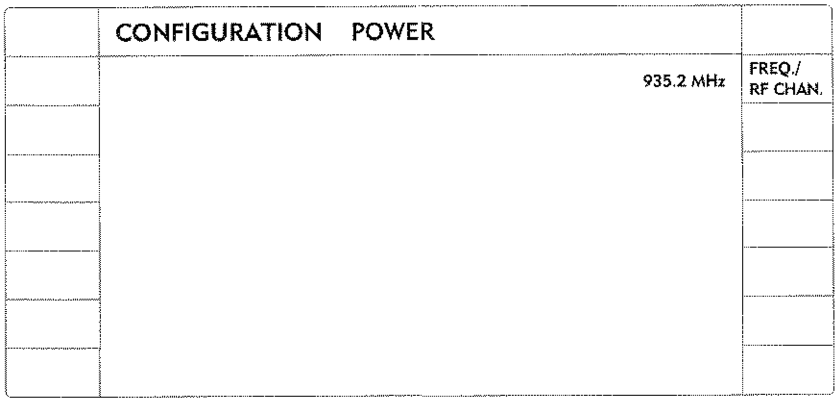


Fig. 2.4-22 CONFIGURATION POWER menu

FREQ./ RF CHAN.	Input of the receive frequency or receive channel.

2.4.6.2.2 Configuration Menu AF METER

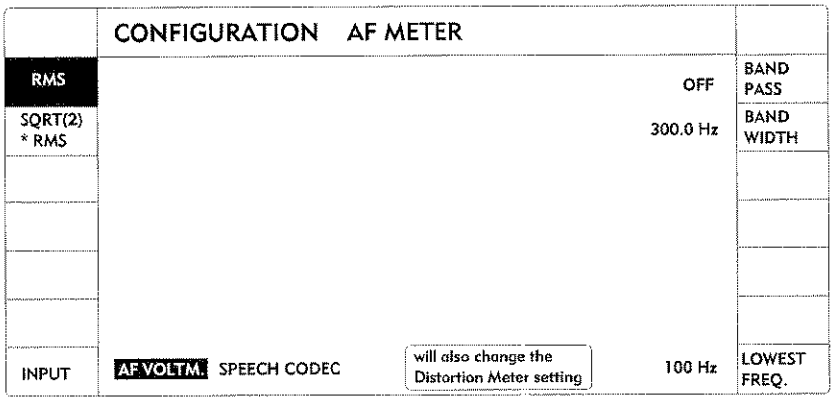


Fig. 2.4-23 CONFIGURATION AF METER menu

RMS

The AF voltmeter measures RMS values.

SQRT (2) * RMS

The AF voltmeter measures RMS values. However, the display is weighted with factor 1.41 (corresponds to peak value in the case of sinusoidal signal).

INPUT

(depending on model)

Switchover of input
(only with built-in option CMD-B5):

AF VOLTM.: Signals present at the AF VOLTM input (front panel) are measured.

SPEECH CODEC: Signals of the CMD speech decoder are measured.

A bandpass filter may be connected into the measurement path of the AF voltmeter. It has no influence on the AF counter and the distortion meter.

BAND PASS

Switching the bandpass filter on and off using hardkeys ENTER/ON or CLEAR/OFF. Input of a center frequency between 50 Hz and 5000 Hz.

BAND WIDTH

Input of bandpass filter bandwidth (10 Hz to 5000 Hz).

LOWEST FREQ.

Input of the lowest AF frequency that is weighted without measuring errors. High values reduce the measuring time.

Note:
This setting also changes the limit frequency in the case of the distortion measurement.

2.4.6.2.3 Configuration Menu DISTORTION METER

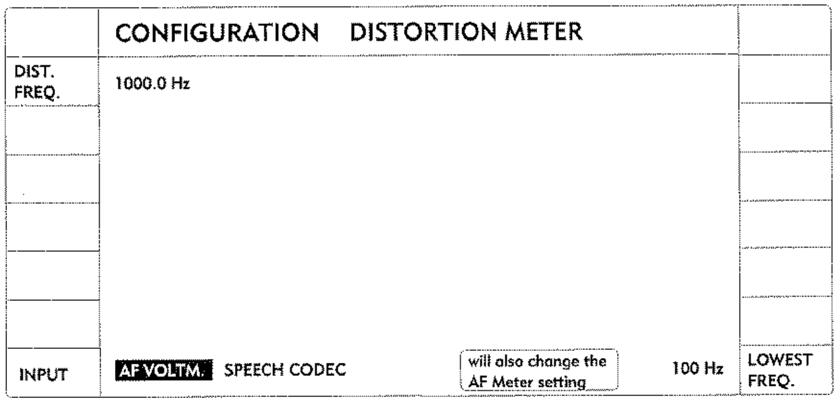


Fig. 2.4-24 CONFIGURATION DISTORTION METER menu

DIST. FREQ.

Input of operating frequency of distortion meter (center frequency of notch filters).

INPUT

(depending on model)

Switchover of input:
(only with built-in Option CMD-B5).

AF VOLTM.: Signals present at the AF VOLTM connector (front panel) are measured.

SPEECH CODEC: signals of the CMD speech decoder are measured.

LOWEST FREQ.

Input of lowest AF frequency that is weighted without measuring errors. High values reduce the measuring time.

Note:
This setting also changes the limit frequency in the case of the AF voltmeter measurement.

2.4.6.2.4 Configuration Menu MULTITONE AUDIO ANALYSIS (only with Options CMD-B41 and CMD-B44)

This menu permits to perform the multitone measurement settings.

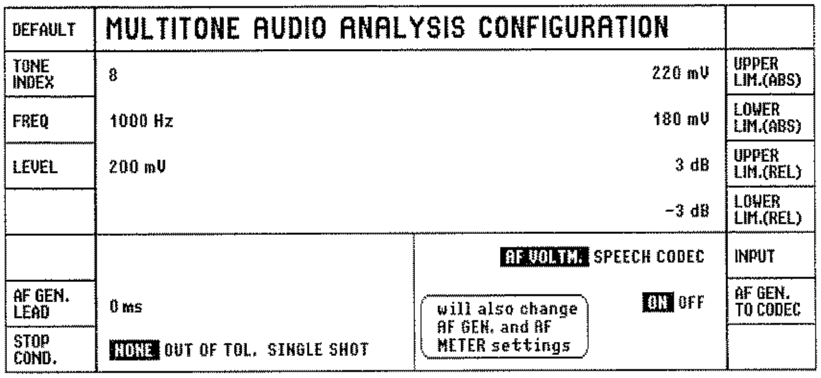


Fig. 2.4-25 MULTITONE AUDIO ANALYSIS CONFIGURATION menu

DEFAULT

This softkey activates the default values for this menu.

TONE INDEX

Via this key the index of the tone is selected the frequency, level and tolerance of which are to be set. Any value from 1 to 14 is permissible.

FREQ

Setting the frequency for the tone selected under TONE INDEX. Integral values between 50 and 8000 Hz can be selected. If the tone is to be excluded from the measurement, ie if less than 14 tones are to be measured, this index can be switched off with the OFF hardkey.

LEVEL

Setting the generator level for the tone selected under TONE INDEX. Any value between 1 mV and 5 V may be selected while the total tone level must not exceed 5 V. The generator can be switched off with the OFF hardkey. Contrary to the switch-off under FREQ, a measurement can still be performed.

UPPER LIM.(ABS)

Setting the upper tolerance value for the tone selected under TONE INDEX for absolute measurements. Values between 1 mV and 9.998 V may be selected. The selected value must be at least 1 mV above the lower limit value. The unit keys allow this value to be entered also in dBm or to be converted from or to dBm.

LOWER LIM.(ABS)

Setting the lower tolerance value for the tone selected under TONE INDEX for absolute measurements. Values between 0 mV and 9.998 V. The selected value must be at least 1 mV below the upper limit value. The unit keys allow this value to be entered also in dBm or to be converted from or into dBm.

UPPER LIM.(REL)

Setting the upper tolerance value for the tone selected under TONE INDEX for relative measurements. Values between -79 dB and +80 dB may be selected. The selected value must be at least 1 dB above the lower limit value.

LOWER LIM.(REL)

Setting the lower tolerance value for the tone selected under TONE INDEX for relative measurements. Values between -80 dB and +79 dB may be selected. The selected value must not be more than 1 dB below the upper limit value.

AF GEN. LEAD

Setting a generator lead before start of the measurement to allow for filter settling times and transmission delays. Values between 0 and 65 s can be set in steps of 1 ms.

STOP COND.

Selection of measurement abort:

- NONE The measurement is performed without interruption.
- OUT OF TOL The measurement stops when a tolerance is exceeded.
- SINGLE SHOT Stop after first measurement.

INPUT

(with Option CMD-B5 only, depending on model)

Input switchover:

VOLTM.: Signals at the AF VOLTM input (front panel) are measured.

SPEECH CODEC: Signals of the CMD speech decoder are measured.

Note:
This setting also changes the input for all other AF measurements.

AF GEN. TO CODEC

(with Option CMD-B5 only, depending on model)

The source of the CMD speech coder is either the input signal at the handset connector or the AF generator signal.

Note:
This setting also changes the output of the AF generator.

2.4.6.2.5 Configuration Menu AF GENERATOR

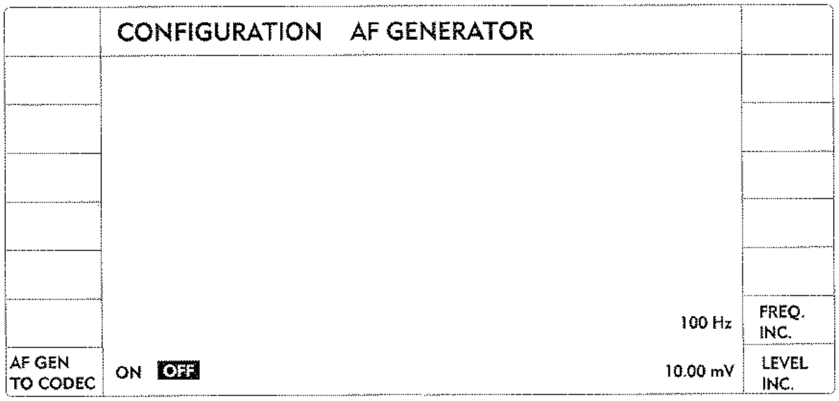


Fig. 2.4-26 CONFIGURATION AF GENERATOR menu

AF GEN to CODEC

(with Option CMD-B5 only, depending on model)

The source of the CMD speech coder is either the input signal at the handset connector or the AF generator signal.

FREQ. INC.

Input of increment for varying the frequency of the AF generator using the spinwheel.

LEVEL INC.

Input of increment for varying the level of the AF generator using the spinwheel.

2.4.6.3 Configuration Menu TOLERANCE

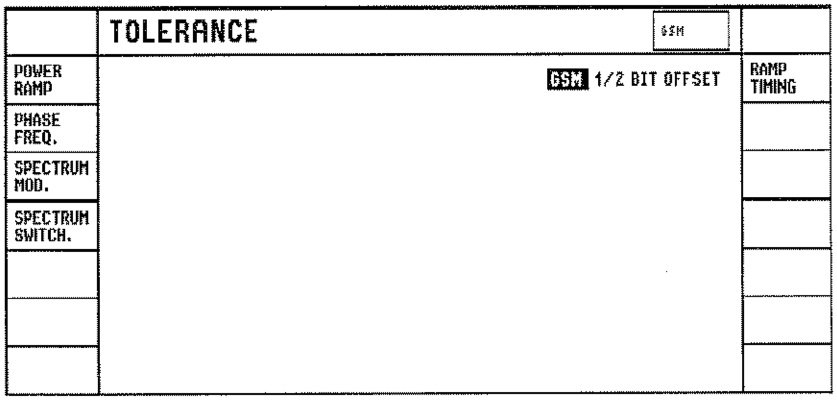


Fig. 2.4-27 TOLERANCE menu

POWER RAMP

Change to the configuration menu TOLERANCE POWER RAMP (see section 2.4.6.3.1).

PHASE FREQ.

Change to the configuration menu TOLERANCE PHASE FREQUENCY (see section 2.4.6.3.2).

SPECTRUM MOD.

Change to the configuration menu TOLERANCE SPECTRUM due to MODULATION (see section 2.4.6.3.3).

SPECTRUM SWITCH.

Change to the configuration menu TOLERANCE SPECTRUM due to SWITCHING (see section 2.4.6.3.4).

RAMP TIMING

This key permits to configure the burst positioning for power ramp and phase/frequency error measurements.

GSM:	Positioning to GSM (default)
½BIT OFFSET:	Positionierung shifted by ½ bit.

2.4.6.3.1 Configuration Menu TOLERANCE POWER RAMP

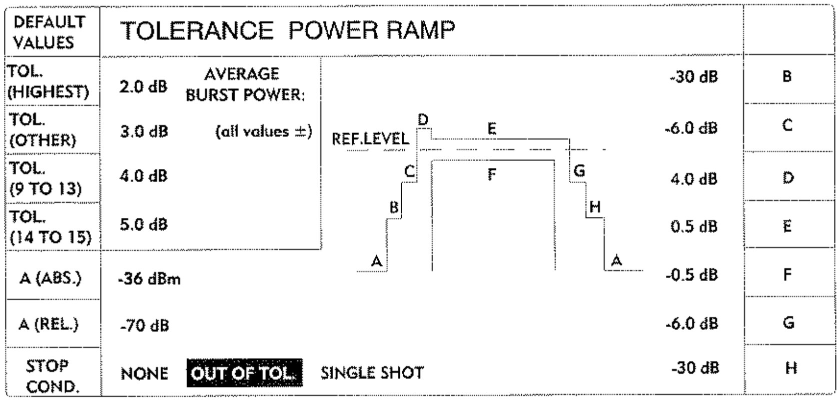


Fig. 2.4-28 TOLERANCE POWER RAMP menu

DEFAULT VALUES

The default values are used as tolerance values. If the tolerance values are changed, the menu title line displays "USER TOL".

TOL. (HIGHEST) to **TOL (XX to YY)**

These softkeys permit to enter the tolerance values for the average burst power (depending on the power level).

Note:
If this menu is selected from the module test, these keys do not exist.

GSM900: Three softkeys are provided, ie for the highest level, for levels 16 to 19 and for the remaining power levels.

GSM1800/1900: Four softkeys are provided, ie for the highest level, for levels 9 to 13, for levels 14 to 15 and for the remaining power levels.

A to **H**

The tolerance values of the power time template can be specified for the various ranges A to H.

Depending on the mobile power, either the relative or the absolute value set is entered as max. tolerance limit for segment A. The greater level value is to be entered.

Example 1:
Ref. Level = 40 dBm, value for A = - 30 dBm
(as 40 dBm - 70 dB = -30 dBm)

Example 2:
Ref. Level = 20 dBm value for A = -36 dBm
(as 20 dBm - 70 dB = -50 dBm and the higher value is to be entered --> A(ABS) here - 36 dBm)

The values for segments B to H are always used relatively to the ref. level.

STOP COND.

This softkey permits to change between the operating modes continuous measurement, stop after exceeded tolerance and single shot.

2.4.6.3.2 Configuration Menu TOLERANCE PHASE FREQUENCY

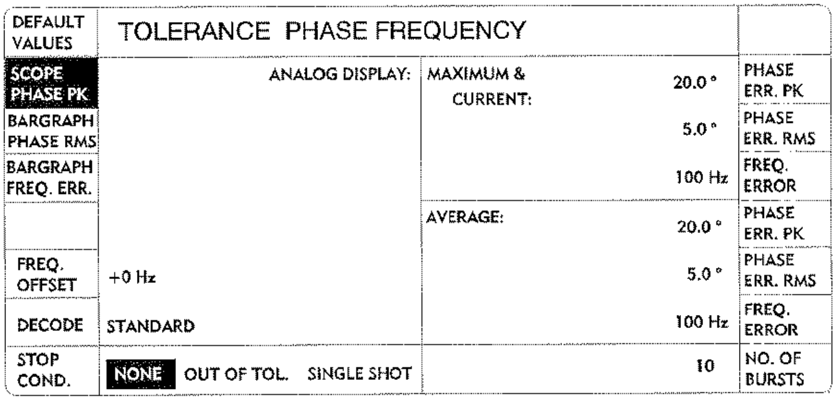


Fig. 2.4-29 TOLERANCE PHASE FREQUENCY menu

DEFAULT VALUES

The default values are used as tolerance values. If the tolerance values are varied, the menu title line displays "USER TOL".

SCOPE PHASE PK

Indication of the phase in a scope display.

BARGRAPH PHASE RMS

Analog bar display of averaged RMS phase error.

BARGRAPH FREQ. ERR.

Analog bar display of averaged frequency error.

FREQ. OFFSET

Input of a frequency offset of up to ±200 kHz.

This function is used to measure mobile frequencies that differ considerably from the nominal value (not synchronized, module test).

If an offset ≠ 0 is set, it is indicated in the measurement menu.

DECODE

Decoding mode with phase/frequency error measurement:

STANDARD:	to GSM specifications
WITH GUARD AND TAILBITS:	The guard and tail bits are not regarded as defined, but are decoded.

STOP COND.

This softkey permits to change between the three operating modes continuous measurement, stop after exceeded tolerance and single shot.

PHASE ERR. PK

to

FREQ. ERROR

Input of tolerance values for measuring the frequency and phase error (peak value and rms value) for current/maximum and averaged measured value separately.

NO. OF BURSTS

The number of bursts the average of which is taken in the phase/frequency error measurements can be set in this menu.

The maximum and average values from n bursts are calculated as follows:

Phase RMS maximum:	highest value (always positive)
Phase Peak maximum:	highest absolute value (indicated with sign)
Frequency maximum:	highest absolute value (indicatd with sign)
Phase RMS average:	averaged without sign (always positive)
Phase Peak average:	absolute value averaged (averaging without sign)
Frequency average:	averaged with sign

2.4.6.3.3 Configuration Menu TOLERANCE SPECT. due to MOD.

This menu permits to enter the tolerance values for the spectrum measurement as desired.

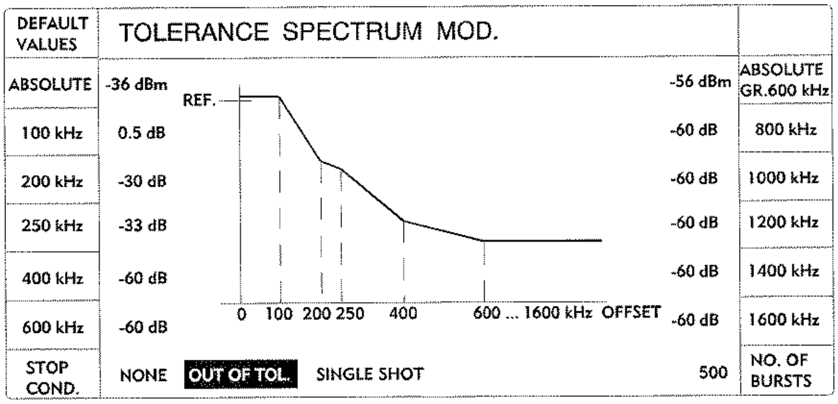


Fig. 2.4-30 TOLERANCE SPECTRUM MOD. menu

DEFAULT VALUES

By pressing this softkey, the default values for the tolerances are set again. If the user changes the tolerances, the menu title line displays USER TOL.

ABSOLUTE

Setting the lowest absolute tolerance level for the offset frequencies 100 to 600 kHz. The valid tolerance limit is the less stringent requirement of absolute and relative limit value, i.e. if the relative values are smaller than the value set here, they are not taken into account.

ABSOLUTE GR.600 kHz

Setting of the lowest absolute tolerance level for the offset frequencies 600 to 1600 kHz.

100 kHz... 1600 kHz

Setting the relative tolerance level per measured offset frequency referred to the carrier. The valid tolerance limit is the less stringent requirement of absolute and relative limit value, i.e. the values set here are only taken into account if the measured values exeed the absolute limit value. Frequencies can be switched off separately with the CLEAR/OFF hardkey. No measurement will be made at a frequency switched off (advantage: higher measurement speed). To switch a frequency on again, use the ENTER/ON hardkey.

STOP COND.

Selection of operating modes:

Repeating non-interrupted operation.
Stop if tolerance is exceeded.
Single recording, measurement is restarted by pressing the softkey SPECTRUM MOD.

NO. OF BURSTS

Number of bursts recorded per offset frequency and to be taken into account in the calculation.

2.4.6.3.4 Configuration Menu TOLERANCE SPECT. due to SWITCH.

This menu permits to enter the tolerance values for the spectrum measurement as desired.

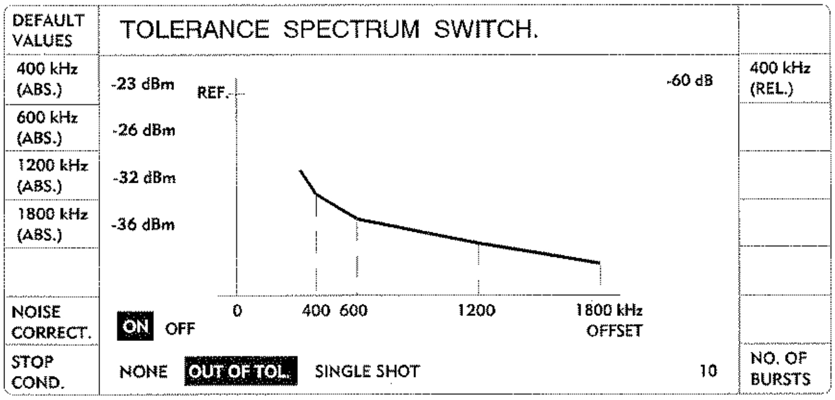


Fig. 2.4-31 TOLERANCE SPECTRUM SWITCH. menu

DEFAULT VALUES

By pressing this softkey, the default values for the tolerances are restored. If the user changes the tolerances, the menu title line displays USER TOL.

400..1800 kHz (ABS)

Setting the lowest absolute tolerance level. The tolerance limit is the less stringent requirement of absolute and relative limit value, i.e. if the relative values are smaller than the value set here, they are not taken into account. Frequencies can be switched off separately with the CLEAR/OFF hardkey. No measurement will be made at a frequency switched off (advantage: higher measurement speed). To switch a frequency on again, use the ENTER/ON hardkey.

400 kHz (REL.)

Setting the relative tolerance level per measured offset frequency referred to the carrier. The valid tolerance limit is the less stringent requirement of absolute and relative limit value, i.e. the values set here are only taken into account if the measured values exceed the absolute limit value.

NOISE CORRECT.

In the "ON" position, the dynamic range is increased by taking into account the CMD noise limit.

STOP COND.

Selection of operating modes:

Repeating non-interrupted operation.
Stop if tolerance is exceeded.
Single recording, the measurement is restarted by pressing the softkey SPECTRUM SWITCH.

NO. OF BURSTS

Number of bursts recorded per offset frequency and to be taken into account in the calculation.

2.4.6.4 Configuration Menu BER TEST DEFINITION

General settings can be performed at the first configuration menu level for BER measurements and one of the 7 configuration menus for tests 1 to 7 can be called up.

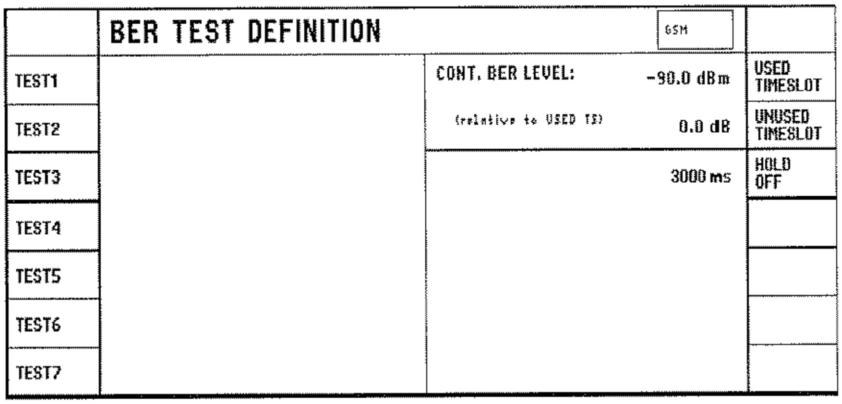


Fig. 2.4-32 BER TEST DEFINITION menu

TEST1 to **TEST7**

Change to one of the 7 configuration menus for tests 1 to 7.

USED TIMESLOT

UNUSED TIMESLOT

These two softkeys are valid for the continuous BER measurement. The level at which the BER measurement is performed can be set here (for the used and unused timeslot separately).

Important application for setting capabilities in this menu:
If the RF level is reduced for test purposes in the case of continuous BER measurements (test menu), the call is cleared down. When the BER test menu is selected after a new call has been set up, this very low RF level would again be set and lead to another call cleardown. In the configuration menu, the level can be increased prior to entering the test menu.

HOLD OFF

At the beginning of the BER measurement the mobiles requires some time to tune to the new RF level. This mobile-specific waiting period can be reduced individually for time-optimized remote-control programs (the preset value is 3000 ms).

The 7 tests are identical with respect to their structure. They may differ in the stimuli and analysis criteria by different user configurations.

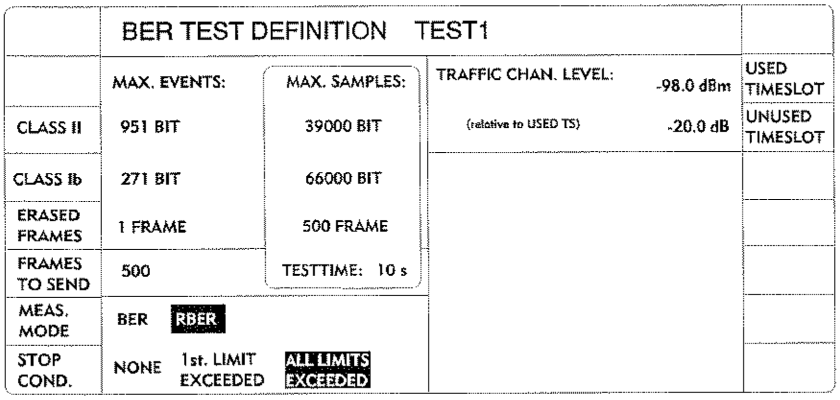


Fig. 2.4-33 BER TEST DEFINITION TEST 1 menu

Fig. 2.4-33 hows a bit error rate test of individual configuration. The stimuli generated by the CMD for this test are to be seen on the right side of the screen, the analysis criteria on the left side.

The two modes of measurement Bit Error Rate (BER) and Residual Bit Error Rate (RBER) are to be explained first. In the case of the BER test, errors with the unprotected bits (class II) and with the protected bits (class Ib) are counted. The bits sent by the CMD are designated as samples and also counted, a wrongly received bit is referred to as event and also counted. The ratio of bits received wrongly with respect to all bits set is designated as Bit Error Rate (BER).

In the case of the residual bit error rate test (RBER), the bits sent are additionally combined in frames. The frames sent are again designated as samples and counted, the erased frames are designated as events and counted as well. The ratio of erased frames to all frames sent is the frame erasure rate (FER). In the case of an RBER test, the Class I and Class II events have to be interpreted in a somewhat different way as well. The bits belonging to erased frames are neither counted with the samples nor with the events, so that the ratio of events to samples with respect to the bits is not concerned by the faulty frames.

CLASS II

CLASS Ib

These softkeys are used to enter the maximum number of permissible bit errors according to classes. The bits sent in this test are indicated on the right for comparison. They represent the reference value for the bit error rate for the BER test. If there are erased frames in an RBER test, they are no reference for the residual bit error rate, as bits from erased frames are not counted, but listed here.

ERASED FRAMES

This softkey is only significant if the residual bit error rate is measured. An entry here describes the maximum number of erased frames in this test. The total number of frames is shown next to the entry for comparison. It is the reference value for the frame erasure rate (FER).

FRAMES TO SEND

This softkey determines over how many frames the test extends. This requires a certain test time calculated and indicated by the CMD as well. As every frame contains exactly 132 Class Ib bits and 78 Class II bits, the total number of bits concerned is also displayed according to classes.

MEAS. MODE

This softkey permits to switch between the two measurement modes BER and RBER.

STOP COND.

This softkey determines when the test is to be aborted before reaching the required number of frames. There are three possibilities:

NONE
The test runs for the specified number of frames, irrespective of how many errors occur. However, it can be manually aborted using the STOP/BREAK key.

1st LIMIT EXCEEDED
The test is aborted when the first of the error limits indicated is reached. These are, alternatively, two different upper limits in the BER test (test runs until Max Events Class Ib or Max Events Class II has been reached) and three in the RBER test (Max Events with respect to frames in addition).

ALL LIMITS EXCEEDED
The test is only aborted before the end if all error limits have been exceeded at an early point in time.).

The stimuli generated by the CMD are programmed for the test using the following softkeys:

USED TIMESLOT

Communication with the radiophone is performed on one of 8 timeslots (CALL ESTABLISHED menu; TIMESLOT softkey). This softkey is used to set the RF level of the CMD in the used timeslot to its absolute value.

UNUSED TIMESLOT

This softkey is used to set a uniform level for the remaining timeslots. It is relative and related to the level of the used timeslot. The levels selectable for the used and the unused timeslot are to some extent dependent on other parameters. The unused-timeslot level can be switched off with the CLEAR/OFF hardkey and then switched on again with ENTER/ON.

Notes on BER measurements in remote-control mode

After a BER measurement has been started, the CMD simultaneously calculates the BER and RBER values. These measurement results can be picked up for BER and RBER separately.

As to the abort criterions of the BER measurement, it is possible to use a remote-control command to indicate for each of the 7 settings whether the BER or RBER limit values are to be used.

2.4.6.5 Configuration Menu NETWORK DEFINITION

This menu permits e.g. to enter the network parameters for the SIM card of the operator. The default values comply with the values of the R&S test SIM card CRT-Z2.

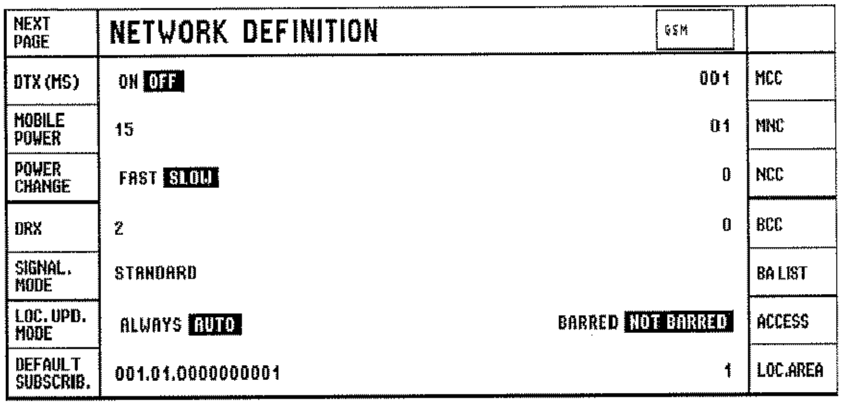


Fig. 2.4-34 NETWORK DEFINITION menu (1st page)

NEXT PAGE

Change to second page of the NETWORK DEFINITION menu.

DTX (MS)

Switching on of DTX mode (discontinuous transmission) on the mobile.

Note:
Since, in this operating mode, the mobile only transmits sporadically, the RF measurements can only be performed sporadically by the CMD.

MOBILE POWER

Input of mobile power used to perform the location update and the call setup. If the powers given are too high, the maximum possible power is used depending on the mobile (Power Class) .

Important note:
If very low powers are specified, the mobile transmits with a higher power depending on its power class or state of revision (phase 1 or phase 2) which might cause the CMD to be overdriven.

Example: **GSM1800/1900 phase 1:**
Minimum level with the power class 2 mobile is +4 dBm (power control level 13). However, the mobile involved is a a mobile of power class 1, which is why 10 dBm (10) is used for the transmission.

GSM900:
Minimum level with phase 2 is 5 dBm (19). However, the mobile involved is a mobile of power class 1, which is why 13 dBm (15) is used for the transmission.

POWER CHANGE

Input of type of signalling on power change:

- SLOW (Default): Power change via the SACCH.
- FAST: Power change via the FACCH (channel change on identical channel, however different power).
  Advantage: time-saving.

  Note:
  The CMD does not check whether the new power has already been achieved by the mobile at the end of the command (be careful with remote-control programs).

DRX

Discontinuous reception (2 to 9); (parameter BS_PA_MFRMS)
2: short timeout period, fast response (default)
9: long timeout period, saves battery power

SIGNAL. MODE

This softkey is used to determine the number of messages transferred to the mobile station and thus the time required for the location update and the call setup.

There are three possible settings (VAR spinwheel + ENTER):

STANDARD (Default) implies that signalling is completely performed according to GSM. This corresponds to a detailed signalling where all parameters of the mobile station are polled.

FAST implies that signalling is reduced to the most necessary messages. Only the IMEI is additionally polled.

FAST WITHOUT EQUIP. ID corrsponds to the position FAST, however, the IMEI is not polled. Therefore, this is the fastest possible type of signalling.

LOC. UPD. MODE

Location update mode.

Two toggle positions are provided:

ALWAYS (Default) implies that the attach bit is set. This causes the mobile station to perform a location update after every switch-on.

AUTO implies that the attach bit is cleared. The mobile station only performs the location update if it seems to be not registered. This may be the case when the SIM card is changed or the network parameters are varied in the CMD (e.g. location area).

DEFAULT SUBSCRIB.

This softkey only appears if the location update mode is set to AUTO. Thus the IMSI can be entered which is used as a default in the signalling for the paging.

For input of the IMSI the following format is valid:
MCC (3) MNC (2) MSIN (≤10)

The number may be entered with or without points. If points are used, they must be at the correct position.

Example of valid entries:

001.01.0000000001
123121234567890
123.12.1

In the case of GSM1900, the MNC features a three-digit code.

MCC

Mobile country code.

MNC

Mobile network code.

In the case of GSM1900 the MNC features a three-digit code. If the MNC value is 010 and the MCC value 001 (default), the MNC value 010 is coded other than specified for reasons of compatibility. This enables mobiles to be measured that only accept a two-digit MNC.

NCC

Network colour code (PLMN Colour code).

BCC

Base station colour code
(determines the training sequence/midamble, etc).

BA LIST

Selection of the configuration menu "BA LIST".

This menu permits to select the various neighbouring cells
(see section 2.4.6.6).

ACCESS

NOT BARRED (default):
Default status for measurements by means of signalling.

BARRED:
The cell is barred for the mobile, ie the mobile is not allowed to perform a location update.

LOC. AREA

Location area.

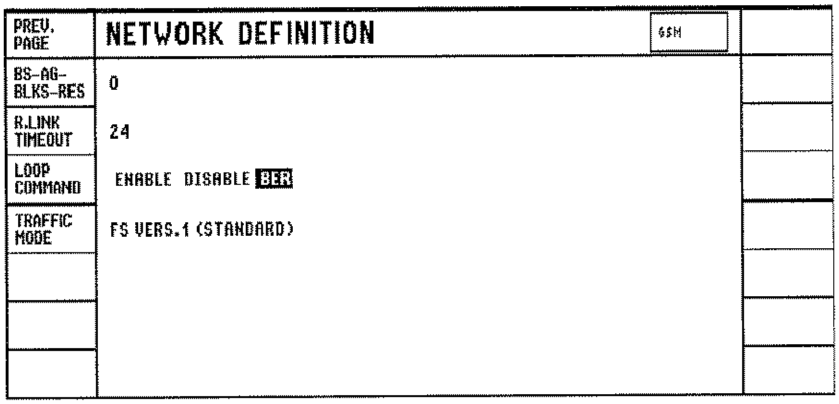


Fig. 2.4-35 NETWORK DEFINITION menu (2nd page)

PREV. PAGE

Change to first page of the NETWORK DEFINITION menu.

BS-AG-BLKS-RES

Signalling parameter BS_AGS_BLKS_RES

Value range: 0 (default) to 9

R.LINK TIMEOUT

Configuration of radio-link timeout of mobile.

Permissible values: 4, 8, 12, 16, to 60, 64

4: short timeout of mobile
64: long timeout of mobile

LOOP COMMAND

Control of close/open-loop command. In the case of BER measurements the mobile has to return the received bits. This is the case when a close-loop command is sent to the mobile. Returning of received bits is interrupted with the open-loop command. The close-loop command is also useful for transmitter measurements as it permits the required pseudo-random-modulated signal to be returned to the transmitter. If the test system sends a pseudo-random bit modulation, the signal sent by the mobile is also pseudo-random-modulated when a close-loop command is given.

ENABLE: If the test system sends a pseudo-random modulation (PSR2E9-1, PSR2E11-1, PSR2E15-1, PSR2E16-1 and BER measurement), the close-loop command is automatically sent to the mobile. If no pseudo-random modulation is sent (ECHO, LOOP, HANDSET) the open-loop command is automatically sent to the mobile.

DISABLE: CMD does not send a close- or open-loop command (not even for BER measurements).

BER: CMD sends the close- and open-loop commands for BER measurements only. This is the default setting.

TRAFFIC MODE

Configuration of desired traffic mode.

FS VERS.1 (STANDARD):	Voice transmission with standard full-rate voice coder (default).
FS VERS.2 (ENHANCED):	Voice transmission with enhanced full-rate voice coder. If the mobile does not have an enhanced full-rate voice coder, the standard full-rate voice coder is set when a call is set up.

2.4.6.6 Configuration Menu BA LIST

This menu permits to enter the neighbouring cells transmitted from the CMD (base station) to the mobile. The channel numbers are selected by means of the spinwheel and subsequent pressing of the ENTER key. The BCCH channel always belongs to the selected channels.

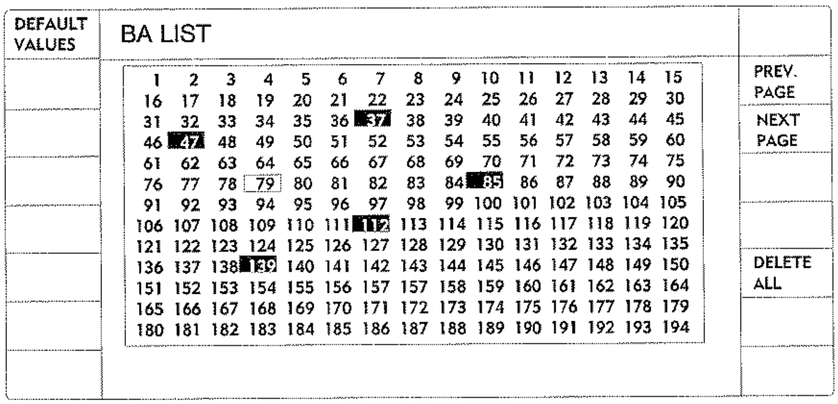


Fig. 2.4-36 BA LIST menu

DEFAULT VALUES — Selection of default values.

PREV. PAGE — Only with GSM1800 and GSM1900.

Due to the large number of channel numbers, there are several pages. Selection with prev. or next page.

NEXT PAGE

DELETE ALL — All selected channels are deleted. Subsequent input with VAR + ENTER.

2.4.6.7 Configuration Menu BS SIGNAL DEFINITION

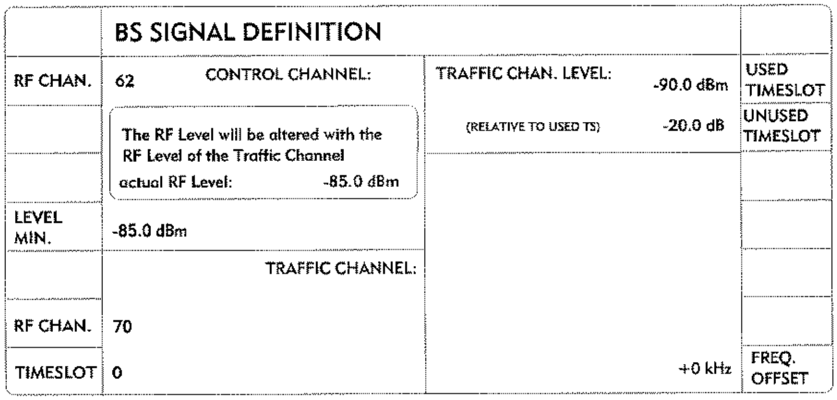


Fig. 2.4-37 BS SIGNAL DEFINITION menu

This configuration menu permits to determine the parameters of the RF signals transmitted from the measuring instrument to the mobile station. An RF synthesizer provides the common control channel (continuous BCCH carrier), the second one simulates the traffic channel.

Note:
If this menu is called up from the location update menu, the level of the control channel changes immediately after a new setting has been performed.

RF CHAN.

This softkey is used to set the RF channel of the common control channel. The timeslot is 0 and cannot be varied. The RF level of the common control channel is automatically set together with that of the traffic channel and displayed accordingly.

LEVEL MIN.

The lower level limit of the control channel can be varied using this softkey (default value is -85 dBm).

RF CHAN.

to

UNUSED TIMESLOT

These 4 softkeys permit to set the parameters of the traffic channel.

FREQ. OFFSET

Input of a frequency offset of up to ±100 kHz for the CMD transmitter signals.

This function is used to test the frequency locking bandwidth of the mobile for synchronization (offset remains even after call setup).

2.4.6.8 Configuration Menu RF CONNECTOR/EXT. ATTENUATION

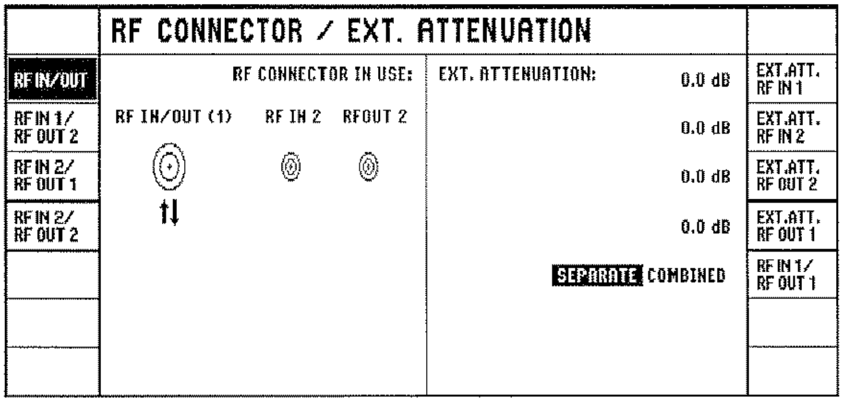


Fig. 2.4-38 RF CONNECTOR/EXT. ATTENUATION menu

The CMD is equipped with 3 RF connectors:

- A bidirectional input/output (RF IN/OUT)
- A sensitive input (RF IN2), (in the case of certain models with Option CMD-B30 only).
- A high-level output (RF OUT2), (in the case of certain models with Option CMD-B30 only).

These three connectors can be used not only alternately, but also in combinations. There are 4 possible combinations. For each of the connectors, an attenuation value can be entered on the CMD which is taken into account in the level settings and level measurements; negative attenuation values are gains.

RF IN/OUT

to

RF IN2/
RF OUT2

These four softkeys permit to select one of the four input/output combinations.

EXT. ATT.
RF IN/OUT

and/or

EXT. ATT.
RF IN 1

Input of external input and output attenuation (COMBINED) or input of external input attenuation (SEPARATE) for connector RF IN/OUT.

EXT. ATT. RF IN 2	Input of external input attenuation for connector RF IN2.
EXT. ATT. RF OUT 2	Input of external output attenuation for output RF OUT2.
EXT. ATT. RF OUT 1	Input of external output attenuation (SEPARATE) for connector RF IN/OUT.
RF IN 1/ RF OUT 1	Switchover between combined and separate input and output attenuation for connector RF IN/OUT. In the COMBINED (default) setting, the external value for both input and output attenuation is set via softkey EXT. ATT. RF IN/OUT. Softkey EXT. ATT. RF OUT 1 is not available in this setting. With SEPARATE selected, the input attenuation can be set via softkey EXT. ATT. RF IN 1 and the output attenuation via softkey EXT. ATT. RF OUT 1. Attenuations entered for COMBINED and SEPARATE do not influence each other.

Notes:
In the case of a few models, connectors RF IN 2 and RF OUT 2 are optional (CMD-B30).
With Modification Kit CMD-U18 the connector RF OUT 2 is not provided. Depending on the hardware version, the softkeys that are not available are blanked..

Notes for the second RF input (RF IN2):
In case the second RF input (RF IN 2) is overdriven, the RF measurements of the CMD are stopped.

The maximum possible input level for a fully driven second input is 0 dBm. It may be destroyed starting from +13 dBm.

In the case of mobiles with a maximum output power of +43 dBm, an external attenuation of at least 43 dB is thus required (ohmic attenuator pads and/or coupling attenuation by means of antennas).

Portable phones with a maximum output power of +33 dBm require an external attenuation of at least 33 dB.

2.4.6.9 Configuration Menu SYNCHRONIZATION

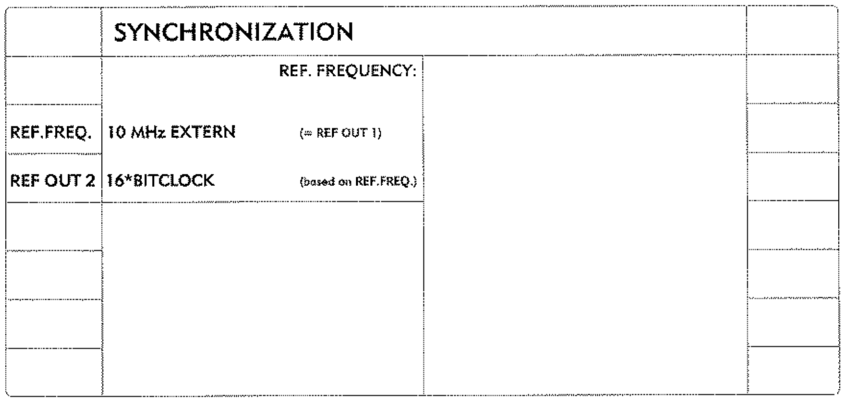


Fig. 2.4-39 SYNCHRONIZATION menu

REF. FREQ.

Selection of external synchronization with various reference frequencies at the reference frequency input or internal synchronization with 10 MHz (TCXO or OCXO CMD-B1). This frequency will then be applied at reference frequency output 1.

REF OUT 2

Selection of the frequency for reference frequency output 2.

Notes:

1. *In the case of external synchronization with squarewave signals (TTL) ensure correct signal matching. Faulty matching may causes reflections. Resulting overshoots may lead to trigger problems at the CMD input. A possible remedy is the use of a lowpass filter or an attenuator pad directly at the CMD input. Correct synchronization may be checked by comparing the signal REF OUT 1 or REF OUT 2 with the input signal.*

2. *With external synchronization selected, the title line cyclically displays a warning if there has been no synchronization e.g. due to missing or faulty input signal.*

2.4.6.10 Configuration Menu RF SIGNAL GENERATOR

It is possible to configure 7 complete parameter sets for the RF signal generator.

	RF SIGNAL GENERATOR SETTING <nummer>	
FREQ./ RF CHAN.	70	
FREQ. OFFSET	- 13.678 kHz	
BIT MOD.	PSEUDO RANDOM OFF	
RAMP	ON OFF	
RF LEVEL	- 60.0 dBm	

Fig. 2.4-40 RF SIGNAL GENERATOR SETTING menu

FREQ./ RF CHAN.	Input of RF frequency or RF channel.
FREQ. OFFSET	Input of frequency offset (fine resolution of frequency).
BIT MOD.	Selection of operating mode modulated/unmodulated.
RAMP	Selection of operating mode burst/no burst.
RF LEVEL	Input of RF output level.

Note:
For details on the input refer to section 2.4.5.2, RF GENERATOR.

2.4.6.11 Configuration Menu PRINTER

Various settings for the printout of data can made in this menu:

- Selection of printer type.
- Selection of whether a hardcopy is made immediately or whether the diagram is first stored in a file.
- Selection of whether the application report is printed immediately or first stored in a file.
- Selection of the file name under which the hardcopy or application report can be stored. The name may include a number which is incremented each time a new file is created (auto increment).
- Files can be displayed before they are printed by the CMD.

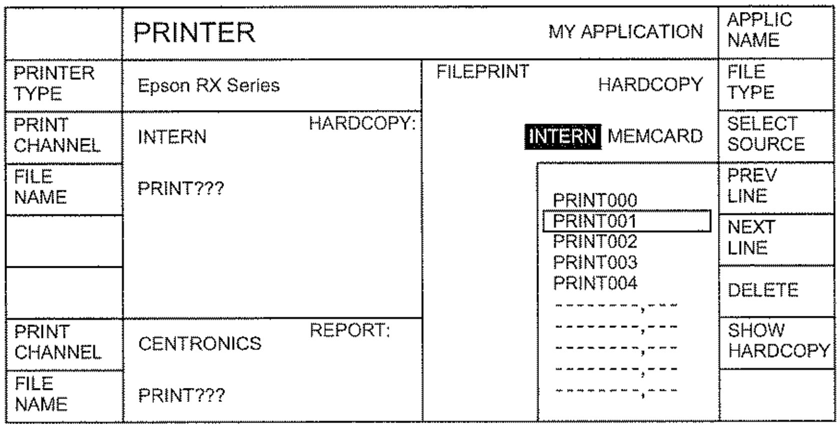


Fig. 2.4-41 PRINTER menu

PRINTER TYPE

Selection of printer type.

Softkeys in the HARDCOPY field:

PRINT CHANNEL

Selection of print channel for hardcopy.

CENTRONICS	CMD prints via the Centronics interface.
INTERN	CMD prints into an internally generated file. The name of this file can be selected with the FILE NAME softkey.
MEMCARD	CMD prints into a file generated on its memory-card drive. The name of this file can be selected with the FILE NAME softkey.

FILE NAME

Input of file name into which a hardcopy should be written. The general DOS rules apply for the file name. Groups of successive question marks in the file name are replaced by a numeral when the file is created. Counting starts at 0, if 0 already exists it is replaced by 1, an existing 1 is replaced by 2, etc. When the group of numerals is full, no more files can be created by the CMD.

Example:
Files PRINT000 to PRINT999 are created with FILE NAME in the PRINTER menu. As soon as the file PRINT999 exists no more files can be created. Therefore, with the next hardcopy the CMD will write into the PRINT999 file, however not before asking the operator whether the existing file may be overwritten. In the Printer menu shown, files PRINT000 to PRINT004 already exist. The next hardcopy command on the print channel INTERN would create the file PRINT005.

This softkey cannot be used if CENTRONICS has been selected under PRINT CHANNEL.

Softkeys in the REPORT field:

PRINT CHANNEL

Selection of print channel for the different application reports.

CENTRONICS	CMD directly prints onto the Centronics interface.
INTERN	CMD prints into an internally created file. You may choose a name for this file with the FILE NAME softkey.
MEMCARD	CMD prints into a file created on its memory-card drive. You may choose a name for this file with the FILE NAME softkey.
OFF	CMD ignores all print commands.

FILE NAME

Same as in the HARDCOPY field. This softkey cannot be used if CENTRONICS or OFF has been selected under PRINT CHANNEL.

Note:
Irrespective of the softkey setting chosen in the REPORT field, settings may be changed by any application. Control by the application has priority!

Menu line:

APPLIC NAME

Selection of the application the report files of which are to be displayed.

This softkey can only be used if APPLIC. REPORT has been selected under FILE TYPE in the FILEPRINT field.

Softkeys in the FILEPRINT field:

Here the services are available which are required for selecting, displaying and printing the files generated for printing into the INTERN or MEMCARD channel.

FILE TYPE

Selection of report type.

AUTOTEST REPORT	Files generated by the CMD during a DECT autotest.
HARDCOPY	Files generated by the CMD when the HARDCOPY key is pressed.
APPLIC. REPORT	Files generated by the CMD during execution of an application program.

SELECT SOURCE

Selection of file display.

INTERN	CMD displays internally stored files.
MEMCARD	CMD displays the files stored on the memory card.

The files selected with FILE TYPE are displayed at the right-hand side in the FILEPRINT field. The lines around a file name mark the currently displayed file and will in the following be referred to as file cursor.

PREV LINE

Downward scroll in the displayed file list. The cursor remains in its original position.

NEXT LINE

Upward scroll in the displayed file list. The cursor remains in its original position.

DELETE

Clears the cursor-selected file.

SHOW HARDCOPY

Display of cursor-selected file. Since the hardcopy display takes up the whole screen, all softkeys are disabled while the file is displayed. For printing the displayed file press the HARDCOPY key.

This softkey is only available if HARDCOPY has been selected with FILE TYPE.

SHOW REPORT

Display of cursor-selected file. To do so CMD changes to the REPORT menu.

This softkey is only available if AUTOTEST REPORT or APPLIC. REPORT has been selected under FILE TYPE. The key is at the same location as the SHOW HARDCOPY softkey.

With the print channel set to internal, the user is requested to confirm the file name. When ENTER is pressed the proposed name is used (? being replaced by corresponding numerals), STOP aborts the procedure, CLEAR allows editing of the file name. In this case the following menu is displayed.

	PRINTER		
PRINTER TYPE	Epson RX Series		
PRINT CHANNEL	INTERN		
FILE NAME	PRINT???		
START PRINT			

Fig. 2.4-42 PRINTER menu (for editing a file name)

PRINTER TYPE Selection of printer type.

PRINT CHANNEL The print channel is displayed but no changes can be made.

FILE NAME Input of file name as described above.

START PRINT Printing (into a file), which has been interrupted for editing, is now continued. Press MENU UP to abort the print procedure.

2.4.6.12 Configuration Menu REPORT

In this menu the content of the file selected with the file cursor in the PRINTER menu is displayed. The file type is indicated in the menu line: AUTOTEST REPORT for the report of a DECT autotest and APPLIC. REPORT for the report of an application.

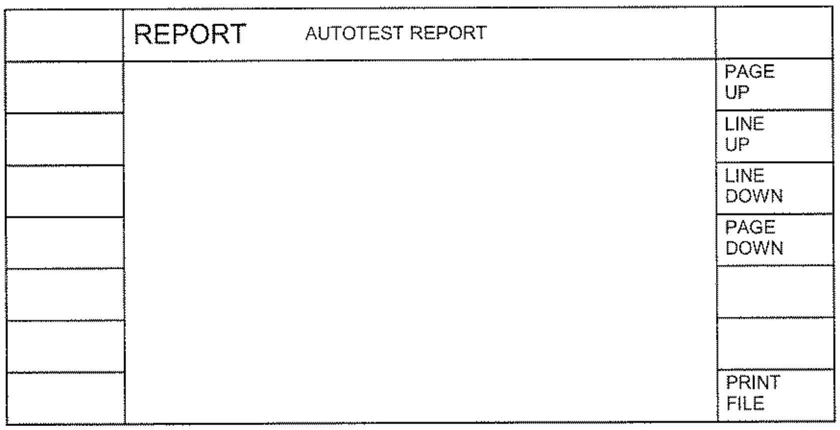


Fig. 2.4-43 REPORT menu

PAGE UP	Upward scroll of displayed text by one page.
LINE UP	Upward scroll of displayed text by one line.
LINE DOWN	Downward scroll of displayed text by one line.
PAGE DOWN	Downward scroll of displayed text by one page.
PRINT FILE	Output of displayed text to a printer.

2.4.6.13 Configuration Menu OTHER PARAMETERS

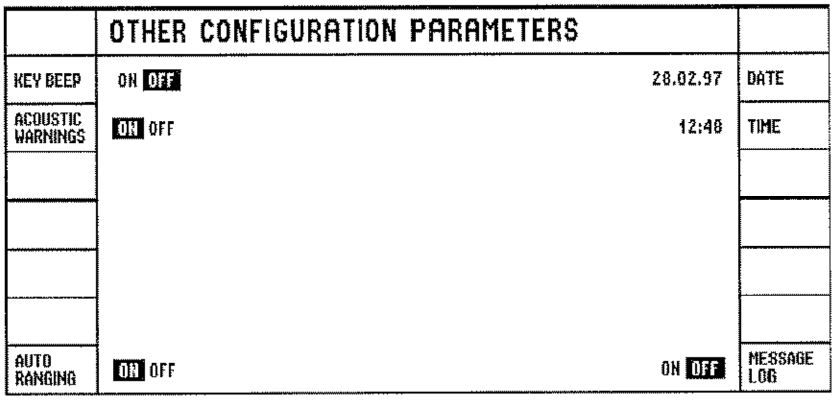


Fig. 2.4-44 OTHER CONFIGURATION PARAMETERS menus

KEY BEEP

Acoustic signal when a valid softkey is pressed (default: OFF).

ACOUSTIC WARNINGS

Acoustic signal when an error message is output (default: ON).

AUTO RANGING

Autoranging of test system (default: ON).

DATE

TIME

Setting of the realtime clock. Instead of the colon a decimal point may be entered. The entry can be edited like an alphanumeric entry.

(Format: tt.mm.jj)

MESSAGE LOG

This key permits to activate or deactivate the message log function (default).

ON: All signalling messages between mobile and test system are recorded.

OFF: (Default). When changing to OFF, all previously recorded signalling messages are stored in a file on the hard disk of the test system. This file can be output with the FTRANS program or by means of a remote-control command. In the OFF state, signalling messages are not recorded.

(Information on setup of a message log is given in the remote-control section).

2.4.7 Autotest

This test runs automatically, allowing a GSM mobile phone to be completely checked. At the end of the test run, all measured values are output on the display or on a printer in the form of a report together with an OK/FAIL statement.

After calling the autotest from the selection menu, the required test setup is graphically indicated (see Fig. 2.4-45).

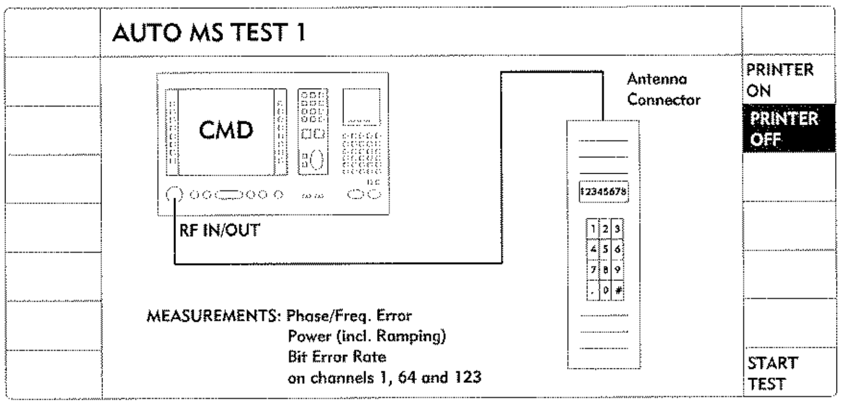


Fig. 2.4-45 AUTO MS TEST 1 menu

PRINTER ON	Switching on the printer.
PRINTER OFF	Switching off the printer.
START TEST	The test is started using this softkey. The program branches into the menu (Fig. 2.4-47).

After pressing the "CONFIG" hardkey, the configuration menu of the autotest is called up, which permits to vary the channels to be measured (see Fig. 2.4-46).

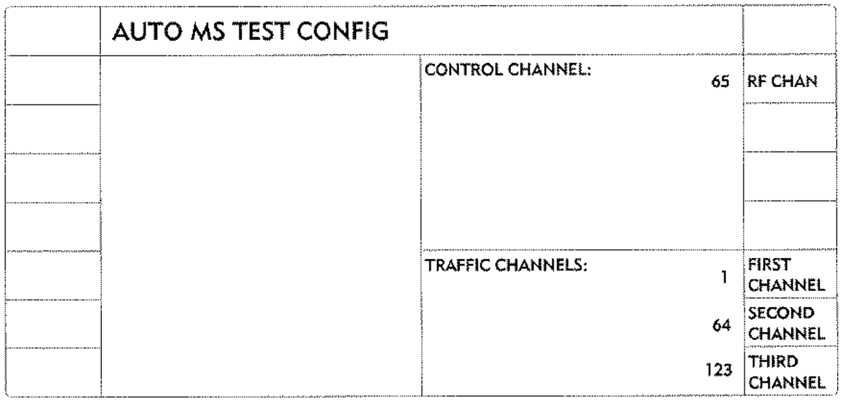


Fig. 2.4-46 AUTO MS TEST CONFIG menu

RF CHAN

Input of channel number of the BCCH channel (control channel).

FIRST CHANNEL

to

THIRD CHANNEL

All measurements are performed successively on three different traffic channels (TCH). These three softkeys are used to enter the channels of the three tests, however, note that the setting value of the BCCH channel (softkey RF CHAN) cannot be used.

To return to the "AUTOTEST" menu use the "MENU UP" hardkey.

The second main menu of the autotest (see Fig. 2.4-47) allows to enter various test parameters such as type and manufacturer of the mobile or serial number of the device under test. After the test, they are output on the hardcopy printout. Entry is made numerically via the CMD keypad. If an external AT keyboard is connected to the CMD (rear), these entries can also be made alphanumerically.

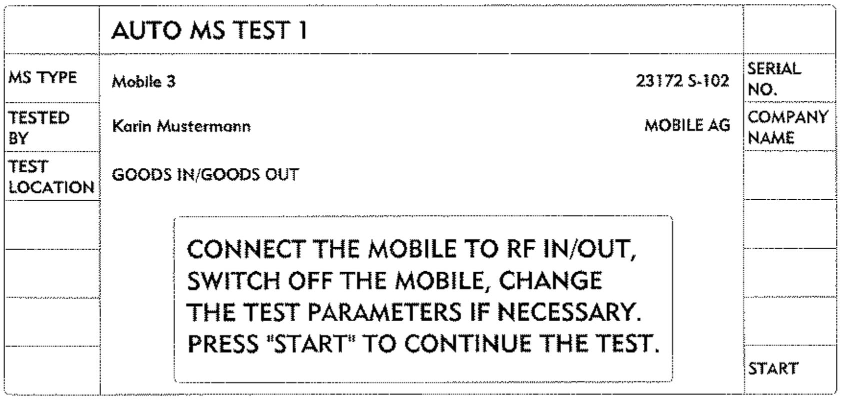


Fig. 2.4-47 AUTO MS TEST 1 menu

MS TYPE to **COMPANY NAME**	Numeric/alphanumeric entry of the test parameters.
START	Start of autotest measurements. Branching to the menu (Fig. 2.4-48).

This menu also permits to call the configuration menu of the autotest using the hardkey "CONFIG" (entry of the channels, see Fig. 2.4-46).

In the third main menu of the autotest (see Fig. 2.4-48), the user is informed on the required steps to be taken on the mobile and on the current status of the CMD in a status line at the lower edge of the screen.

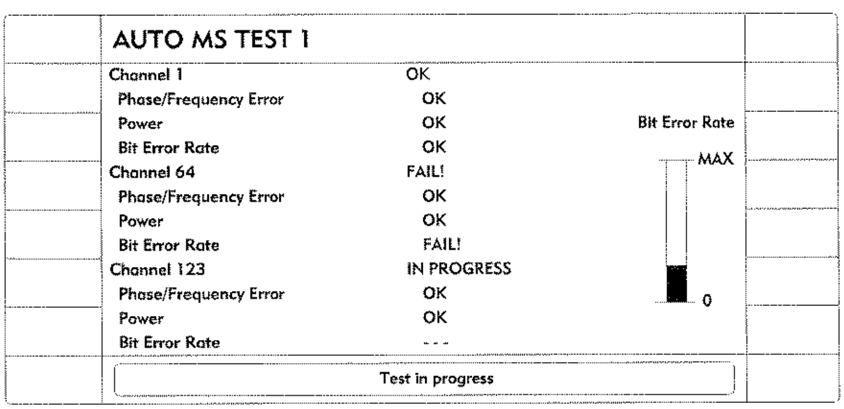


Fig. 2.4-48 AUTO MS TEST 1 menu

Step 1: The mobile is switched on on request.

Step 2: The CMD carries out a location update (registration) at the RF level given in the manual test (default value -90 dBm). A call setup is made, subsequently (call to mobile).

Step 3: The call is received by the mobile on request.

Step 4: The call is terminated on the mobile by hanging up the hook (call clearing by mobile).

Step 5: The CMD is called from the mobile by dialling (call from mobile) on request.

After this call setup, a channel change is performed on the first configured TCH channel and the mobile set to the maximum possible mobile power.

Step 6: Performing a phase/frequency error measurement

Phase errors are measured separately for peak and RMS. With phase/frequency error measurement, several bursts are used for averaging and the maximum and average values are indicated (see section GSM Measurements).

The tolerances of the manual test are used as tolerance values, i.e., they can be varied in the configuration menu "TOLERANCE PHASE FREQUENCY".

Step 7: Performing a power measurement with maximum mobile power.

Step 8: Performing a power ramp measurement

The tolerances of the manual test are used as tolerance values for power and power ramp measurements, ie, they can be varied in the configuration menu "TOLERANCE POWER RAMP".

Step 9: Performing a bit-error-rate measurement (BER). The analog time display informs about the current test progress.

The parameters of the BER measurement are specified for the autotest.

The measurement is performed with the following RF levels:

-104 dBm with GSM900 mobiles
-102 dBm with GSM900 portable phones
-100 dBm with GSM1800/GSM1900

100 074 Class II samples (corresponding to 1283 frames) are evaluated, leading to a measuring time of approx. 25 s. The tolerances for go/nogo analysis are specified (according to the GSM regulation):

Residual Bit Error Rate Class II:	*2.4%*
Residual Bit Error Rate Class Ib:	*0.4%*
Frame Erasure Rate:	*6.7%*

RBER Class Ib and FER are subject to α-weighting; i.e., with high RBER and very low FER or with very low RBER and high FER both are evaluated as "good".

After the BER measurement, the instrument switches back to the specified RF level of the manual test.

Step 10: Switchover to the second configured TCH channel.

Step 11: The measurements described under steps 6 to 9 are repeated on the second TCH channel.

Step 12: Switchover to the third configured TCH channel.

Step 13: The measurements described under steps 6 to 9 are repeated on the second TCH channel.

Step 14: The call to the mobile is cleared (Call Clearing by CMD).

Thereupon, the program branches to the fourth main menu of the auto test (see Fig. 2.4-49).

It is indicated whether all measurements were within the specified tolerances.

When the printer is switched on, (cf. Autotest, Fig. 2.4-45) printing is started immediately upon termination of the measurements.

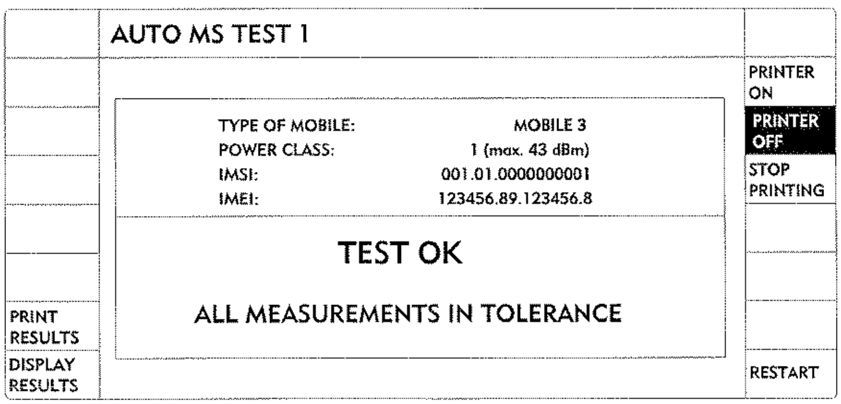


Fig. 2.4-49 AUTO MS TEST 1 menu

PRINT RESULTS — Starts printing, eg for a second printout.

DISPLAY RESULTS — Output of the test report on the LCD of the CMD (see Fig. 2.4-50).

PRINTER ON — Switching on printer (start using softkey "PRINT RESULTS", printing is started with the next autotest run).

PRINTER OFF — Switching off printer (no immediate printing with next autotest run).

STOP PRINTING — The data transfer to the printer is immediately stopped (the data buffer of the printer is not cleared).

RESTART — Restart autotest (eg with next mobile).

The test report can be looked up on the LCD of the CMD (see Fig. 2.4-50).

TEST RESULTS

LOCATION UPDATE		NOT PERFORMED				
CALL TO MOBILE		NOT PERFORMED				
CALL CLEARING BY MOBILE		NOT PERFORMED				
CALL FROM MOBILE		OK				OK
***** TX-MEASUREMENTS		CH: 1	CH: 62	CH: 123		
PHASE ERROR RMS	(avg)	3.4	3.2	3.2	deg	OK
PHASE ERROR PEAK	(avg)	14.0	11.6	13.2	deg	OK
FREQUENCY ERROR	(avg)	-22	0	46	Hz	OK
PHASE ERROR RMS	(max)	4.5	3.6	3.7	deg	OK
PHASE ERROR PEAK	(max)	15.0	12.3	14.9	deg	OK
FREQUENCY ERROR	(max)	-45	12	88	Hz	OK

PAGE UP

PAGE DOWN

Fig. 2.4-50 TEST RESULTS menu

Since the report consists of more lines than can be displayed on the screen, a window can be selected using the softkeys "PAGE UP" and "PAGE DOWN".

After completion of the autotest, note the following special features:

- The BCCH channel of the manual test is on the BCCH channel of the autotest.
- The TCH channel of the manual test is on the third TCH channel of the autotest.
- The parameters of the bit error rate test No. 7 are overwritten by those of the autotest.

2.4.8 NARROW SPECTRUM Menu (with Options CMD-B4 and CMD-K43 only)

This narrowband spectrum analyzer is particularly suitable for the adjustment of I/Q modulators.

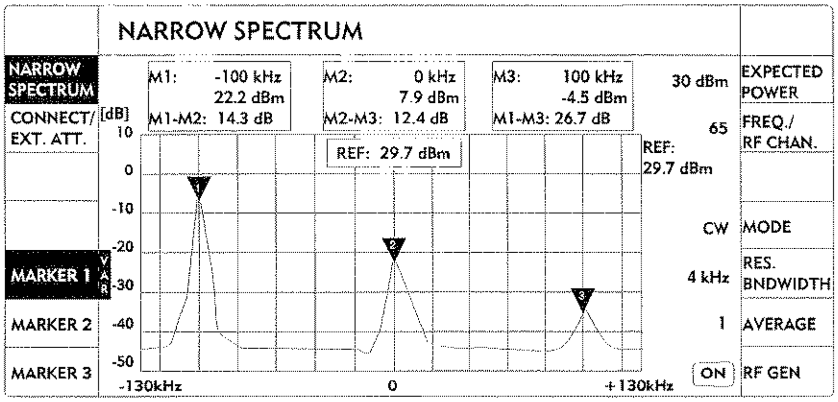


Fig. 2.4-51 NARROW SPECTRUM menu

NARROW SPECTRUM

For switching the measurement on/off.

CONNECT/ EXT. ATT.

Change to the configuration menu "RF CONNECTOR/EXT. ATT." for selecting the input and the external attenuation (see section 2.4.6.8).

MARKER 1

MARKER 2

MARKER 3

Upon activation of the key, the three markers can either be set using the spinwheel or directly via the keyboard.

EXPECTED POWER

Input of the expected power of the device under test.

FREQ./ RF CHAN.

Input of the frequency or the channel on which the measurement is to be made. For converting the channel into a frequency, the same tables can be used as for the module test (BURST ANALYSIS menu, see section 2.4.5.1).

MODE

(only with particular hardware configuration)

Switchover of operating mode:

CW: Continuous input signal
BURST: Pulsed input signal

RES. BNDWIDTH

Input of filter bandwidth (4, 10, 20, 50 or 100 kHz) with spinwheel and subsequent confirmation

AVERAGE

Input of averaging (1, 2, 5, 10, 20, 50 measurements or max. hold) with spinwheel and subsequent confirmation.

RF GEN

Change to the RF GEN menu (see section 2.4.5.2).

Important note:
Whether the level of the CMD RF generator is switched on or off is indicated next to the softkey.

With an unfavourable setting of the RF generator (frequency, level), it is possible that the CMD performs self-measurements. This applies in particular to the common input/output RF IN/OUT (common 20-dB attenuator for input and output).

2.4.9 RF MONITOR Menu

(only with particular hardware configuration).

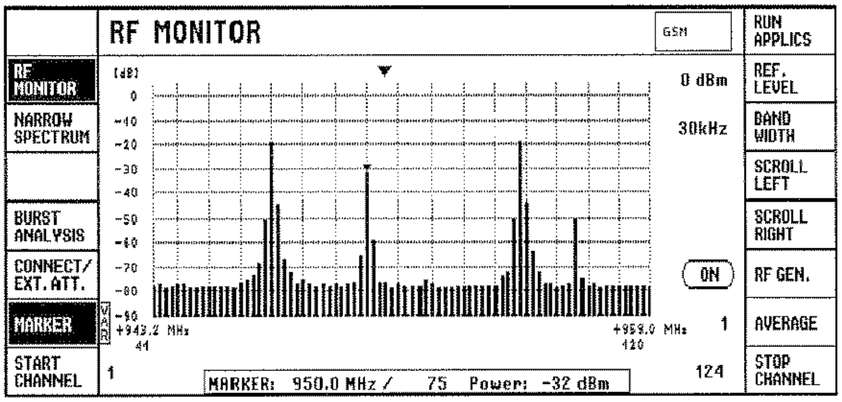


Fig. 2.4-52 RF MONITOR menu

The RF monitor is a channel occupancy meter. The test system measures the peak power of all channels between START CHANNEL and STOP CHANNEL and displays the result graphically.

Note:
The RF monitor does not meet the accuracy for power measurements specified in the data sheet.

If several input signals are present, signals that, in reality, are not available may be displayed due to cross modulation. Furthermore, at some frequencies internal signals of the test system may appear in the display (Setting GSM1800: 1833.0 MHz, 1854.6 MHz and 1867.8 MHz; setting GSM1900: 1848.0 MHz, 1912.0 MHz, 1936.0 MHz, 1946.6 MHz and 1952.0 MHz).

RF MONITOR

Start and stop of RF monitor.

NARROW SPECTRUM

(with Option CMD-K43 only)

Change to NARROW SPECTRUM menu (see section 2.4.8).

BURST ANALYSIS

Change to BURST ANALYSIS menu (see section 2.4.5.1).

CONNECT EXT. ATT.

Change to configuration menu RF CONNECTOR/EXT. ATTENUATION (see section 2.4.6.8).

MARKER

With this key active (black), the marker (small arrow on the bargraph display) can be moved from channel to channel by means of the spinwheel. In the lower part of the display the channel number, frequency and peak power of the selected channel are displayed.

START CHANNEL

Input of start channel (unit key: dBm) or start frequency (unit key: MHz). When the entry is confirmed with ENTER, the last unit used is retained.

Outside the defined band limits the system uses fictitious channel numbers like in the module test (BURST ANALYSIS menu, see section 2.4.5.1).

REF. LEVEL

Input of reference level (0 dB line in the display). The setting must be such that the total power of all channels applied to the test system is below or equal to the reference level. If the applied total power is greater than the set reference level, considerable measurement errors may occur due to overdriving. An overdrive condition can be recognized by the attempt to increase the reference level.

BAND WIDTH

(with Option CMD-B42 only)

Setting of the measurement bandwidth. The test bandwidth can be varied between 30 kHz and 100 kHz with the aid of the spinwheel.

SCROLL LEFT

SCROLL RIGHT

If the range between start and stop channel covers more than the channels displayed on the screen, these keys are displayed. They permit the displayed range to be shifted to the right or left.

RF GEN.

Selection of RF GENERATOR menu. If the RF generator is active, ON displayed next to the RF GEN. key indicates that the generator can influence the measurement.

AVERAGE

This key permits to set averaging for several peak-power measurements. The displayed result is the arithmetic mean of all peak-power values measured on the selected channel.

STOP CHANNEL

Input of stop channel or stop frequency. The input is made as for the start channel.

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3 Remote Control

3.1 Introduction

The instrument is equipped with a serial interface (RS 232-C) as standard and, optionally, with an IEC-bus interface according to standard IEC 625.1/IEEE 488.2. The connector is located at the rear of the instrument and permits to connect a controller for remote control. The instrument supports the SCPI version 1992.0 (Standard Commands for Programmable Instruments). The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers (see Section 3.5.1).

This section assumes basic knowledge of IEC-bus programming and operation of the controller. A description of the interface commands is to be obtained from the relevant manuals.
The requirements of the SCPI standard placed on command syntax, error handling and configuration of the status registers are explained in detail in the respective sections. Tables provide a fast overview of the commands implemented in the instrument and the bit assignment in the status registers. The tables are supplemented by a comprehensive description of every command and the status registers.

3.2 Brief Instructions

The short and simple operating sequence given below permits fast putting into operation of the instrument and setting of its basic functions. Remote control via IEC bus assumes that the IEC-bus address, which is factory-set to 1, has not been changed.

1. Connect instrument and controller using IEC-bus cable.
2. Write and start the following program on the controller:

```
CALL IBFIND("DEV1", device%)                 Open channel to the instrument
CALL IBPAD(device%, 28)                      Inform controller about instrument address
CALL IBWRT(device%, "*RST;*CLS")             Reset instrument
CALL IBWRT(device%, "CONF:CHAN:ARFC 50")     Set channel 50
CALL IBWRT(device%, "PROC:SEL MAN")          Set MS or BS test
```

The CMD then performs a location update if a mobile is connected and is ready to set up a call with this mobile.

3. To return to manual control, press the [LOCAL] key at the front panel.

The CMD can also be addressed via the serial interface using the same commands. To this end, the terminal emulation of Microsoft Windows, for example, can be used on the controller.

Via RS-232 only one unit can be controlled at a time. Those program parts in the above examples which contain addressing or are IEC/IEEE-bus-specific are irrelevant in this case. The above example is reduced to the following commands:

```
"*RST;*CLS"
"CONF:CHAN:ARFC 50"
"PROC:SEL MAN"
```

The character strings must be terminated by a delimiter.

3.3 Switchover to Remote Control

On power-on, the instrument is always in the manual operating state ("LOCAL" state) and can be operated via the front panel. It is switched to remote control ("REMOTE" state) as soon as it receives a command from a controller. During remote control, operation via the front panel is disabled. The instrument remains in the remote state until it is reset to the manual state via the front panel or via remote control (see Section 3.3.3). Switching from manual operation to remote control and vice versa does not affect the instrument settings.

3.3.1 Setting the Device Address

The IEC-bus address of the instrument is factory-set to 1. It can be changed manually in the CONFIG-MENU/IEEE-ADDRESS menu or via the remote control interfaces. Addresses 0 to 30 are permissible.

Manually:

- ➢ Call CONFIG-MENU/IEEE-ADDRESS menu
- ➢ Enter desired address
- ➢ Terminate input using the [1x/ENTER] key

Via IEC bus (or via the serial interface):

`CALL IBFIND("DEV1", device%)`	Open channel to the instrument
`CALL IBPAD(device%, 1)`	Inform controller about old address
`CALL IBWRT(device%, "SYST:COMM:GPIB:ADDR 20")`	Set instrument to new address
`CALL IBPAD(device%, 20)`	Inform controller about new address

3.3.2 Indications during Remote Control

In the REMOTE state, no menus but only the keyword REMOTE and, unless configured otherwise, the input and output strings of the remote-control interface are indicated on the display.

3.3.3 Return to Manual Operation

Return to manual operation is possible via the front panel or the IEC bus.

Manually: ➢ Press the [LOCAL] key.

Notes: *Before switchover, command processing must be completed as otherwise switchover to remote control is effected immediately.*

The [LOCAL] key can be disabled by the universal command LLO (see annex 3) in order to prevent unintentional switchover. In this case, switchover to manual mode is only possible via the IEC bus.

The [LOCAL] key can be enabled again by deactivating the REN line of the IEC bus (see annex A 3).

-Switchover to LOCAL is not possible via the serial interface.

Via IEC bus:

```
...
CALL IBLOC(device%)
...
```

Set instrument to manual operation

3.4 IEC-bus Messages

The messages transferred via the data lines of the IEC bus (see annex A3) can be divided into two groups:

- **interface messages and**
- **device messages.**

The serial interface only recognizes device messages.

3.4.1 Interface Messages

Interface messages are transferred on the data lines of the IEC bus, the "ATN" control line being active. They are used for communication between controller and instrument and can only be sent by a controller which has the IEC-bus control. Interface commands can be subdivided into

- **universal commands and**
- **addressed commands.**

Universal commands act on all devices connected to the IEC bus without previous addressing, addressed commands only act on devices previously addressed as listeners. The interface messages relevant to the instrument are listed in annex A3.

3.4.2 Device Messages (Commands and Device Responses)

Device messages are transferred on the data lines of the remote-control interface, the "ATN" control line not being active. ASCII code is used. A distinction is made according to the direction in which they are sent on the remote-control interface:

– **Commands** are messages the controller sends to the instrument. They operate the device functions and request information.
The commands are subdivided according to two criteria:

1. According to the effect they have on the instrument:

   Setting commands cause instrument settings such as reset of the instrument or setting the output level to 1 volt.

   Queries cause data to be provided for output on the remote-control interface, e.g. for identification of the device or polling the active input.

2. According to their definition in standard IEEE 488.2:

   Common Commands are exactly defined as to their function and notation in standard IEEE 488.2. They refer to functions such as management of the standar-dized status registers, reset and selftest.

   Device-specific commands refer to functions depending on the features of the instrument such as frequency setting. A majority of these commands has also been standar-dized by the SCPI committee (cf. Section 3.5.1).

– **Device responses** are messages the instrument sends to the controller after a query. They can contain measurement results, instrument settings and information on the instrument status (cf. Section 3.5.4).

Structure and syntax of the device messages are described in Section 3.5. The commands are listed and explained in detail in Section 3.6.

3.5 Structure and Syntax of the Device Messages

3.5.1 SCPI Introduction

SCPI (Standard Commands for Programmable Instruments) describes a standard command set for programming instruments, irrespective of the type of instrument or manufacturer. The goal of the SCPI consortium is to standardize the device-specific commands to a large extent. For this purpose, a model was developed which defines the same functions inside a device or for different devices. Command systems were generated which are assigned to these functions. Thus it is possible to address the same functions with identical commands. The command systems are of a hierarchical structure. Fig. 3-1 illustrates this tree structure using a section of command system SOURce, which operates the signal sources of the devices. The other examples concerning syntax and structure of the commands are derived from this command system.
SCPI is based on standard IEEE 488.2, i.e. it uses the same syntactic basic elements as well as the common commands defined in this standard. Part of the syntax of the device responses is defined with greater restrictions than in standard IEEE 488.2 (see Section 3.5.4, Responses to Queries).

3.5.2 Structure of a Command

The commands consist of a so-called header and, in most cases, one or more parameters. Header and parameter are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several key words. Queries are formed by directly appending a question mark to the header.

Note: *The commands of the SOURCE system used in the following examples are not implemented in the CMD.*

Common commands

Common commands consist of a header preceded by an asterisk "*" and one or several parameters, if any.

Examples:

`*RST`	RESET, resets the device
`*ESE 253`	EVENT STATUS ENABLE, sets the bits of the event status enable register
`*ESR?`	EVENT STATUS QUERY, queries the contents of the event status register.

Device-specific commands

Hierarchy: Device-specific commands are of hierarchical structure (see Fig. 3-1). The different levels are represented by combined headers. Headers of the highest level (root level) have only one key word. This key word denotes a complete command system.

Example: `SOURce` This key word denotes the command system `SOURce`.

For commands of lower levels, the complete path has to be specified, starting on the left with the highest level, the individual key words being separated by a colon ":".

Example: `SOURce:FM:EXTernal:COUPling AC`

This command lies in the fourth level of the SOURce system. It sets the coupling of the external signal source to AC.

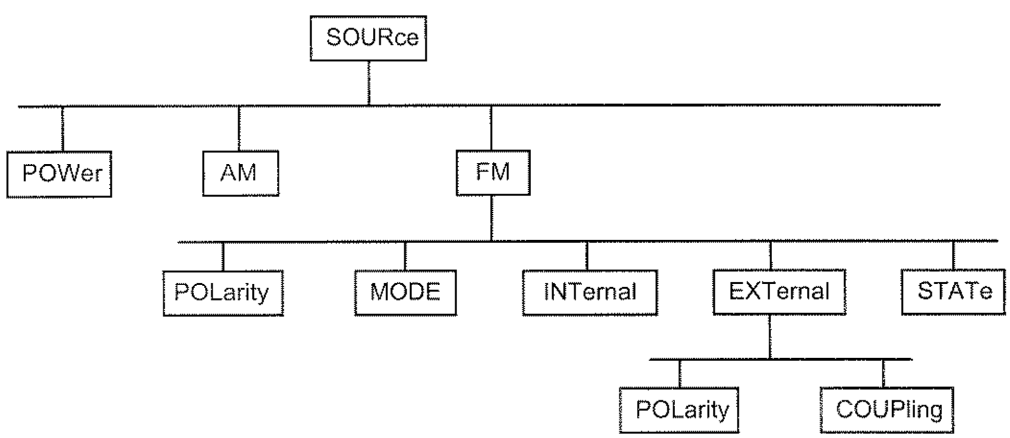


Fig. 3-1 Tree structure of the SCPI command systems using the SOURce system by way of example

Some key words occur in several levels within one command system. Their effect depends on the structure of the command, that is to say, at which position in the header of a command they are inserted.

Example: `SOURce:FM:POLarity NORMal`
This command contains key word POLarity in the third command level. It defines the polarity between modulator and modulation signal.

`SOURce:FM:EXTernal:POLarity NORMal`
This command contains key word POLarity in the fourth command level. It defines the polarity between modulation voltage and the resulting direction of the modulation only for the external signal source indicated.

Optional key words: Some command systems permit certain key words to be optionally inserted into the header or omitted. These key words are marked by square brackets in the description. The full command length must be recognized by the instrument for reasons of compatibility with the SCPI standard. Some commands are considerably shortened by these optional key words.

Example: `[SOURce]:POWer[:LEVel][:IMMediate]:OFFSet 1`
This command immediately sets the offset of the signal to 1 volt. The following command has the same effect:
`POWer:OFFSet 1`

Note: *An optional key word must not be omitted if its effect is specified in detail by a numeric suffix.*

Long and short form: The key words feature a long form and a short form. Either the short form or the long form can be entered, other abbreviations are not permissible.

Example: `STATus:QUEStionable:ENABle 1= STAT:QUES:ENAB 1`

Note: *The short form is marked by upper-case letters, the long form corresponds to the complete word. Upper-case and lower-case notation only serve the above purpose, the instrument itself does not make any difference between upper-case and lower-case letters.*

Parameter: The parameter must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma ",". A few queries permit the parameters MINimum, MAXimum and DEFault to be entered. For a description of the types of parameter, refer to Section 3.5.5.

Example: `SOURce:POWer:ATTenuation? MAXimum` Response: `60`
This query requests the maximal value for the attenuation.

Numeric suffix: If a device features several functions or features of the same kind, e.g. inputs, the desired function can be selected by a suffix added to the command. Entries without suffix are interpreted like entries with the suffix 1.

Example:. `SOURce:FM:EXTernal2:COUPling AC`
This command sets the coupling of the second external signal source.

3.5.3 Structure of a Command Line

A command line may consist of one or several commands. It is terminated by a <New Line>, a <New Line> with EOI or an EOI together with the last data byte. Quick BASIC automatically produces an EOI together with the last data byte.

Several commands in a command line are separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon.

Example:
`CALL IBWRT(device%, "SOURce:POWer:CENTer MINimum;:OUTPut:ATTenuation 10")`

This command line contains two commands. The first command is part of the SOURce system and is used to specify the center frequency of the output signal. The second command is part of the OUTPut system and sets the attenuation of the output signal.

If the successive commands belong to the same system, having one or several levels in common, the command line can be abbreviated. To this end, the second command after the semicolon starts with the level that lies below the common levels (see also Fig. 3-1). The colon following the semicolon must be omitted in this case.

Example:
`CALL IBWRT(device%, "SOURce:FM:MODE LOCKed;:SOURce:FM:INT:FREQuency 1kHz")`

This command line is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the SOURce command system, subsystem FM, i.e. they have two common levels.
When abbreviating the command line, the second command begins with the level below SOURce:FM. The colon after the semicolon is omitted.

The abbreviated form of the command line reads as follows:

`CALL IBWRT(device%, "SOURce:FM:MODE LOCKed;INT:FREQuency 1kHz")`

However, a new command line always begins with the complete path.

Example:
```
CALL IBWRT(device%, "SOURce:FM:MODE LOCKed")
CALL IBWRT(device%, "SOURce:FM:INT:FREQuency 1kHz")
```

3.5.4 Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

1. The requested parameter is transmitted without header.
   Example: `SOURce:EXTernal:COUPling?` Response: `AC`
2. Maximum values, minimum values and all further quantities, which are requested via a special text parameter are returned as numerical values.
   Example: `FREQuency? MAX` Response: `10E3`
3. Numerical values are output without a unit. Physical quantities are referred to the basic units or to the units set using the Unit command.
   Example: `FREQuency?` Response: `1E6` for 1 MHz
4. Truth values <Boolean values> are returned as 0 (for OFF) and 1 (for ON).
   Example: `OUTPut:STATe?` Response: `1`
5. Text (character data) is returned in a short form (see also Section 3.5.5).
   Example: `SOURce:FM:SOURce?` Response: `INT1`

3.5.5 Parameters

Most commands require a parameter to be specified. The parameters must be separated from the header by a "white space". Permissible parameters are numerical values, Boolean parameters, text, character strings and block data. The type of parameter required for the respective command and the permissible range of values are specified in the command description (see Section 3.6).

Numerical values

Numerical values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not permissible. In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), MOHM and MHZ are also permissible), K (kilo), M (milli), U (micro) and N (nano). It the unit is missing, the basic unit is used.

Example:
`SOURce:FREQuency 1.5 kHz = SOURce:FREQuency 1.5E3`

Special numerical values

The texts MINimum, MAXimum, DEFault, UP and DOWN are interpreted as special numerical values.

In the case of a query, the numerical value is provided.

Example: Setting command: `SOURce:VOLTage MAXimum`
Query: `SOURce:VOLTage?` Response: `15`

MIN/MAX — MINimum and MAXimum denote the minimum and maximum value.

DEF — DEFault denotes a preset value which has been stored in the EPROM. This value conforms to the default setting, as it is called by the *RST command

UP/DOWN — UP, DOWN increases or reduces the numerical value by one step. The step width can be specified via an allocated step command (see annex C3, List of Commands) for each parameter which can be set via UP, DOWN.

INF/NINF — INFinity, Negative INFinity (NINF) Negative INFinity (NINF) represent the numerical values -9.9E37 or 9.9E37, respectively. INF and NINF are only sent as device reponses.

NAN — Not A Number (NAN) represents the value 9.91E37. NAN is only sent as device response. This value is not defined. Possible causes are the division of zero by zero, the subtraction of infinite from infinite and the representation of missing values.

Boolean Parameters

Boolean parameters represent two states. The ON state (logically true) is represented by ON or a numerical value unequal to 0. The OFF state (logically untrue) is represented by OFF or the numerical value 0. 0 or 1 is provided in a query.

Example: Setting command: `SOURce:FM:STATe ON`
Query: `SOURce:FM:STATe?` Response: `1`

Text

Text parameters observe the syntactic rules for key words, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example: Setting command: `OUTPut:FILTer:TYPE EXTernal`
Query: `OUTPut:FILTer:TYPE?` Response `EXT`

Strings

Strings must always be entered in quotation marks (' or ").

Example: `SYSTem:LANGuage "English"` or
`SYSTem:LANGuage 'English'`

Block data

Block data are a transmission format which is suitable for the transmission of large amounts of data. A command using a block data parameter has the following structure:

Example: `HEADer:HEADer #45168xxxxxxxx`

ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all End or other control signs are ignored until all bytes are transmitted. Data elements comprising more than one byte are transmitted with the byte being the first which was specified by SCPI command "FORMat:BORDer".

3.5.6 Overview of Syntax Elements

The following survey offers an overview of the syntax elements.

:	The colon separates the key words of a command. In a command line the colon after the separating semicolon marks the uppermost command level.
;	The semicolon separates two commands of a command line. It does not alter the path.
,	The comma separates several parameters of a command.
?	The question mark forms a query.
*	The asterix marks a common command.
"	Quotation marks introduce a string and terminate it.
#	ASCII character # introduces block data.
	A "white space (ASCII-Code 0 to 9, 11 to 32 decimal, e.g.blank) separates header and parameter.

3.6 Description of Commands

3.6.1 Notation

In the following sections, all commands implemented in the instrument are first listed in tables and then described in detail, separated according to the command system. The notation corresponds to the one of the SCPI standards to a large extent. The SCPI conformity information can be taken from the list of commands in annex C3.

Note: *The commands indicated by way of example are not implemented in the CMD.*

Table of Commands

Command: In the command column, the table provides an overview of the commands and their hierarchical arrangement (see indentations).

Parameter: In the parameter column the requested parameters are indicated together with their specified range.

Unit: The unit column indicates the basic unit of the physical parameters.

Remark: In the remark column an indication is made on:
- whether the command does not have a query form,
- whether the command has only one query form ,
- whether this command is implemented only with a certain option of the instrument.

Indentations

The different levels of the SCPI command hierarchy are represented in the table by means of indentations to the right. The lower the level is, the farther the indentation to the right is. Please observe that the complete notation of the command always includes the higher levels as well.

Example: `SOURce:FM:MODE` iis represented in the table as follows:

SOURce	first level
:FM	second level
:MODE	third level

In the individual description, the hierarchy is represented in the corresponding way. That is to say, for each command all key words above up to the left-hand margin must be considered. An example for each command is written out at the end of the individual description.

Upper/lower case notation Upper/lower case letters serve to mark the long or short form of the key words of a command in the description (see Section 3.5.2). The instrument itself does not distinguish between upper and lower case letters.

Special characters **|** A selection of key words with an identical effect exists for several commands. These key words are indicated in the same line, they are separated by a vertical stroke. Only one of these key words has to be indicated in the header of the command. The effect of the command is independent of which of the key words is indicated.

Example: SOURce
:FREQuency
:CW|:FIXed

The two following commands of identical meaning can be formed. They set the frequency of the constantly frequent signal to 1 kHz:

```
SOURce:FREQuency:CW 1E3 = SOURce:FREQuency:FIXed 1E3
```

A vertical stroke in indicating the parameters marks alternative possibilities in the sense of "or". The effect of the command is different, depending on which parameter is entered.

Example: Selection of the parameters for the command
`SOURce:COUPling AC | DC`

If parameter AC is selected, only the AC content is fed through, in the case of DC, the DC as well as the AC content.

[ ] Key words in square brackets can be omitted when composing the header (cf. Section 3.5.2, Optional Keywords). The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.
Parameters in square brackets can optionally be incorporated in the command or omitted as well.

{ } Parameters in braces can optionally be incorporated in the command either not at all, once or several times.

3.6.2 Common Commands

The common commands are taken from the IEEE 488.2 (IEC 625-2) standard. Same commands have the same effect on different devices. The headers of these commands consist of "*" followed by three letters. Many common commands refer to the status reporting system which is described in detail in Section 3.8.

Table 3-1 Common Commands

Command	Parameter	Unit	Remark
*CLS			no query
*ESE	0...255		
*ESR?			only query
*IDN?			only query
*IST?			only query
*OPC			
*OPT?			only query
*PRE	0...255		
*PSC	0 | 1		
*RST			no query
*SRE	0...255		
*STB?			only query
*TST?			only query
*WAI			

***CLS**
CLEAR STATUS sets the status byte (STB), the standard event register (ESR) and the EVENt-part of the QUEStionable and the OPERation register to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

***ESE** 0...255
EVENT STATUS ENABLE sets the event status enable register to the value indicated. Query *ESE? returns the contents of the event status enable register in decimal form.

***ESR?**
STANDARD EVENT STATUS QUERY returns the contents of the event status register in decimal form (0 to 255) and subsequently sets the register to zero.

***IDN?**
IDENTIFICATION QUERY queries the instrument identification.
The device response is for example: "Rohde&Schwarz, CMD,0, 1.00 18.10.93"
0= serial number
1.0 18.10.93 = Firmware version number and date of delivery

***IST?**

INDIVIDUAL STATUS QUERY returns the contents of the IST flag in decimal form (0 | 1). The IST-flag is the status bit which is sent during a parallel poll (see section 3.8.3.2).

***OPC**

OPERATION COMPLETE sets bit 0 in the event status register when all preceding commands have been executed. This bit can be used to initiate a service request (cf. Section 3.7).

***OPC?**

OPERATION COMPLETE QUERY writes message "1" into the output buffer as soon as all preceding commands have been executed (cf. Section 3.7).

***OPT?**

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the options installed. The options are separated from each other by means of commas.

The responses have the following meaning:

B1	OCXO Reference
B3	Ref. Frequency In/Out
B4	DSP
B41	AF Unit
B42	IF Log. Amplifier
B43	Spectrum Measurements
B5	Speech Codec
B6	Option Basic Board
B61	IEEE Bus
B62	Memcard Interface
B63	Flashdisk
B64	EMMI/DAI
B65	Control In/Out
B7	A-Bis
B8	Coprocessor
B9	Second RF Synthesizer

Example of a device response: B1,,B4,,,,,B6,B61,,,,,,,B9

***PRE 0...255**
PARALLEL POLL REGISTER ENABLE sets parallel poll enable register to the value indicated. Query *PRE? returns the contents of the parallel poll enable register in decimal form.

***PSC** 0 | 1
POWER ON STATUS CLEAR determines whether the contents of the ENABle registers is maintained or reset in switching on.

*PSC = 0	causes the contents of the status registers to be maintained. Thus a service request can be triggered in switching on in the case of a corresponding configuration of status registers ESE and SRE.
*PSC ≠ 0	resets the registers.

Query *PSC? reads out the contents of the power-on-status-clear flag. The response can be 0 or 1.

***RST**
RESET sets the instrument to a defined default status. The command essentially corresponds to pressing the [RESET] key. The default setting is indicated in the description of commands.

***SRE** 0...255
SERVICE REQUEST ENABLE sets the service request enable register to the value indicated. Bit 6 (MSS mask bit) remains 0. This command determines under which conditions a service request is triggered. Query *SRE? reads the contents of the service request enable register in decimal form. Bit 6 is always 0.

***STB?**
READ STATUS BYTE QUERY reads the contents of the status byte in decimal form.

***TST?**
SELF TEST QUERY triggers selftests of the instrument and outputs an error code in decimal form.

WAI
WAIT-to-CONTINUE only permits the servicing of the subsequent commands after all preceding commands have been executed and all signals have settled (see also section 3.7 and "*OPC").

3.7 Instrument Model and Command Processing

The instrument model shown in Fig. 3.2 has been made viewed from the standpoint of the servicing of remote-control commands. The individual components work independently of each other and simultaneously. They communicate by means of so-called "messages".

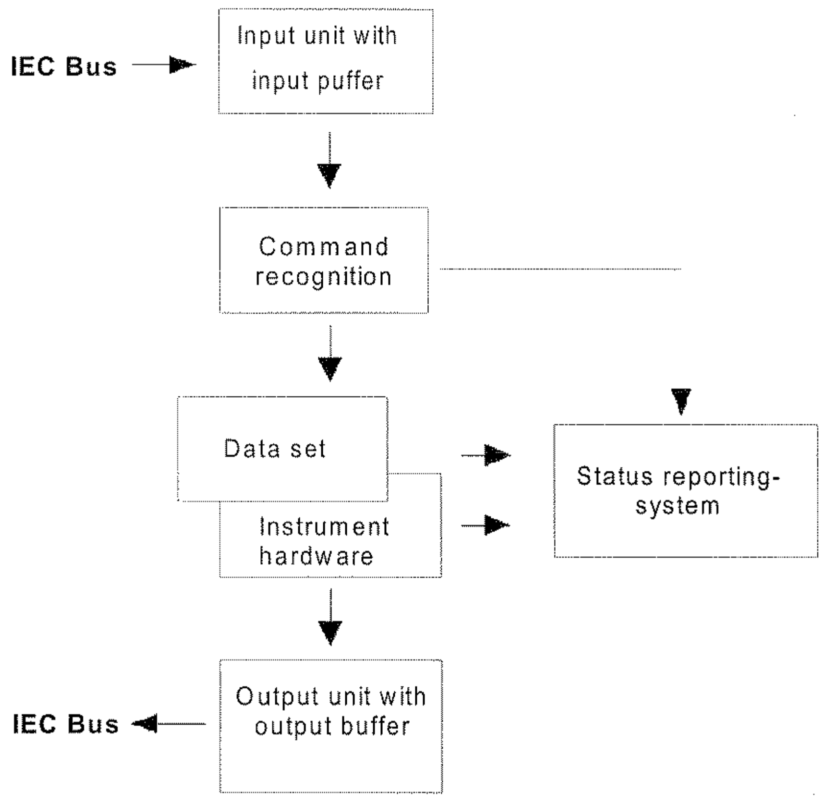


Fig. 3-2 Instrument model in the case of remote control

3.7.1 Input Unit

The input unit receives commands character by character from the remote-control interface and collects them in the input buffer. The input buffer has a size of 256 characters. The input unit sends a message to the command recognition as soon as the input buffer is full or as soon as it receives a delimiter, <PROGRAM MESSAGE TERMINATOR>, as defined in IEEE 488.2, or the interface message DCL.
If the input buffer is full, the remote-control traffic is stopped and the data received up to then are processed. Subsequently the remote-control traffic is continued. If, however, the buffer is not yet full when receiving the delimiter, the input unit can already receive the next command during command recognition and execution. The reception of a DCL clears the input buffer and immediately initiates a message to the command recognition.
In RS-232 mode, no interface message DCL is output.

3.7.2 Command Recognition

The command recognition analyses the data received from the input unit. It proceeds in the order in which it receives the data. Only a DCL is serviced with priority, a GET (Group Execute Trigger), e.g., is only executed after the commands received before as well. Each recognized command is immediately transferred to the data set but without being executed there at once.
Syntactical errors in the command are recognized here and supplied to the status reporting system. The rest of a command line after a syntax error is analysed further if possible and serviced.
If the command recognition recognizes a delimiter or a DCL, it requests the data set to set the commands in the instrument hardware as well now. Subsequently it is immediately prepared to process commands again. This means for the command servicing that further commands can already be serviced while the hardware is still being set ("overlapping execution").

3.7.3 Data Set and Instrument Hardware

Here the expression "instrument hardware" denotes the part of the instrument fulfilling the actual instrument function - signal generation, measurement etc. The controller is not included.

The data set is a detailed reproduction of the instrument hardware in the software.

Remote-control setting commands lead to an alteration in the data set. The data set management enters the new values (e.g. frequency) into the data set, however, only passes them on to the hardware when requested by the command recognition. As this is always only effected at the end of a command line, the order of the setting commands in the command line is not relevant.

The data are only checked for their compatibility among each other and with the instrument hardware immediately before they are transmitted to the instrument hardware. If the detection is made that an execution is not possible, an "execution error" is signalled to the status reporting system. All alterations of the data set are cancelled, the instrument hardware is not reset. Due to the delayed checking and hardware setting, however, it is permissible to set impermissible instrument states within one command line for a short period of time without this leading to an error message (example: simultaneous activation of FM and PM). At the end of the command line, however, a permissible instrument state must have been reached again.

Remote-control queries induce the data set management to send the desired data to the output unit.

3.7.4 Status Reporting System

The status reporting system collects information on the instrument state and makes it available to the output unit on request. The exact structure and function are described in Section 3.8

3.7.5 Output Unit

The output unit collects the information requested by the controller, which it receives from the data set management. It processes it according to the SCPI rules and makes it available in the output buffer. The output buffer has a size of 256 characters. If the information requested is longer, it is made available "in portions" without this being recognized by the controller.
If the instrument is addressed as a talker without the output buffer containing data or awaiting data from the data set management, the output unit sends error message "Query UNTERMINATED" to the status reporting system. No data are sent on the remote-control interface, the controller waits until it has reached its time limit. This behaviour is specified by SCPI.

3.7.6 Command Sequence and Command Synchronization

What has been said above makes clear that all commands can potentially be carried out overlapping. Equally, setting commands within one command line are not absolutely serviced in the order in which they have been received.

In order to make sure that commands are actually carried out in a certain order, each command must be sent in a separate command line, that is to say, with a separate IBWRT()-call.
In order to prevent an overlapping execution of commands, one of commands *OPC, *OPC? or *WAI must be used. All three commands cause a certain action only to be carried out after the hardware has been set and has settled. By a suitable programming, the contoller can be forced to wait for the respective action to occur (cf. table 3-2).

Table 3-2 Synchronisation using *OPC *OPC? and *WAI

Commnd	Action after the hardware has settled	Programming the controller
*OPC	Setting the operation-complete bit in the ESR	- Setting bit 0 in the ESE - Setting bit 5 in the SRE - Waiting for service request (SRQ)
*OPC?	Writing a "1" into the output buffer	Addressing the instrument as a talker
*WAI	Continuing the IEC-bus handshake	Sending the next command

3.8 Status Reporting System

The status reporting system (cf. Fig. 3-4) stores all information on the present operating state of the instrument and on errors which have occurred. This information is stored in the status registers and in the error queue. The status registers and the error queue can be queried via the remote-control interface.

The information is of a hierarchical structure. The register status byte (STB) defined in IEEE 488.2 and its associated mask register service request enable (SRE) form the uppermost level. The STB receives its information from the standard event status register (ESR) which is also defined in IEEE 488.2 with the associated mask register standard event status enable (ESE) and registers STATus:OPERation and STATus:QUEStionable which are defined by SCPI and contain detailed information on the instrument.

The IST flag ("Individual STatus") and the parallel poll enable register (PPE) allocated to it are also part of the status reporting system. The IST flag, like the SRQ, combines the entire instrument status in a single bit. The PPE fulfills an analog function for the IST flag as the SRE for the service request.

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB and thus is represented in Fig. 3.4.

3.8.1 Structure of an SCPI Status Register

Each SCPI register consists of 5 parts which each have a width of 16 bits and have different functions (cf. Fig. 3-3). The individual bits are independent of each other, i.e. each hardware status is assigned a bit number which is valid for all five parts. For example, bit 3 of the STATus:OPERation register is assigned to the hardware status "wait for trigger" in all five parts. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integer.

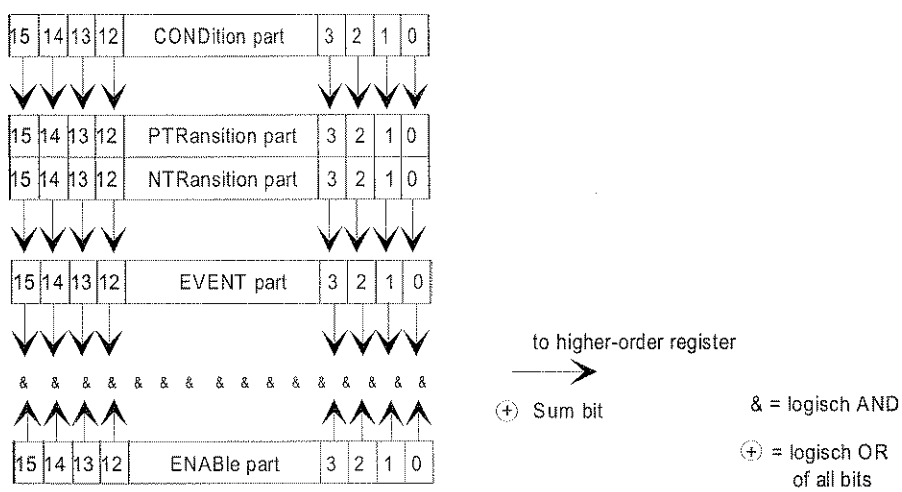


Fig. 3-3 The status-register model

CONDition part The CONDition part is directly written into by the hardware or the sum bit of the next lower register. Its contents reflects the current instrument status. This register part can only be read, but not written into or cleared. Its contents is not affected by reading.

PTRansition part The Positive-TRansition part acts as an edge detector. When a bit of the CONDition part is changed from 0 to 1, the associated PTR bit decides whether the EVENt bit is set to 1.
PTR bit =1: the EVENt bit is set.
PTR bit =0: the EVENt bit is not set.
This part can be written into and read at will. Its contents is not affected by reading.

NTRansition part The Negative-TRansition part also acts as an edge detector. When a bit of the CONDition part is changed from 1 to 0, the associated NTR bit decides whether the EVENt bit is set to 1.
NTR-Bit = 1: the EVENt bit is set.
NTR-Bit = 0: the EVENt bit is not set.
This part can be written into and read at will. Its contents is not affected by reading.

With these two edge register parts the user can define which state transition of the condition part (none, 0 to 1, 1 to 0 or both) is stored in the EVENt part.

EVENt part The EVENt part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the edge filters. It is permanently updated by the instrument. This part can only be read by the user. During reading, its contents is set to zero. In linguistic usage this part is often equated with the entire register.

ENABle part The ENABle part determines whether the associated EVENt bit contributes to the sum bit (cf. below). Each bit of the EVENt part is ANDed with the associated ENABle bit (symbol '&'). The results of all logical operations of this part are passed on to the sum bit via an OR function (symbol '+').
ENAB-Bit = 1: the associated EVENt bit does not contribute to the sum bit
ENAB-Bit = 0: if the associated EVENT bit is "1", the sum bit is set to "1" as well.
This part can be written into and read by the user at will. Its contents is not affected by reading.

Sum bit As indicated above, the sum bit is obtained from the EVENt and ENABle part for each register. The result is then entered into a bit of the CONDition part of the higher-order register.
The instrument automatically generates the sum bit for each register. Thus an event, e.g. a PLL that has not locked, can lead to a service request throughout all levels of the hierarchy.

Note: *The service request enable register SRE defined in IEEE 488.2 can be taken as ENABle part of the STB if the STB is structured according to SCPI. By analogy, the ESE can be taken as the ENABle part of the ESR.*

3.8.2 Overview of the Status Registers

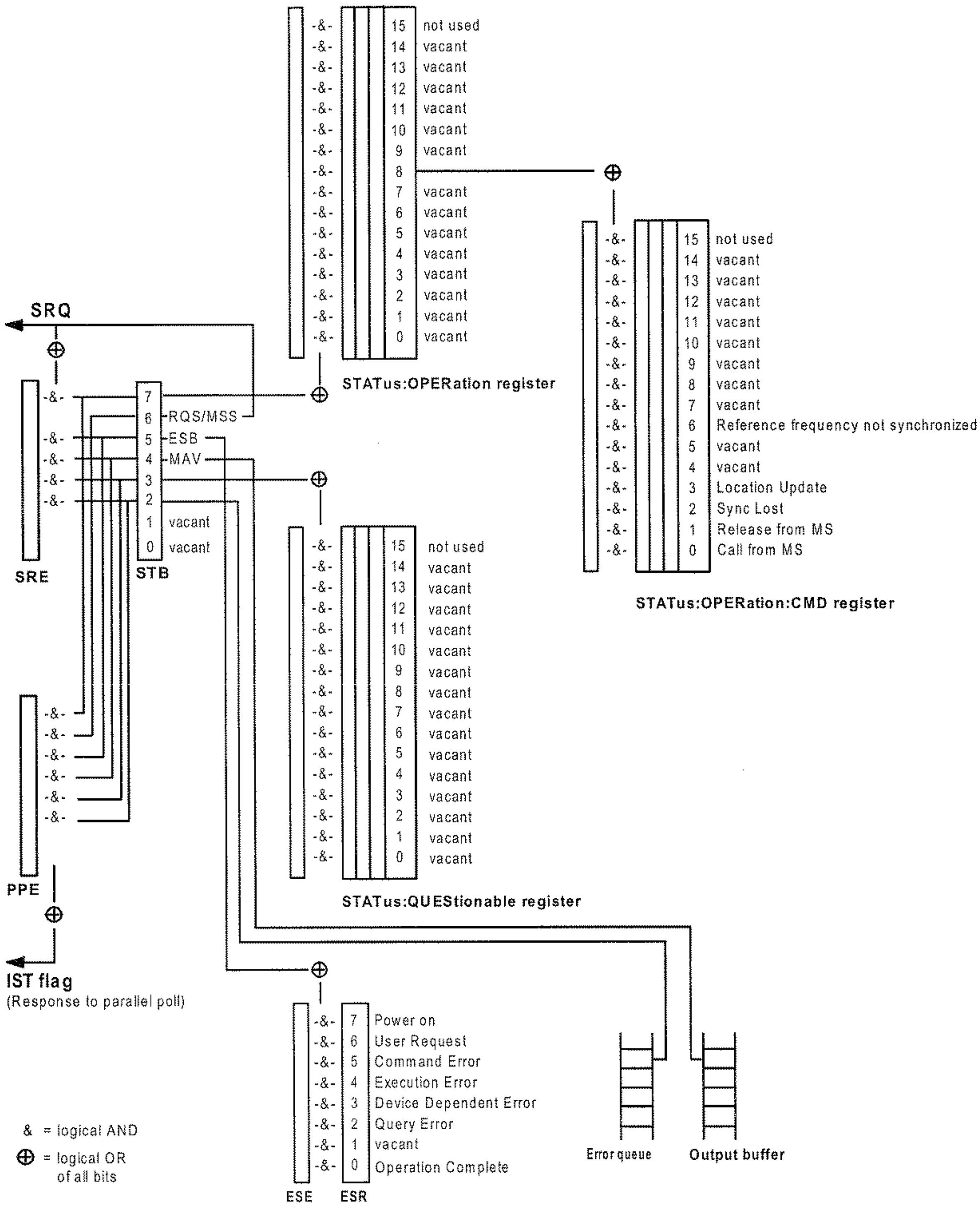


Fig. 3-4 Overview of status registers

3.8.3 Description of the Status Registers

3.8.3.1 Status Byte (STB) and Service Request Enable Register (SRE)

The STB is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. It can thus be compared with the CONDition part of an SCPI register and assumes the highest level within the SCPI hierarchy. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.
The STATUS BYTE is read out using the command "*STB?" or a serial poll.

The STB includes the SRE. It corresponds to the ENABle part of the SCPI registers as to its function. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a Service Request (SRQ) is generated on the IEC bus, which triggers an interrupt in the controller if this is appropriately configured and can be further processed there. (An SRQ cannot be triggered on the serial interface, since no appropriate hardware lines are provided there).
The SRE can be set using command "*SRE" and read using "*SRE?".

Table 3-3 Meaning of the bits used in the satus byte

Bit No.	Meaning
2	**Error Queue not empty** The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a Service Request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.
3	**QUEStionable status sum bit** The bit is set if an EVENt bit is set in the QUEStionable-Status register and the associated ENABle bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by polling the QUEStionable-Status register.
4	**MAV bit** (message available) The bit is set if a message is available in the output buffer which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller (cf. annex D3, program examples).
5	**ESB bit** Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit implies a serious error which can be specified in greater detail by polling the event status register.
6	**MSS bit** (master status smmary bit) The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.
7	**OPERation status register sum bit** The bit is set if an EVENt bit is set in the OPERation-Status register and the associated ENABle bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by polling the QUEStionable -Status register.

3.8.3.2 IST Flag and Parallel Poll Enable Register (PPE)

By analogy with the SRQ, the IST flag combines the entire status information in a single bit. It can be queried by means of a parallel poll (cf. Section 3.8.4.3) or using command "*IST?".

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are ANDed with the corresponding bits of the PPE, with bit 6 being used as well in contrast to the SRE. The Ist flag results from the ORing of all results. The PPE can be set using commands "*PRE" and read using command "*PRE?".

3.8.3.3 Event-Status-Register (ESR) und Event-Status-Enable-Register (ESE)

The ESR is already defined in IEEE 488.2. It can be compared with the EVENt part of an SCPI register. The event status register can be read out using command "*ESR?".
The ESE is the associated ENABle part. It can be set using command "*ESE" and read using command "*ESE?".

Table 3-4 Meaning of the bits used in the event status register

Bit No.	Meaning
0	**Operation Complete** This bit is set on reception of the command *OPC exactly when all previous commands have been executed.
2	**Query Error** This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	**Device-dependent Error** This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue (cf. annex B3, Error Messages).
4	**Execution Error** This bit is set if a received command is syntactically correct, however, cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue (cf. annex B3, Error Messages).
5	**Command Error** This bit is set if a command which is undefined or syntactically incorrect is received. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the rror queue (cf. annex B3, -Error Messages).
6	**User Request** This bit is set on pressing the LOCAL key, i. e., when the instrument is switched over to manual control.
7	**Power On** (supply voltage on) This bit is set on switching on the instrument.

3.8.3.4 STATus:OPERation Register

In the CONDition part, this 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 reading. It can be read using the commands `STATus:OPERation:CONDition?` bzw. `STATus:OPERation[:EVENt]?`.

Table 3-5 Meaning of the bits used in the STATus:OPERation register

Bit No.	Meaning
8	**CMD Event** This bit is set if one of the events specified in the CMD event register has occurred.

The CMD only uses bit 8 of this register.

3.8.3.5 STATus:QUEStionable Register

This register contains information on questionable instrument states. They can occur, e.g. if the instrument is operated out of its specifications. It can be queried using the commands `STATus:QUEStionable:CONDition?` or `STATus:QUEStionable[:EVENt]?`.

The CMD does not use this register.

3.8.4 Application of the Status Reporting System

In order to be able to effectively use the status reporting system, the information contained there must be transmitted to the controller and further processed there. There are several methods which are represented in the following.

In RS-232 mode, the status can only be queried with the aid of commands (see 3.8.4.4).

3.8.4.1 Service Request, Making Use of the Hierarchy Structure

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react with corresponding actions. As evident from Fig. 3.4 (Section 3.8.2), an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of a further register, the error queue or the output buffer. The corresponding setting of the ENABle parts of the status registers can achieve that arbitrary bits in an arbitrary status register initiate an SRQ. In order to make use of the possibilities of the service request, all bits should be set to "1" in enable registers SRE and ESE.

Examples (cf. Fig. 3.4, Section 3.8.2):

Use of command "*OPC" to generate an SRQ

- ➢ Set bit 0 in the ESE (Operation Complete)
- ➢ Set bit 5 in the SRE (ESB)?

  After its settings have been completed, the instrument generates an SRQ.

Indication of the end of a call setup from the mobile by means of an SRQ with the controller

- ➢ Set bit 7 in the SRE (sum bit of the STATus:OPERation register)
- ➢ Set bit 8 (CMD event) in the STATus:OPERation:ENABle.

  After a call setup has been completed, the instrument generates an SRQ.

The SRQ is the only possibility for the instrument to become active on its own. Each controller program should set the instrument such that a service request is initiated in the case of malfunction. The program should react appropriately to the service request.

3.8.4.2 Serial Poll

In a serial poll, as with command "*STB", the status byte of an instrument is queried. However, the query is implemented via interface messages and is thus clearly faster. The serial-poll method has already been defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works with instruments which do not adhere to SCPI or IEEE 488.2.

The quick-BASIC command for executing a serial poll is "IBRSP()". Serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the IEC bus.

3.8.4.3 Parallel Poll

In a parallel poll, up to eight instruments are simultaneously requested by the controller by means of a single command to transmit 1 bit of information each on the data lines, i.e., to set the data line allocated to each instrument to logically "0" or "1". By analogy to the SRE register which determines under which conditions an SRQ is generated, there is a parallel poll enable register (PPE) which is ANDed with the STB bit by bit as well considering bit 6. The results are ORed, the result is then sent (possibly inverted) as a response in the parallel poll of the controller. The result can also be queried without parallel poll by means of command "*IST".

The instrument first has to be set for the parallel poll using quick-BASIC command "IBPPC()". This command allocates a data line to the instrument and determines whether the response is to be inverted. The parallel poll itself is executed using "IBRPP()".

The parallel-poll method is mainly used in order to quickly find out after an SRQ which instrument has sent the service request if there are many instruments connected to the IEC bus. To this effect, SRE and PPE must be set to the same value.

3.8.4.4 Query by Means of Commands

Each part of every status register can be read by means of queries. The individual commands are indicated in the detailed description of the registers in Section 3.8.3. What is returned is always a number which represents the bit pattern of the register queried. Evaluating this number is effected by the controller program.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ

3.8.4.5 Error-Queue Query

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain-text error messages which can be queried via the remote control using command "SYSTem:ERRor?". Each call of "SYSTem:ERRor?" provides an entry from the error queue. If no error messages are stored there any more, the instrument responds with 0, "No error".

The error queue should be queried after every SRQ in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

3.8.5 Resetting Values of the Status Reporting System

Table 3-6 comprises the different commands and events causing the status reporting system to be reset. None of the commands, except for *RST and SYSTem:PRESet influences the functional instrument settings. In particular, DCL does not change the instrument settings.

Table 3-6 Resettting instrument functions

Event / Effect	Switching on supply voltage Power-On-Status-Clear 0	Switching on supply voltage Power-On-Status-Clear 1	DCL,SDC (Device Clear, Selected Device Clear)	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
Clear STB,ESR	—	yes	—	—	—	yes
Clear SRE,ESE	—	yes	—	—	—	—
Clear PPE	—	yes	—	—	—	—
Clear EVENTt parts of the registers	—	yes	—	—	—	yes
Clear Enable parts of all OPERation and QUEStionable registers, Fill Enable parts of all other registers with "1".	—	yes	—	—	yes	—
Clear error queue	yes	yes	—	—	—	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	—	—	yes

1) Every command being the first in a command line, i.e., immediately following a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.

4 Maintenance

Under normal operating conditions, regular maintenance is not required. However, we recommend to check the lithium battery and the frequency accuracy of the reference oscillator every one to two years.

4.1 Checking the Lithium Battery

A battery-backed CMOS-RAM retains the data of the setup as well as the complete instrument settings after switch-off.

The battery voltage can be measured using the performance-test software (menu item: Performance Test, internal diaganosis and battery).

4.2 Testing and Adjustment of the Frequency Accuracy

If the option CMD-B1 is not fitted, check the TCXO reference oscillator.

If the option CMD-B1 is fitted, check the OCXO reference oscillator (note warm-up period).

The reference frequency can be checked and re-adjusted, if required, using the performance-test software (menu item: Adjustment TCXO 10 MHz, OCXO 10 MHz).

5 Testing the Rated Specifications

5.1 Test Instruments and Utilities

RF frequency counter	up to 2.2 GHz	e.g., FSB
Power meter	up to 2.2 GHz, -37...+13 dBm	e.g., NRVS
RF spectrum analyzer	up to 3.1 GHz	e.g., FSB
RF signal generator	up to 2.2 GHz	e.g., SMHU
Oscilloscope	up to 50 MHz	e.g., BOL
Power supply for lab use	up to 30 V, up to 10 A	e.g., NGPE
AF voltmeter		e.g., UPA
AF distortion meter		e.g., UPA
AF generator		e.g., UPA
GSM mobile telephone		

Note:
The instruments mentioned below are required to completely check,whether the data given in the data sheets are adhered to, however, a limited function and data test can be performed without these instruments.

GMSK generator	GSM frequency range	e.g., CMTA 94
Power generator	Frequency depends on type, up to +47 dBm	

5.2 Test Procedure (using Service Software)

5.2.1 Booting for DOS

All service programs of the CMD are only accessible under DOS. An external keyboard must be connected to the CMD, in order to enter the DOS surface. Upon switching on the CMD, a short signal is audible. The keys <Alt>, <Control> and <E> must now be pressed within 1.5 seconds. Do not press the key <E> until the two other keys are being pressed. Startup messages such as "Testing..." are then displayed by the controller.

If switchover fails, switch off the CMD and repeat.

When the controller-startup has been completed, the DOS prompt is displayed.

Note:
Files must not be modified or deleted. This would impair the validity of data and function of the CMD.

5.2.2 Starting the Program

- Boot the CMD for DOS, if required (see Section 5.2.1).
- Change directory: cd \service <ENTER>.
- Call performance-test program: check <ENTER>.

5.2.3 Operating the Program

The program can be operated either using the CMD keyboard or the external PC keyboard. That key on the external keyboard that corresponds to the softkey is given in brackets "<>". The default key is framed by two lines; it can be selected with any key which is not used, e.g., <SPACE KEY> or < ENTER>. -The <ESC> key can be used to abort the running test or the program.

Subsequent to the start messages, the CMD status is displayed. Check, whether the instrument variation and all options fitted have been exactly identified.

The program then prompts for the desired program status. Select the "SERVICE" mode. It is advisable to used the option "External Reference" (CMD-B3), but is is not absolutely necessary. The test selection menu is then displayed. For selection of a menu item, use the keys <Cursor up>, <Cursor down>, <Page up> and <Page down> to position the cursor next to the menu item, then, press the <ENTER> key.

A test point is entered under the assumption that there is no connection to an external test instrument.

When a test has been selected, the user is prompted step by step to carry out various actions, such as:

connection of external measuring facilties to the CMD, settings and measurements on test instruments as well as reading off CMD-internal test results.

If the requested action has been executed, the test run is continued by pressing the default key. A number of measurements allow for repeating the current or the preceding measurement or to skip the subsequent measurement.

A few instructions are output together with additional information to ease troubleshooting.

The program is left by simply switching off the instrument.

5.2.4 Tests To Be Performed

The test selection menu is divided into two sections:

Adjustments
is used to perform mere adjustments and to check the internal diagnosis facitlity. A few diagnostic voltages have no corresponding trimming facility. If the voltage is out of tolerance, the module must be replaced.

Trimmers and rated values at the associated test points are displayed.

Performance-Test
A complete performance test of the CMD includes all selectable menu entries of the test selection menu under performance test

A few additional actions have to be carried out by means of the user software and using a mobile telephone:

- call setup
- echo test
- phase/-frequency error measurement and power ramp measurement

Test protocol

Notes on Remote Control of Mobile Station Tester CMD

1 Switching-on the Mobile Test

The CMD is brought to the mobile test mode by means of remote-control command PROCEDURE:SELECT MAN (function same as with MANUAL TEST key).

It is however not necessary to reset the CMD to initial state after each test run (MENU HOME in the local mode or PROCEDURE:SELECT NONE in the remote mode). This is necessary only if the CMD is to be reconfigured for a different network (eg GSM<->DCS 1800) or if the external attenuation is changed. After each test run, the CMD is either in the MIDL or in the MSYN state. In either case, a location update can be performed after the next mobile is switched on. Location update is indicated by status MIDL changing to MSYN. If the CMD is already in the MSYN status, location update can be displayed by querying STATUS:OPERATION:CMD?. The value 8 corresponds to a location update (see Annex). By not resetting the CMD to initial state after each test, an advantage is gained: each test run will be 2 to 3 s shorter.

2 Reading of Receive Level RXLEV Signalled by Mobile

If RXLEV is read immediately after a power or channel change, zero may be obtained. This is due to the fact that the RXLEV value is sent via the SACCH channel, which is slow, and the new value may thus not yet be available at the time reading is attempted. RXLEV is reset to zero by the CMD after each channel or power change.

Solution:

a) Insert a delay of 2 s between a power or channel change and the command SENSE:SIGNALLING:RXLEV?.

b) Continue reading RXLEV until a value other than zero is obtained.

Likewise, up to 2 seconds should be allowed after a change of the CMD transmit level (command PROCEDURE:SET:POWER:CMD) for the mobile to measure and report the new level before the new RXLEV value is read.

3 Transmit Level of CMD during Signalling Procedures

All signalling procedures (channel, slot or power change, Close Loop command at the start of a BER measurement, or call to/from mobile) require a sufficiently high transmit level of the CMD. For example, BER measurements should not be started at a level of -102 dBm during an echo test, as the mobile may not be able to receive the Close Loop command from the CMD correctly.

Solution:

Prior to signalling procedures, set the CMD to a level between -90 and -60 dBm, using command PROCEDURE:SET:POWER:CMD if a call is already set up. For new calls to be set up, use command CONFIGURE:CHANNEL:POWER in the initial state of CMD.

4 Fast Change of CMD Transmit Level

Handling large level variations (>40 dB) during a call appears to cause problems to some mobiles. Loss of synchronization may result.

Example:

A call is set up between the CMD and a mobile and the echo test is being performed with the CMD transmitting at a level of -60 dBm. Then a BER measurement at a level of -104 dBm is started. With some mobiles, this will lead to an immediate loss of synchronization.

Solution:

Vary the level of the CMD stepwise for a set-up call by means of command PROCEDURE:SET:POWER:CMD.

5 Different Commands for Configuring/Changing the Channel, Slot or Level

There are two ways of setting the transmit level, channel number and slot number on the CMD:

a) Configuration of the CMD for a specific level (CMD only), channel (CCCH and TCH) or slot is possible only in the IDLE or initial state using the CONFIGURE:CHANNEL:... commands. These commands cannot be used for a set-up call. The configured level, channel and slot are stored and are used for every new call that is set up.

b) A change of the level (CMD and MS), channel (TCH only) or slot is possible only in the MCE or Call Established state, using the PROCEDURE:SET:... commands. The changed values are valid only for the call in question.

6 Optimizing the Configuration Speed

As a general rule, in a remote control program, all setting commands (CONFIGURE:... or CALCULATE:...) should be sent before switching to the mobile test mode. For repeated tests of a mobile or for testing several mobiles, the initialization procedure can be skipped completely. For any parameter changes made during mobile tests, the PROCEDURE:... commands are to be used. If, during a test, several BER measurements with different parameters are to be made, there is no need for reconfiguring the CMD for the new values each time. It is more advisable to select, in the initialization section, data records for the intended BER measurements by means of command CONFIGURE:BER:SELECT BER1 (to BER7) and to configure the records for each measurement. After setting up the call, only the desired BER test records have to be selected by means of CONFIGURE:BER:SEL BER1 (to BER7) and the measurements executed by means of READ:BER:TRESULT?.

7 Optimizing the Speed for Channel, Slot or Power Changes

The PROCEDURE:... commands for channel, slot or power changes involve lengthy signalling procedures between the mobile and the CMD. To speed up matters, such commands should be sent only if the new value differs from the set value. In case of doubt, it is faster by far to query the set value (eg by means of PROCEDURE:SET:ARFCN?) and to compare it with the new value to be sent.

8 Optimizing the Speed for Average-power and Phase/Frequency Error Measurements

Average-power, phase and frequency error measurements are carried out simultaneously. For this reason, only one measurement needs to be triggered by means of READ:BURST:...?. The results of the other three measurements can be fetched with FETCH:BURST:...?. It may then be queried if tolerance limits are met, using the CALCULATE:LIMIT:...MATCHING? commands.

9 Querying the Selected Network

The selected network (GSM or PCN) can be queried in any operating state of the CMD.

10 Procedure for BER Measurements

Each BER measurement should be started with the command READ:BER:TRESULT?. If PASS or FAIL is obtained for a result, the measured values (BER CLASS Ib, II, etc) can be read with FETCH:BER:...? without restarting the measurement. If INV, TLOW or IMP is obtained for a result, this means that the BER measurement was not completed because the level was too low, the mobile lost synchronization during the test, or the mobile did not respond correctly. Reading the results is meaningless in such case and may even lead to errors. In such case it should be verified by means of command STATUS:DEVICE? if there is still a call set up with the CMD (= MCE) prior to repeating the BER measurement in question or proceeding with further measurements.

To save time, the abort criterion for BER measurements can be defined to be the first tolerance limit exceeded (by means of command CONFIGURE:BER:SCONDITION FLIMIT). In the case of mobiles with poor reception quality, the BER test will thus not be performed completely but aborted at the instance the first tolerance limit is exceeded.

11 Fast Channel Changes

For GSM-specific reasons, there should be an interval of at least 1 s between channel changes (command PROCEDURE:SET:ARFCN).

12 Max. Input Level at Connector RF IN2

The input level applied to connector RF IN2 should not exceed 0 dBm for measurements and signalling procedures to be performed correctly. With levels above 0 dBm, overdriving of the input amplifiers and thus distortion of the input signal will result. The value of 13 dBm indicated on the front panel merely refers to the highest level beyond which the input will be damaged.

13 Impairment of Measurements through Carriers (eg from Base Stations)

Most European cities have blanket coverage with GSM radio channels (plus PCN channels in Great Britain and Germany). It is inevitable that channels used in mobile tests are sometimes occupied by a nearby base station. The extent of impairment resulting for the measurement depends on the field strength incident on the mobile, and may range from increased BER to loss of synchronization at low CMD levels. Experience has shown that radiated interference may occur on the mobile even if it is connected with the CMD via a screened cable and its antenna is switched off. However, not all traffic channels are permanently occupied, and problems occur only intermittently.

Solution:

a) Use a spectrum analyzer and a small antenna to check if there are carrier signals in the receive band of the mobile (935 to 960 MHz for GSM and 1805 to 1870 MHz for PCN).

b) Set up a call from the mobile to the CMD and switch to continuous BER test mode. Lower the level of the CMD until 2 to 3% Class II BER is displayed. Switch to an adjacent channel and read the bit error rate. If the BER markedly deteriorates after the channel change, this suggests the presence of an interfering signal.

Channels in which carrier signals are suspected to be present should not be used as TCH or BCCH channels for the CMD. In the case of strong interference, tests should be performed at a spacing of at least 2 to 3 channels.

14 Linking of Service Requests to Mobile-related Events

As with any IEEE-bus device, certain events such as command errors or end of operation can be linked to a service request sent to the control computer. CMD offers the possibility of triggering additional service requests upon a number of events related to the mobile:

- The mobile has made a location update.
- The mobile has lost synchronization during a call.
- The mobile has cleared down a call.
- The mobile has called and set up a call.

For each event, a bit will be set in a register that can be read with the command STATUS:OPERATION:CMD? (see description of this command). The hierarchy of the associated registers and the various ways of linking their information to service requests (SRQs) are shown in the Annex.

15 Setting of Timeouts

Generally, in remote-control programs, adjustable intervals are used within which a connected device must respond to a query sent by the control computer or be ready to receive the next command. If a device does not respond as expected during the selected timeout, the IEEE-bus function in question will be aborted. For most of the commands sent to the CMD, a timeout of 10 s will suffice. There are, however, the following reservations:

- The command PROCEDURE:CALL:TOMS (call to mobile) will not be terminated until the mobile has accepted the call.
- For averaging measurements with an adjustable number of bursts or frames (eg BER or spectrum measurements), the measurement time will increase with the number of values averaged.
- The time taken up by signalling commands (PROCEDURE:...) and measurements (READ:....?) also depends on the quality of the mobile under test. That is, if levels received from a mobile considerably deviate from expected levels or strongly fluctuate, the CMD will perform extensive autoranging functions. In such cases, the corresponding timeouts may have to be increased considerably.
- In RS232 mode, there is no hardware acknowledgement of a command. Therefore, a timeout recognition has to be managed by the control program. Querying ";*OPC?" after a command is a good solution.

Annex A3

IEC-Bus Interface

Depending on the model, the instrument can be equipped with an optional IEC/IEEE-bus connector. The mating connector according to IEEE 488 is at the rear of the instrument. A controller for remote control can be connected via the interface. The connection is effected using a shielded cable.

Characteristics of the Interface

- 8-bit parallel data transfer
- bidirectional data transfer
- three-line handshake
- high data transfer rate of max. 350 kByte/s
- up to 15 devices can be connected
- maximal length of the connecting cables 15 m (single connection 2m)
- wired OR if several instruments are connected in parallel.

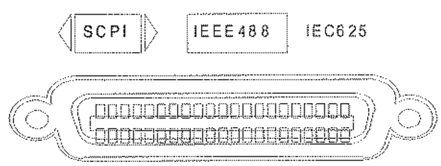


Fig. A3-1 IEC-Bus-Interface

Bus Lines

1. **Data bus with 8 lines DIO 1 to DIO 8.**
   The transmission is bit-parallel and byte-serial in the ASCII/ISO code. DIO1 is the least significant, DIO8 the most significant bit.

2. **Control bus with 5 lines.**
   IFC (Interface Clear),
   active low resets the interfaces of the instruments connected to the default setting.

   ATN (Attention),
   active low signals the transmission of interface messages
   inactive high signals the transmission of device-dependent messages.

SRQ (Service Request),
active low enables a device connected to send a service request to the controller.

REN (Remote Enable),
active low permits the switchover to remote control.

EOI (End or Identify),
has two functions in connection with ATN:
active low marks the end of data transmission with ATN=high
active low triggers a parallel poll with ATN=low.

3. Handshake bus with three lines.
DAV (Data Valid),
active low signals a valid data byte on the data bus.

NRFD (Not Ready For Data),
active low signals that one of the devices connected is not ready for data transfer .

NDAC (Not Data Accepted),
active low as long as the instrument connected is accepting the data present on the data bus.

Interface Functions

Instruments which can be remote-controlled via IEC bus can be equipped with different interface functions. Table A3-1 lists the interface functions appropriate for the instrument.

Table A3-1 Interface functions

Control character	Interface function
SH1	Handshake source function (source handshake)
AH1	Handshake drain function (acceptor handshake)
L4	Listener function.
T6	Talker function, ability to respond to serial poll
SR1	Service request function (Service Request)
PP1	Parallel poll function
RL1	Remote/Local switchover function
DC1	Resetting function (Device Clear)
DT1	Trigger function (Device Trigger)
C0	Controller function

Interface Messages

Interface messages are transmitted to the instrument on the data lines, with the attention line being active (LOW). They serve to communicate between instrument and controller.

Universal Commands

The universal commands are encoded in the range 10 through 1F hex. They act on all instruments connected to the bus without addressing them before.

Table A3-2 Universal Commands

Command	QuickBASIC command	Effect on the instrument
DCL (Device Clear)	IBCMD (controller%, CHR$(20))	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
IFC (Interface Clear)	IBSIC (controller%)	Resets the interfaces to the default setting.
LLO (Local Lockout)	IBCMD (controller%, CHR$(17))	The LOC/IEC ADDR key is disabled.
SPE (Serial Poll Enable)	IBCMD (controller%, CHR$(24))	Ready for seriall poll.
SPD (Serial Poll Disable)	IBCMD (controller%, CHR$(25))	End of seriall poll.
PPU (Parallel Poll Unconfigure)	IBCMD (controller%, CHR$(21))	End of the parallel-poll state.

Addressed Commands

The addressed commands are encoded in the range 00 through 0F hex. They are only effective for instruments addressed as listeners.

Table A3-3 Addressed Commands

Command	QuickBASIC command	Effect on the instrument
SDC (Selected Device Clear)	IBCLR (device%)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
GTL (Go to Local)	IBLOC (device%)	Transition to the "Local" state (manual control).
PPC (Parallel Poll Configure)	IBPPC (device%, data%)	Configure instrument for parallel poll. The QuickBASIC command additionally executes PPE/PPD.

Serial Interface

The instrument is equipped with a serial interface (RS-232-C) as standard. The 9-pin connector is located at the rear of the instrument. A controller for remote control can be connected via the interface. The connection is effected using a zero modem cable.

For remote control via the serial interface, an important aspect is to be noted:
Some controllers already send characters on the serial interface during booting, causing the instrument to switch to the REMOTE state as soon as it receives these characters (since no explicit addressing is possible with the serial remote control).

Characteristics of the Interface

- serial data transfer
- bidirectional data transfer
- Software or hardware handshake
- Data transfer rate between 110 baud and 115200 baud
- Possible length of connecting cable > 20 m

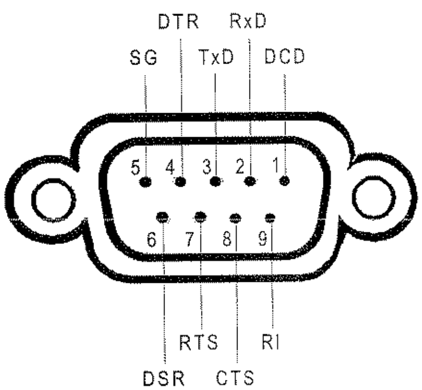


Fig. A3-2 RS232 interface

Designation		Pin (9-pin)	Pin (25-pin)
Data Carrier Detect	DCD	1	8
Receive Data	RxD	2	3
Transmit Data	TxD	3	2
Data Terminal Ready	DTR	4	20
Signal Ground	SG	5	7
Data Set Ready	DSR	6	6
Request To Send	RTS	7	4
Clear To Send	CTS	8	5
Ring Indicator	RI	9	21

Lines

1. Data lines
RxD (receive data) and **TxD** (transmit data)
The transmission is bit-serial in the ASCII code starting with the LSB.
The two lines are necessary as the minimum requirement for a transmission; however, no hardware handshake is possible, but only the XON/XOFF protocol.

2. Control lines
DCD (Data Carrier Detect),
active LOW.
Input; using this signal, the data terminal recognizes that the modem of the remote station receives valid signals with sufficient level. DCD is used to disable the receiver in the data terminal and prevent reading of false data if the modem cannot interpret the signals of the remote station.

DTR (Data Terminal Ready),
active LOW,
Output indicating that the data terminal is ready to receive data.

DSR (Data Set Ready),
active LOW,
Input indicating that the external device is ready to receive data.

RTS (Request To Send),
active LOW.
Output that can be used to indicate the readiness to receive data.

CTS (Clear To Send),
active LOW.
Input used to enable the transmission of data.

RI (Ring Indicator),
active LOW.
Input; RI is used by a modem to indicate that a remote station wants to set up a connection.

Default settings

The serial interface is set to the following values:

Table A3-4 Default setting

Parameter	**Setting value**
Baud rate	2400 baud
Data bits	8 bits
Stop bits	1 bits
Parity	none

Handshake

Software handshake

In the case of the software handshake, the data transfer is controlled using the two control characters XON / XOFF.
The CMD uses the control character XON to indicate that it is ready to receive data.
If the receive buffer is full, it sends the XOFF character via the interface to the controller. The controller then interrupts the data output until it receives another XON from the CMD.
The controller indicates to the CMD that it is ready to receive data in the same way.

Cable for local controller coupling in the case of software handshake

The connection of the CMD with a controller in the case of software handshake is effected by crossing the data lines. The following wiring diagram applies to a controller with 9-pin or 25-pin configuration.

CMD 9-pin		Controller 9-pin
1		1
2	------------RxD / TxD--------------	3
3	------------TxD / RxD--------------	2
4		6
5	------------GND / GND------------	5
6		4
7		8
8		7
9		9

CMD 9-pin		Controller 25-pin
1		8
2	------------RxD / TxD--------------	2
3	------------TxD / RxD--------------	3
4		6
5	------------GND / GND------------	7
6		20
7		5
8		4
9		22

Fig. A1-3 Wiring of the data lines for software handshake

Hardware handshake

In the case of the hardware handshake, the CMD indicates that it is ready to receive data via the lines DTR and RTS. A logic '0' on both lines means "ready" and a logic '1' means "not ready". The RTS line is always active (logic '0') as long as the serial interface is switched on. The DTR line thus controls the readiness of the CMD to receive data.

The readiness of the remote station to receive data is reported to the CMD via the CTS and DSR line. A logic '0' on both lines activates the data output and a logic '1' on both lines stops the data output of the CMD. The data output is effected via the TxD line.

Cable for local controller coupling in the case of hardware handshake

The connection of the CMD to a controller is effected with a so-called zero modem cable. In the case of this cable, the data, control and report lines must be crossed. The following wiring diagram applies to a controller with 9-pin or 25-pin configuration.

CMD 9-pin		Controller 9-pin
1		1
2	------------RxD / TxD--------------	3
3	------------TxD / RxD--------------	2
4	------------DTR /DSR-------------	6
5	-	5
6	------------GND / GND------------	4
7	------------DSR / DTR------------	8
8	------------RTS / CTS-------------	7
9	------------CTS / RTS-------------	9

CMD 9-pin		Controller 25-pin
1		8
2	------------RxD / TxD--------------	2
3	------------TxD / RxD--------------	3
4	------------DTR /DSR-------------	6
5	-	7
6	------------GND / GND------------	20
7	------------DSR / DTR------------	5
8	------------RTS / CTS-------------	4
9	------------CTS / RTS-------------	22

Fig. A3-4 Wiring of the data, control and report lines for hardware handshake

Annex B3

List of Error Messages

The following list contains all error messages for errors occurring in the instrument. The meaning of negative error codes is defined in SCPI, positive error codes mark errors specific of the instrument.

The table contains the error code in the left-hand column. In the right-hand column the error text being entered into the error/event queue or being displayed is printed in bold face. Below the error text, there is an explanation as to the respective error.

SCPI-Specific Error Messages

No Error

Error code	**Error text in the case of queue poll** Error explanation
0	**No error** This message is output if the error queue does not contain any entries.

Command Error - Faulty command; sets bit 5 in the ESR register.

Error code	**Error text in the case of queue poll** Error explanation
-100	**Command Error** The command is faulty or invalid.
-101	**Invalid Character** The command contains an invalid sign. Example: A header contains an ampersand, "SOURCE &".
-102	**Syntax error** The command is invalid. Example: The command contains block data the instrument does not accept.
-103	**Invalid separator** The command contains an impermissible sign instead of a separator. Example: A semicolon is missing after the command.
-104	**Data type error** The command contains an invalid value indication. Example: ON is indicated instead of a numeric value for frequency setting.
-105	**GET not allowed** A Group Execute Trigger (GET) is within a command line.
-108	**Parameter not allowed** The command contains too many parameters. Example: Command `CONFigure:REGen:FREQency` permits only one fraquency indication.

Contiuation: Command Error

Error code	**Error text in the case of queue poll** Error explanation
-109	**Missing parameter** The command contains too few parameters. Example: The command `CONFigure:RFGen:FREQuency` requires a frequency indication.
-111	**Header separator error** The header contains an impermissible separator. Example: the header is not followed by a "White Space", "`*ESE255`"
-112	**Program mnemonic too long** The header contains more than 12 characters.
-113	**Undefined header** The header is not defined for the instrument. Example: `*XYZ` is undefined for every instrument.
-114	**Header suffix out of range** The header contains an impermissible numeric suffix. Example: `SOURce3` does not exist in the instrument.
-120	**Numeric data error** The command contains a faulty numeric parameter.
-121	**Invalid character in number** A number contains an invalid character. Example: An "A" in a decimal number or a "9" in an octal number.
-123	**Exponent too large** The absolute value of the exponent is greater than 32000.
-124	**Too many digits** The number includes too many digits.
-128	**Numeric data not allowed** The command includes a number which is not allowed at this position. Example: The command `SOURce:RFGen:SELect` requires indication of a text parameter.
-131	**Invalid suffix** The suffix is invalid for this instrument. Example: nHz is not defined.
-134	**Suffix too long** The suffix contains more than 12 characters.
-138	**Suffix not allowed** A suffix is not allowed for this command or at this position of the command. Example: The command `*RCL` does not permit a suffix to be indicated.
-141	**Invalid character data** The text parameter either contains an invalid character or it is invalid for this command. Example: write error with parameter indication; `SOURce:RFGen:SELect STT1.`
-144	**Character data too long** The text parameter contains more than 12 characters.
-148	**Character data not allowed** The text parameter is not allowed for this command or at this position of the command. Example: The command `*RCL` requires a number to be indicated.

Continuation: Command Error

Error code	**Error text in the case of queue poll** Error explanation
-151	**Invalid string data** The command contains a faulty string. Example:An END message has been received prior to the terminating apostrophe.
-158	**String data not allowed** The command contains a valid string at a position which is not allowed. Example: A text parameter is set in quotation marks, `SOURce:RFGen:SELect "SETting1"`
-161	**Invalid block data** The command contains faulty block data. Example: An END message was received prior to reception of the expected number of data.
-168	**Block data not allowed** The command contains valid block data at an impermissible position. Example:
-171	**Invalid expression** The command contains an invalid mathematical expression. Example: the expression contains mismatching parentheses.
-178	**Expression data not allowed** The command contains a mathematical expression at an impermissible position. Example:
-180	**Macro error** A faulty macro has been defined, or an error has occurred during execution of a macro.

Execution Error - Error on execution of a command; sets bit 4 in the ESR register

Error code	**Error text in the case of queue poll** Error explanation
-200	**Execution error** Error on execution of the command.
-221	**Settings conflict** There is a conflict between setting of parameter value and instrument state. Example: External attenuation has been set in a state other than IDLE.
-222	**Data out of range** The parameter value lies out of the permissible range of the instrument. Eample: The command *RCL only permits entries in the range from 0 to 50.
-223	**Too much data** The command contains too many data. Example: The instrument does not have sufficient storage space.
-241	**Hardware missing** The command cannot be executed due to missing hardware. Example: An option is not fitted.

Device Specific Error; sets bit 3 in the ESR register

Error code	**Error test in the case of queue poll** Error explanation
-300	**Device-specific error** SM3-specific error not defined in greater detail.
-350	**Queue overflow** This error code is entered in the queue instead of the actual error code if the queue is full. It indicates that an error has occurred but not been accepted. The queue can accept 5 entries.

Query Error - Error in data request; sets bit 2 in the ESR register

Error code	**Error text in the case of queue poll** Error explanation
-400	**Query error** General error occurring when data are requested by a query.
-410	**Query INTERRUPTED** The query has been interrupted. Example: After a query, the instrument receives new data before the response has been sent completely.
-420	**Query UNTERMINATED** The query is incomplete. Example: The instrument is addressed as a talker and receives incomplete data.
-430	**Query DEADLOCKED** The query cannot be processed. Example: The input and output buffers are full, the instrument cannot continue operation.
-440	**Query UNTERMINATED after indefinite response** A query is in the same command line after a query which requests an indefinite response.

Contents

Annex C3

1 General Information

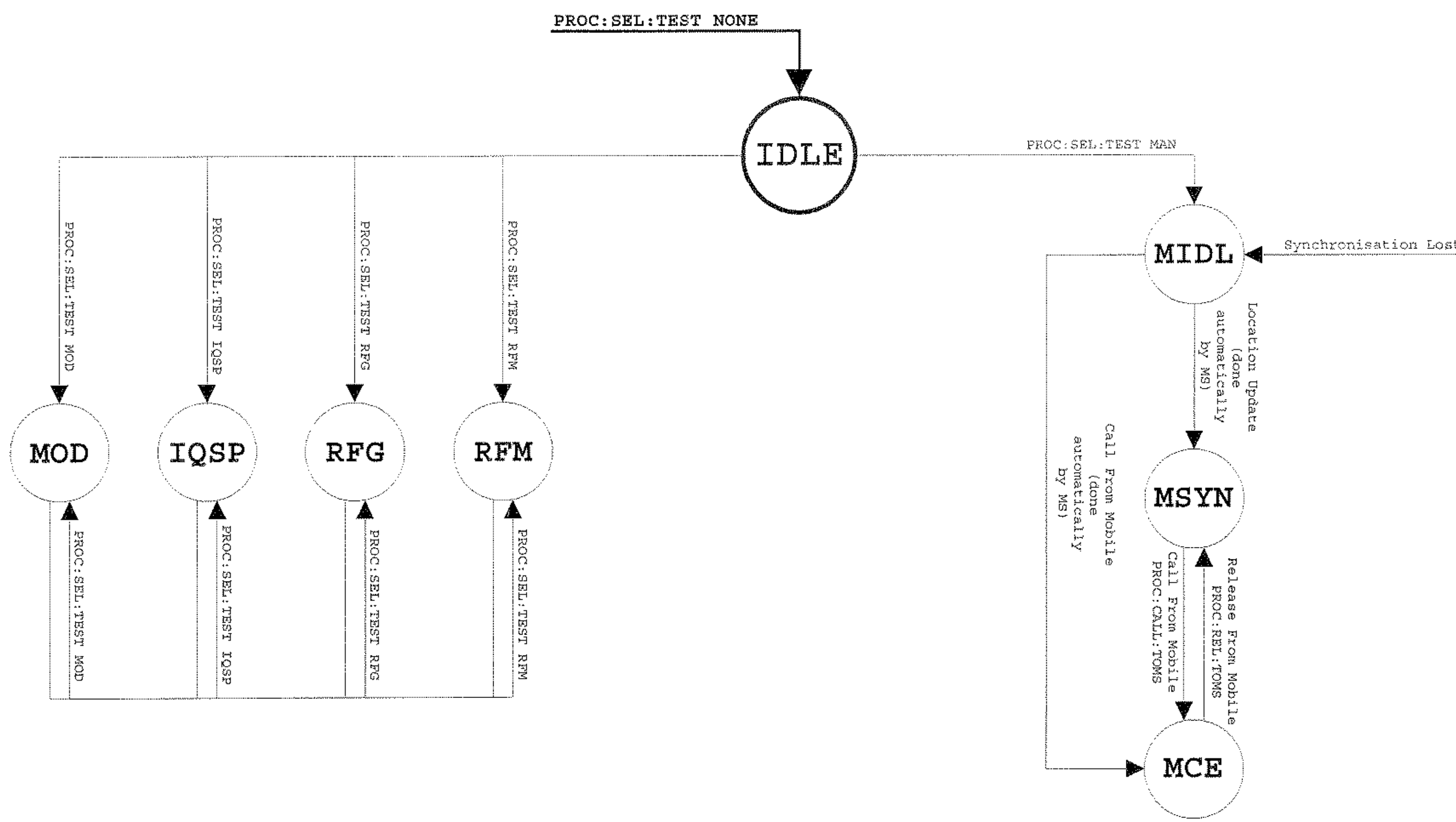
1.1 States

In the description of commands the following abbreviations are used for the indication of permissible states:

IDLE:	Initial state of CMD; also achieved by means of PROCedure:SELect[:TEST] NONE.
IQSP:	IQ spectrum active
MOD:	Module test active
MIDL:	MS test selected
MSYN:	MS test: synchronized (call setup possible; BCCH generated)
MCE:	MS test: call established
RFG:	RF generator active
RFM:	RF monitor active
ALL:	All states (IDLE, IQSP, MOD, MIDL, MSYN, MCE or RFG)

Note: The BAN state still exists for compatibility reasons but MOD is recommended for new developments.
Other than in the BAN state, the RF generator is active in the MOD state.
CAUTION: When changing from BAN to the manual mode, MOD is automatically set.

The following diagram illustrates the individual state transitions:


PROC:SEL:TEST NONE
IDLE
PROC:SEL:TEST MAN
MIDL
Synchronisation Lost
Location Update (done automatically by MS)
MSYN
Release From Mobile PROC:REL:TOMS
Call From Mobile PROC:CALL:TOMS
MCE
Call From Mobile (done automatically by MS)
PROC:SEL:TEST MOD
PROC:SEL:TEST IQSP
PROC:SEL:TEST RFG
PROC:SEL:TEST RFM
MOD
IQSP
RFG
RFM
PROC:SEL:TEST MOD
PROC:SEL:TEST IQSP
PROC:SEL:TEST RFG
PROC:SEL:TEST RFM

1.2 DCS1800

The settings for DCS1800 are only provided for the CMD55; the CMD52 outputs an error message when the attempt is made to set DCS1800 values.

If DCS1800 is desired as type of network, the switchover must be made by means of CONFigure:NETWork:TYPE DCS1800 before settings are changed. After the switchover, all commands act on the DCS1800 data set, without switchover the GSM data set is used.

1.3 DCS1900 (PCS1900)

The settings for DCS1900 are only available on the CMD55 with built-in option CMD-B19. If DCS1900 is desired as type of network, switchover using CONFigure:NETWork:TYPE DCS1900 must be made prior to changing settings.

1.4 UIC

The settings for UIC are only available with built-in option CMD-K80. If UIC is desired as type of network, switchover using CONFigure:NETWork:TYPE UIC must be made prior to changing settings.
Unless otherwise specified, settings are identical to the values for GSM.

1.5 Note

<numeric_value> denotes a numeric value; MAXimum or MINimum can be indicated as well unless stated otherwise.
If <numeric_value> may contain a unit, indicating the unit is optional. The value is always returned without a unit.
Some commands additionally allow ON and OFF instead of a value (for activating or deactivating the associated parameter). Specification of a value (numeric_value) implies a transition to ON. If OFF is set at the time of a query, OFF will be returned instead of the value.

<value> denotes a character date from a list; only list entries are permissible.

All commands are structured analogously to the SCPI description, ie the upper-case letters indicate the short form of the command; the CMD only accepts this short form as an abbreviation (according to SCPI), otherwise the long form is to be used.

1.6 Error Handling

If no value is available when a query is made or the value is invalid, NAN is returned instead of the value. An overflow of the value is indicated by INF, a missing input signal by NINF.

If CMD is not in the right state to carry out the command, SCPI error -221, "Settings conflict" is generated. No value is returned in the case of queries.
The permissible state is indicated in the following table in the column "State".

However, if an option required to execute the command is missing, SCPI error -241, "Hardware missing" is displayed. No result is returned either in the case of a query.
The option necessary to execute the command is entered in the tables under "Option".

1.7 RESET Values

Unless otherwise specified, the values given in the column "Default:" are set on RESET of the CMD.

1.8 Memory Requirement

The supplied CMD software versions are intended for CMDs with a 4 or 8 Mbyte main memory. Some commands are only available in the 8 Mbyte version.
In column "Available as of software version:" the first software version in which the command is available is stated for the respective instrument model.

2 Settings

2.1 Input and Output

External attenuation at RF In Out

Syntax:	`SENSe1:CORRection:LOSS[:INPut][:MAGNitude] <numeric_value>` or `SOURce1:CORRection:LOSS[:OUTPut][:MAGNitude] <numeric_value>`				
Value range:	`-40.0 to +50.0 dB`			**Default:** `0.0 dB`	
State:	Setting: IDLE Query: ALL	**Option:** None	With query	**Note:** Positive values refer to an attenuation; (N1)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00			

External attenuation at RF In 2

Syntax:	`SENSe2:CORRection:LOSS[:INPut][:MAGNitude] <numeric_value>`				
Value range:	`-40.0 to +90.0 dB`			**Default:** `0.0 dB`	
State:	Setting: IDLE Query: ALL	**Option:** None	With query	**Note:** Positive Values refer to an attenuation; (N1)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00			

External attenuation at RF Out 2

Syntax:	`SOURce2:CORRection:LOSS[:OUTPut][:MAGNitude] <numeric_value>`				
Value range:	`-40.0 to +90.0 dB`			**Default:** `0.0 dB`	
State:	Setting: IDLE Query: ALL	**Option:** None	With query	**Note:** Positive Values refer to an attenuation; (N1)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 MBYTE:** 1.50	**CMD52/55 with 8 MBYTE:** 3.00			

Inputs and outputs used

Syntax:	ROUTe:IOConnector <value>				
Value range:	I1O1 | I1O2 | I2O1 | I2O2	Input: RF In Out; Output: RF In Out Input: RF In Out; Output: RF Out 2 Input: RF In 2; Output: RF In Out Input: RF In 2; Output: RF Out 2			**Default:** I1O1
State: Setting: IDLE Query: ALL	**Option:** None	With query	**Note:** (N2)		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00			

Separate external attenuation at RF In/Out

Syntax:	ROUTe:IOConnector:INPut[:ONE]:MODE			
Value range:	COMBined | SEParate	Combined external attenuation for input and output Separate ext. attenuation for input and output		**Default:** COMB
State: Setting: IDLE Query: ALL	**Option:** None	With query	**Note:** In the case of COMB, SENS1:CORR:LOSS and SOUR1:CORR:LOSS are identical (affect the same setting); with SEP different attenuation can be set for input and output; (N1)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.20		

Reference frequency (input)

Syntax:	CONFigure:FREQuency:REFerence <value>	
Value range:	BC | External, bit clock BC2 | External, 2 * bit clock BC4 | External, 4 * bit clock BC16 | External, 16 * bit clock E1M | External, 1 MHz E2M | External, 2 MHz E204 | External, 2.048 MHz E3M | External, 3 MHz E4M | External, 4 MHz E5M | External, 5 MHz E6M | External, 6 MHz E7M | External, 7 MHz E8M | External, 8 MHz E9M | External, 9 MHz E10M | External, 10 MHz E11M | External, 11 MHz E12M | External, 12 MHz E13M | External, 13 MHz E163 | External, 16.384 MHz E26M | External, 26 MHz E39M | External, 39 MHz E52M | External, 52 MHz I10M Internal, 10 MHz	**Default:** I10M
State: IDLE	**Option:** B3	With query
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00

Reference frequency (output)

Syntax:	CONFigure:FREQuency:OUTPut:REFerence <value>	
Value range:	BC | Bit clock BC2 | 2 * bit clock BC4 | 4 * bit clock BC16 | 16 * bit clock F1M | Clock signal with 1 MHz F2M | Clock signal with 2 MHz F4M | Clock signal with 4 MHz F13M Clock signal with 13 MHz	**Default:** F13M
State: IDLE	**Option:** B3	With query
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60	**CMD52/55 with 8 Mbyte:** 3.00

2.2 Signalling and RF Parameters

2.2.1 Signalling Parameters of Mobile Station

International Mobile Subscriber Identity (IMSI)

Syntax:	`SENSe:SIGNalling:IDENtity:IMSI?`			
Return:	<value> (max. 15 digits)			
State: MSYN, MCE	**Option:** None	Query only	**Note:** (N3)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

International Mobile Equipment Identity (IMEI)

Syntax:	`SENSe:SIGNalling:IDENtity:IMEI?`			
Return:	<value> (max. 15 digits)			
State: MSYN, MCE	**Option:** None	Query only	**Note:** (N3)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Revision level of mobile

Syntax:	`SENSe:SIGNalling:IDENtity:MS:REVision:LEVel?`		
Return:	`PH1` | Phase I `PH2` Phase II		
State: MSYN, MCE	**Option:** None	Query only	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00	

Signalled DTX mode of mobile

Syntax:	`SENSe:SIGNalling:DTX:USED?`		
Return:	`ON` | DTX is activated `OFF` DTX is not activated		
State: MCE	**Option:** None	Query only	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00	

Receiving level at mobile station (RXLEV)

Syntax:	`SENSe:SIGNalling:RXLev?`			
Return:	`0 to 63` (full value)			
State: MCE	**Option:** None	Query only	**Note:** (N3)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Quality of reception at mobile station (RXQUAL)

Syntax:	`SENSe:SIGNalling:RXQual?`			
Return:	`0 to 7` (full value)			
State: MCE	**Option:** None	Query only	**Note:** (N3)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Dialled number

Syntax:	`SENSe:SIGNalling:DNUMber?`			
Return:	<value> (max. 20 digits)			
State: MCE	**Option:** None	Query only	**Note:** (N3)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Power class

Syntax:	`SENSe:SIGNalling:POWer:CLASs?`			
Return:	GSM: `1 to 5` DCS1800: `1 to 2` DCS1900: `1 to 2` UIC: `1 to 5`			
State: MSYN, MCE	**Option:** None	Query only	**Note:** (N3)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Signalled power of mobile

This is the value signalled by the mobile as its own transmitter level. The actual level (peak value) can be obtained by means of SENSe:POWer:MS?.

Syntax:	`SENSe:SIGNalling:POWer:LEVel?`				
Return:	GSM: `13.0 to 43.0` (unit: dBm) DCS1800: `4.0 to 30.0` (unit: dBm) DCS1900: `4.0 to 30.0` (unit: dBm) UIC: `13.0 to 43.0` (unit: dBm)				
State: MCE	**Option:** None	Query only	**Note:** (N3)		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00			

Measured power of mobile (peak value)

SENSe:POWer:MS? is used to measure the transmitter power of the mobile. SENSe:SIGNalling:POWer:LEVel? indicates the nominal value.

Syntax:	`SENSe:POWer:MS?`		
Return:	RF In Out: `(0.0 + ext. att.) to (+50.0 + ext. att.)` (unit: dBm) RF In 2: `(-60.0 + ext. att.) to (+13.0 + ext. att.)` (unit: dBm)		
State: ALL	**Option:** None	Query only	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

2.2.2 Signalling Parameters for CMD

DTX mode

Syntax:	CONFigure:DTX:STATe <value>		
Value range:	ON | OFF	DTX used DTX not used	**Default:** OFF
State: IDLE	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80	**CMD52/55 with 8 Mbyte:** 3.00	

Mobile country code

Syntax:	CONFigure:SIGNalling:IDENtity:MCC <numeric_value>		
Value range:	0 to 999		**Default:** 1
State: IDLE	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Mobile network code

Syntax:	CONFigure:SIGNalling:IDENtity:MNC <numeric_value>		
Value range:	GSM, DCS1800, UIC: DCS1900:	0 to 99 0 to 999	**Default:** GSM, DCS1800, UIC: 01 DCS1800: 010
State: IDLE	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Network colour code

Syntax:	CONFigure:SIGNalling:IDENtity:NCC <numeric_value>		
Value range:	0 to 7		**Default:** 0
State: IDLE	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Location area code

Syntax:	`CONFigure:SIGNalling:IDENtity:LAC <numeric_value>`			
Value range:	`0 to 65535`			**Default:** `1`
State: IDLE	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00	

Base station colour code

Syntax:	`CONFigure:SIGNalling:BCC <numeric_value>`			
Value range:	`0 to 7`			**Default:** `0`
State: IDLE	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50		**CMD52/55 with 8 Mbyte:** 3.00	

Default for international mobile subscriber identity (IMSI)

Syntax:	`CONFigure:SIGNalling:IDENtity:IMSI <string>`			

Value range:	String for default IMSI
	Format: GSM, DCS1800, UIC: `xxx.xx.xxxxxxxxxx`
	DCS1900: `xxx.xxx.xxxxxxxxx` (1)
	In GSM, DCS1800 and UIC networks, the IMSI should consist of 6 to 15 digits. A point may be inserted after the 3rd and 5th digit (but then at the two positions).
	With DCS1900 the minimum length is 7 digits and points may be inserted after the 3rd and 6th digit.
				Default:
				GSM, DCS1800, UIC:
				`001.01.0000000001`
				DCS1900:
				`001.010.000000001`

State: ALL	**Option:** None	With query	**Note:** Used only if no other IMSI is signalled during call setup.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.03 (1) 2.50		**CMD52/55 with 8 Mbyte:** 3.00 (1) 3.20	

Radio link timeout of mobile

Syntax:	`CONFigure:SIGNalling:RADio:LINK:TIMeout <numeric_value>`			
Value range:	`4 to 64`			**Default:** `24`
State: IDLE, MSYN	**Option:** None	With query	**Note:** Forwarded to mobile via system info messages.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50		**CMD52/55 with 8 Mbyte:** 3.20	

Control of close loop command

Syntax:	CONFigure:SIGNalling:LOOP:COMMand <value>			
Value range:	BER | DISable | ENABle	Loop in mobile only closed for BER measurements Loop in mobile never closed Loop in mobile closed whenever a pseudo-random pattern is used (see CONF:SPE:MODE)	**Default:** BER	
State: Setting: IDLE, MSYN Query: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.20		

Radio link timeout of CMD

Syntax:	CONFigure:SIGNalling:RADio:LINK:TIMeout:TESTset <value>			
Value range:	ON | OFF	Radio link timeout observed Radio link timeout disabled	**Default:** ON	
State: ALL	**Option:** None	With query	**Note:** The setting is valid until the instrument is switched off.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.20		

Multiframes for TX

Syntax:	CONFigure:SIGNalling:MFRames <numeric_value>		
Value range:	2 to 9	**Default:** 2	
State: IDLE	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.00	

Number of blocks not used for paging

Syntax:	CONFigure:SIGNalling:AGBLocksres <numeric_value>		
Value range:	0 to 7	**Default:** 2	
State: IDLE	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.00	

Access to cells

Syntax:	`CONFigure:SIGNalling:CELL:ACCess <value>`			
Value range:	`BARRed` | `NotBARred`	Cell barred Cell not barred		**Default:** `NBAR`
State: IDLE	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.00		

Location update mode

Syntax:	`CONFigure:SIGNalling:LOCation:UPDate:MODE <value>`			
Value range:	`ALWays` | `AUTO`	Location update is always executed Location update is only executed if necessary		**Default:** `ALW`
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.03	**CMD52/55 with 8 Mbyte:** 3.00		

Signalling mode

Syntax:	`CONFigure:SIGNalling:MODE <value>`			
Value range:	`STANdard` | `FAST` | `VeryFASt` | `STST` | `FSST` | `VFST`	Full (detailed) signalling during call setup Signalling for call setup reduced to essential messages Fastest possible call setup (same as FAST, but without query of IMEI) Same as STAN, but with starting time (1) Same as FAST, but with starting time (1) Same as VFAS, but with starting time (1)		**Default:** `STAN`
State: Setting: IDLE Query: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10 (1) 2.39	**CMD52/55 with 8 Mbyte:** 3.00		

Neighbouring cell description (BA list)

Syntax:	`CONFigure:BAList:ARFCN <numeric_value>`		
Value range:	GSM: `1 to 124` DCS1800: `512 to 885` DCS1900: `512 to 810` UIC: `0 to 19`		**Default:** GSM: `10, 120` DCS1800: `520, 620` DCS1900: `550, 700` UIC: `2, 15`
State: IDLE	**Option:** None	No query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.03	**CMD52/55 with 8 Mbyte:** 3.00	

Syntax:	CONFigure:BALIst?			
Return	[<value> {, <value>}]			
State: ALL	**Option:** None	Query only	**Note:** Returns all channels entered in the BA list (for the current network)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.03	**CMD52/55 with 8 Mbyte:** 3.00		

Syntax:	CONFigure:BALIst:CLEar			
State: IDLE	**Option:** None	No query	**Note:** This command deletes all channels from the BA list (ie also default channels)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.03	**CMD52/55 with 8 Mbyte:** 3.00		

Channel number (ARFCN) for CCCH

Syntax:	CONFigure:CHANnel:CCCH:ARFCn <numeric_value>		
Value range:	GSM: 1 to 124 DCS1800: 512 to 885 DCS1900: 512 to 810 UIC: 0 to 19	**Default:**	GSM: 31 DCS1800: 735 DCS1900: 600 UIC: 5
State: Setting: IDLE Query: ALL	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Channel number (ARFCN) for TCH

Syntax:	CONFigure:CHANnel[:TCH]:ARFCn <numeric_value>		
Value range:	GSM: 1 to 124 DCS1800: 512 to 885 DCS1900: 512 to 810 UIC: 0 to 19	**Default:**	GSM: 62 DCS1800: 740 DCS1900: 610 UIC: 10
State: Setting: IDLE, MIDL, MSYN Query: ALL	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Frequency offset of transmitter

Syntax:	CONFigure:CHANnel:FREQuency:OFFSet <numeric_value>			
Value range:	-100000 to +100000 Hz			**Default:** 0 Hz
State: Setting: IDLE Query: ALL	**Option:** None	With query	**Note:** The value entered as a frequency offset will be rounded to match the RF generator resolution (33.061 Hz).	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10		**CMD52/55 with 8 Mbyte:** 3.00	

Timeslot of TCH

Syntax:	CONFigure:CHANnel[:TCH]:SLOT <numeric_value>			
Value range:	0 to 7			**Default:** 0
State: Setting: IDLE, MIDL, MSYN Query: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00	

Lower power limit for matching the CO carrier

Syntax:	CONFigure:CHANnel:CCCH:POWer:MINimum <numeric_value>			
Value range:	(N4)			**Default:** -85.0 dBm
State: Setting: IDLE, MIDL, MSYN Query: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.14		**CMD52/55 with 8 Mbyte:** 3.00	

Transmitter power of TCH in used timeslot

Syntax:	CONFigure:CHANnel[:TCH][:POWer][:USED] <numeric_value>			
Value range:	(N4)			**Default:** -90.0 dBm
State: Setting: IDLE, MIDL, MSYN Query: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.50		**CMD52/55 with 8 Mbyte:** 3.00	

Transmitter power of TCH in unused timeslots

Syntax:	`CONFigure:CHANnel[:TCH][:POWer]:UNUSed <numeric_value>`			
Value range:	`-20.0 to +20.0 dB | ON | OFF`			**Default:** `-20.0 dB`
State: Setting: IDLE, MIDL, MSYN Query: ALL	**Option:** None	With query	**Note:** (N5)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00	

Selection of modulation content of TCH

Syntax:	`CONFigure:SPEech:MODE <value>`		
Value range:	`ECHO` | Loopback in CMD with delay `LOOP` | Loopback in CMD with minimum permissible delay `PR9` | 2E9 - 1 PSR bit pattern `PR11` | 2E11 - 1 PSR bit pattern `PR15` | 2E15 - 1 PSR bit pattern `PR16` | 2E16 - 1 PSR bit pattern `HANDset` Speech coder/decoder mode		**Default:** `ECHO`
State: ALL	**Option:** LOOP, ECHO: none PRxx B4 HAND B5	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.00	**CMD52/55 with 8 Mbyte:** 3.00	

Coding of speech frames

Syntax:	`CONFigure:TCH:MODE <value>`		
Value range:	`FS1` | Full-rate speech version 1 `FS2` Full-rate speech version 2 (enhanced full rate)		**Default:** `FS1`
State: IDLE, MSYN	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Basic power setting for location update and call setup of mobile station

Syntax:	CONFigure:POWer:MS <numeric_value>				
Value range:	GSM: 0 to 15 | 13.0 to 43.0 dBm DCS1800: 0 to 13 | 4.0 to 30.0 dBm DCS1900: 0 to 13 | 4.0 to 30.0 dBm UIC: 0 to 15 | 13.0 to 43.0 dBm	Power control level Absolute level Power control level Absolute level Power control level Absolute level Power control level Absolute level	**Default:** GSM: 15 DCS1800: 10 DCS1900: 10 UIC: 15		
State: ALL	**Option:** None	With query	**Note:** Return always as power control level.		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.00	**CMD52/55 with 8 Mbyte:** 3.00			

Type of power change

Syntax:	CONFigure:POWer:MS:CHANge:MODE <value>		
Value range:	FAST | SLOW	Power change via assignment command Power change via SACCH header	**Default:** SLOW
State: ALL	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.00	**CMD52/55 with 8 Mbyte:** 3.00	

2.3 Burst Analysis

Channel number (ARFCN)

Syntax:	CONFigure:CHANnel:BANalysis:ARFCn <numeric_value>				
Value range:	GSM: 0 to 1023 (without 551 to 573) DCS1800: 449 to 1449 DCS1900: 341 to 1341 UIC: -380 to 620			**Default:**	GSM: 65 DCS1800: 712 DCS1900: 662 UIC: 135
State: ALL	**Option:** None	With query	**Note:** Band limits cannot be set in the IQSP state.		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60		**CMD52/55 with 8 Mbyte:** 3.00		

Syntax:	CONFigure:CHANnel:BANalysis:ARFCn:FREQuency <numeric_value>				
Value range:	GSM: 800.0 to 1000.0 MHz (in steps of 0.2 MHz) DCS1800: 1697.6 to 1897.6 MHz (in steps of 0.2 MHz) DCS1900: 1816.0 to 2016.0 MHz (in steps of 0.2 MHz) UIC: 800.0 to 1000.0 MHz (in steps of 0.2 MHz)			**Default:**	GSM: 903.0 MHz DCS1800: 1750.0 MHz DCS1900: 1880.0 MHz UIC: 903.0 MHz
State: ALL	**Option:** None	With query	**Note:** Band limits cannot be set in the IQSP state (0.2 MHz lower limits only).		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10		**CMD52/55 with 8 Mbyte:** 3.00		

Training sequence codes

Syntax:	CONFigure:CHANnel:BANalysis:TSC <numeric_value>			
Value range:	0 to 7			**Default:** 0
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60		**CMD52/55 with 8 Mbyte:** 3.00	

Expected power (of mobile station)

Syntax:	CONFigure:BANalysis:POWer:EXPected <numeric_value>			
Value range:	-50.0 to +47.0 dBm			**Default:** +43.0 dBm
State: ALL	**Option:** None	With query	**Note:** (N4)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60		**CMD52/55 with 8 Mbyte:** 3.00	

Input bandwidth of peak power measurement

Syntax:	`CONFigure:BANalysis:POWer:BANDwidth:INPut[:ONE] <value>`		
Value range:	`NARRow` | `WIDE`	Narrowband measurement Wideband measurement	**Default:** `WIDE`
State: ALL	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00	

Trigger mode

Syntax:	`CONFigure:BANalysis:TRIGger:MODE <value>`		
Value range:	`POWer` | `FREerun`	Triggering on rising signal edge Triggering without edge	**Default:** `POW`
State: ALL	**Option:** SW trigger	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.00	**CMD52/55 with 8 Mbyte:** 3.00	

2.4 Network and Test Mode

Network

Syntax:	CONFigure:NETWork[:TYPE] <value>			
Value range:	GSM | Dcs1800 | Dcs1900 | (1) Pcs1900 | (same as D190) (1) UIC Train radio telephony (2)			**Default:** GSM
State: Setting: IDLE Query: ALL	**Option:** GSM, D180: none D190, P190: B19 UIC: K80	With query	**Note:** After a query, D190 is returned instead of P190 (for reasons of compatibility).	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60 (1), 1.81 (2) 2.11	**CMD52/55 with 8 Mbyte:** 3.00		

Test mode

Syntax:	PROCedure:SELect[:TEST] <value>			
Value range:	NONE | No test mode (initial state) IQSPec | IQ spectrum (1) MODuletest | Module test (2) MANual | MS test RFGenerator | RF generator (3) RFMonitor RF monitor (4)			**Default:** NONE
State: (NONE): ALL (IQSP): NONE, MOD, RFG, RFM (MAN): NONE (MOD): NONE, IQSP, RFG, RFM (RFG): NONE, IQSP, MOD, RFM (RFM): NONE, IQSP, MOD, RFG Query: ALL	**Option:** none B4, K43 none B4 none B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1) 2.10 (2), (3) 1.60 (4) ---	**CMD52/55 with 8 Mbyte:** 3.00 (4) 3.20		

State upon transition from REMOTE to LOCAL and vice versa

Syntax:	CONFigure:LOCal:STATe <value>			
Value range:	IDLE | Transition to IDLE state. CURRent No change of state (current state is maintained).			**Default:** IDLE
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.00	**CMD52/55 with 8 Mbyte:** 3.00		

Switchover to LOCAL

Syntax:	`SYSTem[:STATe]:LOCal`			
State: ALL	**Option:** None	No query	**Note:** The command is only required in case of remote control via the serial interface, since for the IEC/IEEE bus it is sufficient to send the value 1 (GTL) with the ATN line set.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10		**CMD52/55 with 8 Mbyte:** 3.00	

2.5 General Settings for Measurements

Malfunction in case of burst measurements

Syntax:	`CONFigure:BURSt:TIMeout <value>`			
Value range:	`NORMal` | `SHORt`	Normal function (autoranging, repetition of measurements, etc) Fast abort if measurement conditions are not correct.		**Default:** `NORM`
State: ALL	**Option:** B4	With query	**Note:** The setting is valid until the instrument is RESET (or switched off).	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50		**CMD52/55 with 8 Mbyte:** 3.20	

3 Call Setup and Cleardown

Action after receiver pick-up at mobile

Syntax:	CONFigure:CALL:TOMS:ACTion <value>			
Value range:	ABORt | CONNect	Call aborted after pick-up Call setup		**Default:** ABOR
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.00		

Activating the action

Syntax:	CONFigure:CALL:TOMS:ACTion:STATe <value>			
Value range:	ACTive | NotActive	Activates the action configured in CONF:CALL:TOMS:ACT Deactivates the action configured in CONF:CALL:TOMS:ACT.		**Default:** NACT
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.00		

Call setup from CMD to mobile (Call)

Syntax:	PROCedure:CALL:TOMS		
State: MIDL, MSYN	**Option:** None	No query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Call cleardown from CMD to mobile (release)

Syntax:	PROCedure:RELease:TOMS		
State: MCE	**Option:** None	No query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Channel change for TCH

Syntax:	`PROCedure:SET:ARFCn <numeric_value>`			
Value range:	GSM: 1 to 124 DCS1800: 512 to 885 DCS1900: 512 to 810 UIC: 0 to 19			
State: Setting: MCE Query: ALL	**Option:** None	With query	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Channel change to hopping for TCH

Syntax:	`PROCedure:SET:ARFCn:HOPPing[:SEQuence] <value>`			
Value range:	A | Hopping sequence 1 B | Hopping sequence 2 C | Hopping sequence 3 D | Hopping sequence 4			
State: Setting: MCE Query: ALL	**Option:** None	With query	**Note:** No default value, returns the set channel number if no hopping sequence is active.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00		

Change of timeslot for TCH

Syntax:	`PROCedure:SET:SLOT <numeric_value>`			
Value range:	0 to 7			
State: MCE	**Option:** None	With query	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Power change (mobile station, used timeslot only)

Syntax:	PROCedure:SET:POWer:MS <numeric_value>			
Value range:	GSM: 0 to 15 | Power control level 13.0 to 43.0 dBm Absolute level DCS1800: 0 to 13 | Power control level 4.0 to 30.0 dBm Absolute level DCS1900: 0 to 13 | Power control level 4.0 to 30.0 dBm Absolute level UIC: 0 to 15 | Power control level 13.0 to 43.0 dBm Absolute level			
State: MCE	**Option:** None	With query	**Note:** No default value; returns always the power control level.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Power change (CMD) **in used timeslot**

Syntax:	PROCedure:SET:POWer:CMD[:USED] <numeric_value>			
Value range:	(N4)			
State: MCE	**Option:** None	With query	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Power change (CMD) **in unused timeslots**

Syntax:	PROCedure:SET:POWer:CMD:UNUSed <numeric_value>			
Value range:	-20.0 to +20.0 dB | ON | OFF			
State: MCE	**Option:** None	With query	**Note:** No default value, (N5)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Channel change without signalling

Syntax:	PROCedure:SET:RFCHannel <numeric_value>			
Value range:	GSM: 1 to 124 DCS1800: 512 to 885 DCS1900: 512 to 810 UIC: 0 to 19			
State: MCE	**Option:** None	No query	**Note:** No default value; Via remote control only (no manual control).	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.20		

Test setup of digital audio interfaces

Syntax:	`PROCedure:SET:DAI[:DEVice]`			
Value range:	`NORMal` | `SDECoder` | `SENCoder` | `ADEVice`	Normal operation Speech decoder Speech encoder Acoustic device		**Default:** `NORM`
State: Setting: MCE Query: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20		

3.1 Short Message Service (SMS)

Call setup from CMD to mobile station for SMS

Syntax:	`PROCedure:CALL:TOMS:SMS`		
State: MSYN	**Option:** None	No query	**Note:** The short message to the mobile is predefined and cannot be changed.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.00	

Content of SMS from mobile station

Syntax:	Full message: `SENSe:SIGNalling:SMS[:TEXT]?` Read by the line: `SENSe:SIGNalling:SMS[:TEXT]:LINE1?` to `SENSe:SIGNalling:SMS[:TEXT]:LINE6?`		
Return:	Full message: <1st line>, <2nd line >, <3rd line >, <4th line >, <5th line >, <6th line > Read by the line: < line >		
State: ALL	**Option:** None	Query only	**Note:** A line contains a string of maximum 40 characters; if the line contains no text, an empty string is returned ("").
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.00	

4 RF Generator

4.1 Configuration of a Generator Parameter Set

With CONFigure:RFGen:SELect a parameter set is selected which is to be modified with CONFigure:RFGen:... . These changes are maintained even if a different parameter set is selected.

Selection of generator configuration

Syntax:	CONFigure:RFGen:SELect <value>			
Value range:	SETting1 | SETting2 | SETting3 | SETting4 | SETting5 | SETting6 | SETting7			**Default:** SET1
State: ALL	**Option:** None	With query	**Note:** (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

Frequency

Syntax:	CONFigure:RFGen:FREQuency[:CW|:FIXed] <numeric_value>			
Value range:	GSM: 800.0 to 1000.0 MHz (in steps of 0.2 MHz) DCS1800: 1697.6 to 1897.6 MHz (in steps of 0.2 MHz) DCS1900: 1816.0 to 2016.0 MHz (in steps of 0.2 MHz) UIC: 800.0 to 1000.0 MHz (in steps of 0.2 MHz)			**Default:** GSM: 900.0 MHz DCS1800: 1750.0 MHz DCS1900: 1950.0 MHz UIC: 900.0 MHz
State: ALL	**Option:** None	With query	**Note:** The entered value is adapted to the step size given when the parameters are set, (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

Frequency offset

Syntax:	CONFigure:RFGen:FREQuency:OFFSet <numeric_value>			
Value range:	-100.009 to 100.009 kHz (in steps of ca. 33.061 Hz)			**Default:** 0.0 Hz
State: ALL	**Option:** None	With query	**Note:** The entered value is adapted to the step size given when the parameters are set, (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

Type of modulation

Syntax:	`CONFigure:RFGen:DM:FORMat <value>`			
Value range:	DUMmy0 | Dummy burst with TSC 0 DUMmy1 | Dummy burst with TSC 1 DUMmy2 | Dummy burst with TSC 2 DUMmy3 | Dummy burst with TSC 3 DUMmy4 | Dummy burst with TSC 4 DUMmy5 | Dummy burst with TSC 5 DUMmy6 | Dummy burst with TSC 6 DUMmy7 | Dummy burst with TSC 7 PRS | Pseudo random sequence NONE No modulation			**Default:** NONE
State: ALL	**Option:** None	With query	**Note:** (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

Ramping mode

Syntax:	`CONFigure:RFGen:RAMPing:STATe <value>`			
Value range:	ON | Signal with power ramping OFF Permanent signal			**Default:** OFF
State: ALL	**Option:** None	With query	**Note:** (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

Output level

Syntax:	`CONFigure:RFGen:POWer <numeric_value>`			
Value range:	(-120.0 - ext. att.) to (+13.0 - ext. att.) dBm			**Default:** -80.0 dBm
State: ALL	**Option:** None	With query	**Note:** Upon selection of the parameter set the level is automatically adapted to the output and its external circuitry, (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

4.2 Setting the Current Generator Parameter Set

Setting the generator configuration

Transfers the values of the selected configuration and sets the RF generator accordingly. These values can be changed using the following commands. The modifications are lost when SOURce:RFGen:SELect is called again.

Syntax:	SOURce:RFGen:SELect <value>		
Value range:	SETting1 | SETting2 | SETting3 | SETting4 | SETting5 | SETting6 | SETting7 | NONE (with query only, if the selected configuration has been changed.))	**Default:** NONE	
State: RFG, MOD, IQSP	**Option:** None	With query	**Note:** Power level automatically adapted to output and its external circuitry, (N6)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00	

Frequency

Syntax:	SOURce:RFGen:FREQuency[:CW|:FIXed] <numeric_value>		
Value range:	GSM: 800.0 to 1000.0 MHz (in steps of 0.2 MHz) DCS1800: 1697.6 to 1897.6 MHz (in steps of 0.2 MHz) DCS1900: 1816.0 to 2016.0 MHz (in steps of 0.2 MHz) UIC: 800.0 to 1000.0 MHz (in steps of 0.2 MHz)	**Default:** GSM: 900.0 MHz DCS1800: 1750.0 MHz DCS1900: 1950.0 MHz UIC: 900.0 MHz	
State: RFG, MOD, IQSP	**Option:** None	With query	**Note:** The entered value is adapted to the given step size, (N6)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00	

Frequency offset

Syntax:	SOURce:RFGen:FREQuency:OFFSet <numeric_value>		
Value range:	-100.009 to 100.009 kHz (in steps of approx. 33.061 Hz)	**Default:** 0.0 Hz	
State: RFG, MOD, IQSP	**Option:** None	With query	**Note:** The entered value is adapted to the given step size, (N6)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00	

Type of modulation

Syntax:	SOURce:RFGen:DM:FORMat <value>			
Value range:	DUMmy0 | Dummy burst with TSC 0 DUMmy1 | Dummy burst with TSC 1 DUMmy2 | Dummy burst with TSC 2 DUMmy3 | Dummy burst with TSC 3 DUMmy4 | Dummy burst with TSC 4 DUMmy5 | Dummy burst with TSC 5 DUMmy6 | Dummy burst with TSC 6 DUMmy7 | Dummy burst with TSC 7 PRS | Pseudo random sequence NONE No modulation			**Default:** NONE
State: RFG, MOD, IQSP	**Option:** None	With query	**Note:** (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60		**CMD52/55 with 8 Mbyte:** 3.00	

Ramping mode

Syntax:	SOURce:RFGen:RAMPing:STATe <value>			
Value range:	ON | Signal with power ramping OFF Continuous signal			**Default:** OFF
State: RFG, MOD, IQSP	**Option:** None	With query	**Note:** (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60		**CMD52/55 with 8 Mbyte:** 3.00	

Output level

Syntax:	SOURce:RFGen:POWer <numeric_value>			
Value range:	(-120.0 - ext. att.) to (+13.0 - ext. att.) dBm | ON | Output level switched on OFF Output level switched off			**Default:** -80.0 dBm
State: RFG, MOD, IQSP	**Option:** None	With query	**Note:** The level is automatically adapted to the output and its external circuitry when the parameter set is selected, (N6)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60		**CMD52/55 with 8 Mbyte:** 3.00	

5 AF Generator Setting

Frequency

Syntax:	CONFigure:AFGen:FREQuency[:CW|:FIXed] <numeric_value>				
Value range:	20.0 to 10000.0 Hz				**Default:** 1000.0 Hz
State: ALL	**Option:** B41	With query			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60		**CMD52/55 with 8 Mbyte:** 3.00		

Level

Syntax:	CONFigure:AFGen:VOLTage <numeric_value>				
Value range:	10.0 µV to 5.0 V | ON | OFF (in steps of 10 µV)				**Default:** 1.0 V
State: ALL	**Option:** B41	With query			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60		**CMD52/55 with 8 Mbyte:** 3.00		

Switching the generator on and off

Syntax:	SOURce:AFGen:STATe <value>				
Value range:	ON | Switching generator on OFF Switching generator off				**Default:** OFF
State: ALL	**Option:** B41	With query	**Note:** The generator is automatically switched off with burst, spectrum and BER measurements. This setting is effective until the instrument is RESET or switched off.		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60		**CMD52/55 with 8 Mbyte:** 3.00		

Speech coder

Syntax:	CONFigure:AFGEN:SPEech:CODec <value>				
Value range:	ON | The AF generator is the source of the speech coder. OFF The HANDSET connector is the source of the speech coder.				**Default:** OFF
State: ALL	**Option:** B41, B5	With query			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10		**CMD52/55 with 8 Mbyte:** 3.00		

6 AF Setting

Distortion frequency

Syntax:	CONFigure:AFMeas:FREQuency:DISTortion <numeric_value>			
Value range:	50.0 to 5000.0 Hz			**Default:** 1000.0 Hz
State: ALL	**Option:** B41	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

Lower frequency limit (for distortion and voltmeter)

Syntax:	CONFigure:AFMeas:FREQuency:MINimum <numeric_value>			
Value range:	10 to 1000 Hz			**Default:** 100 Hz
State: ALL	**Option:** B41	With query	**Note:** This setting also affects the duration of the measurement.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

Input

Syntax:	CONFigure:AFMeas:INPut <value>			
Value range:	AFVoltmeter | SPeechCodec	AF voltmeter connector Speech decoder signal		**Default:** AFV
State: ALL	**Option:** B41, B5	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00		

7 Measurement, Analysis and Result Query

7.1 AF Measurement

Readout of AF counter

Syntax:	CONFigure:AFMeas:COUNter:FORMat <value>			
Value range:	LT10khz | LT30mhz | LT60mhz | GT10khz	Frequency to be measured < 10 kHz Frequency to be measured < 30 MHz (1) Frequency to be measured < 60 MHz (1) Same as LT60		**Default:** LT10
State: ALL	**Option:** B41	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60 (1) 2.50	**CMD52/55 with 8 Mbyte:** 3.00		

Readout of voltmeter

Syntax:	CONFigure:AFMeas:VOLTage:FORMat <value>		
Value range:	RMS | SQRTrms		**Default:** RMS
State: ALL	**Option:** B41	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.60	**CMD52/55 with 8 Mbyte:** 3.00	

Center frequency of bandpass filter

Syntax:	CONFigure:AFMeas:VOLTage:BPASs:FREQuency <numeric_value>		
Value range:	500.0 to 5000.0 Hz | ON | OFF		**Default:** OFF
State: ALL	**Option:** B41	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.11	**CMD52/55 with 8 Mbyte:** 3.00	

Bandwidth of bandpass filter

Syntax:	CONFigure:AFMeas:VOLTage:BPASs:WIDTh <numeric_value>		
Value range:	10.0 to 1000.0 Hz		**Default:** 300.0 Hz
State: ALL	**Option:** B41	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.11	**CMD52/55 with 8 Mbyte:** 3.00	

AF counter

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ[:SCALar]:AFMeas:COUNter?`
	
	`FETCh[:SCALar]:AFMeas:COUNter?`			

Return:	<value> (unit: Hz)			
State: ALL	**Option:** B41	Query only	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

AF voltage

Syntax:
Perform new measurement and read result.
 	
Read result only
	`READ[:SCALar]:AFMeas:VOLTage?`
	
	`FETCh[:SCALar]:AFMeas:VOLTage?`			

Return:	<value> (unit: V)			
State: ALL	**Option:** B41	Query only	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

Distortion

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ[:SCALar]:AFMeas:DISTortion?`
	
	`FETCh[:SCALar]:AFMeas:DISTortion?`			

Return:	<value> (unit: %)			
State: ALL	**Option:** B41	Query only	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60	**CMD52/55 with 8 Mbyte:** 3.00		

7.2 Multitone Audio Measurement

7.2.1 Measurement Parameters

Frequencies for multitone measurement

Syntax:
Set discrete frequency:
 	
Set all frequencies:
	`CONFigure:MAA:FREQuency1[:CW│:FIXed] <numeric_value>`
	`to`
	`CONFigure:MAA:FREQuency14[:CW│:FIXed] <numeric_value>`
	
	`CONFigure:MAA:FREQuency:ALL`
	`<numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>,`
	`<numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>,`
	`<numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>,`
	`<numeric_value>, <numeric_value>`			

Value range:	`50 to 8460 Hz │`
	`ON │`
	`OFF`
		Default:
		Frequency: 1 2 3 4 5 6 7
		Default (in Hz): 200 250 315 400 500 630 800
		
		8 9 10 11 12 13 14
		1000 1250 1600 2000 2500 3150 4000		

State: ALL	**Option:** B41 and B44	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.00		

Level for multitone measurement

Syntax:
Set single level:
 	
Set all levels:
	`CONFigure:MAA:VOLTage1 <numeric_value>`
	`to`
	`CONFigure:MAA:VOLTage14 <numeric_value>`
	
	`CONFigure:MAA:VOLTage:ALL`
	`<numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>,`
	`<numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>,`
	`<numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>,`
	`<numeric_value>, <numeric_value>`			

Value range:	`1.0 mV to 5.0 V │`
	`-57.7 dBm to 16.1 dBm │`
	`ON │`
	`OFF`
		Default: all `10.0 mV`		

State: ALL	**Option:** B41 and B44	With query	**Note:**	• The total level should not exceed 5.0 V. • Conversion from V to dBm with 600 Ω.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.00		

Reference level for multitone measurement

Syntax:	CONFigure:MAA:VOLTage:REFerence <numeric_value>				
Value range:	0.0 to 9.999 V | -57.7 dBm to 22.2 dBm				**Default** 10.0 mV
State: ALL	**Option:** B41 and B44	With query	**Note:** Valid for result format RREF (CONF:MAA:FORM) only.		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:** 3.00		

Generator lead for multitone measurement

Syntax:	CONFigure:MAA:TIME:LEAD <numeric_value>			
Value range:	0.0 to 65.0 s			**Default:** 0.0 s
State: ALL	**Option:** B41 and B44	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:** 3.00	

Measurement/display mode for multitone measurement

Syntax:	CONFigure:MAA:FORMat <value>			
Value range:	AbsLIN | Results in mV AbsLOG | Results in dBm RelGEN | Results in dB relative to specified generator level RelREF | Results in dB relative to reference (CONF:MAA:VOLT:REF) RelT1 | Results in dB relative to level measured at tone 1 to RelT14 Results in dB relative to level measured at tone 14			**Default:** ALIN
State: ALL	**Option:** B41 and B44	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:** 3.00	

7.2.2 Tolerances

Reset to default values

Syntax:	CALCulate:LIMit:MAA:CLEar		
State: ALL	Option: B41 and B44	No query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.00	

Absolute level limits for multitone measurement

Syntax: Set single limits:	(lower limit) (upper limit) CALCulate:LIMit:MAA:VOLTage1:ABSolute <numeric_value>, <numeric_value> to CALCulate:LIMit:MAA:VOLTage14:ABSolute <numeric_value>, <numeric_value>			
Set all lower limits:	CALCulate:LIMit:MAA:VOLTage:ABSolute:LOWer[:ALL] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>			
Set all upper limits:	CALCulate:LIMit:MAA:VOLTage:ABSolute:UPPer[:ALL] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>			
Value range:	0.0 to 9.999 V| 57.7 dBm to 22.2 dBm		**Default:** Lower limits: 8 mV Upper limits: 12 mV	
State: ALL	Option: B41 and B44	With query	**Note:** The following applies to all limit values: upper limit - lower limit ≥ 1 mV	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.00		

Relative level limits for multitone measurement

Syntax: Set single limits:	(lower limit) (upper limit) CALCulate:LIMit:MAA:VOLTage1:RELative <numeric_value>, <numeric_value> to CALCulate:LIMit:MAA:VOLTage14:RELative <numeric_value>, <numeric_value>		
Set all lower limits:	CALCulate:LIMit:MAA:VOLTage:RELative:LOWer[:ALL] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>		
Set all upper limits:	CALCulate:LIMit:MAA:VOLTage:RELative:UPPer[:ALL] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>		
Value range:	-80.0 to +80.0 dB		**Default:** Lower limits: -3 dB Upper limits: +3 dB
State: ALL	**Option:** B41 and B44	With query	**Note:** The following applies to all limit values: upper limit - lower limit ≥ 1 dB
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:** 3.00

Query for tolerance violations (single-shot measurement)

Syntax:	CALCulate:LIMit:MAA:RESult:MATChing?		
Return:	MATC | NMAT | INV		
State: ALL	**Option:** B41 and B44	Query only	**Note:** The result of the last measurement is displayed; (N11), (N12)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:** 3.00

7.2.3 Measurement

MAA measurement

Syntax:
Perform new measurement and read result
 	
Read result only
	Single-shot measurement:
	`READ[:SCALar]:MAA:RESult1?`
	`to`
	`READ[:SCALar]:MAA:RESult14?`
	
	`FETCh[:SCALar]:MAA:RESult1?`
	`to`
	`FETCh[:SCALar]:MAA:RESult14?`

Perform new measurement and read result
 	
Read result only
	Overall measurement:
	`READ[:SCALar]:MAA:RESult:ALL?`
	
	`FETCh[:SCALar]:MAA:RESult:ALL?`

Return:	Single-shot measurement: <value> Overall measurement: <value1>, to, <value14>

State: ALL	**Option:** B41 and B44	Query only	**Note:** No default value Unit: depends on setting with CONF:MAA:FORM INV results are marked with INV.

Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.00

7.3 BER

7.3.1 Selection of BER Measurement Configuration (Parameter Set)

Syntax:	CONFigure:BER:SELect <value>			
Value range:	BER1 | BER2 | BER3 | BER4 | BER5 | BER6 | BER7			**Default:** BER1
State: ALL	Option: B4	With query	**Note:** (N7)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

7.3.2 Measurement Tolerances for Selected BER Configuration

Maximum values for class-Ib events

Syntax:	CALCulate:LIMit:BER:CLIB:MEVents <numeric_value>		
Value range:	0 to 1000000		
State: ALL	Option: B4	With query	**Note:** No default value, (N9)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Maximum values for class-II events

Syntax:	CALCulate:LIMit:BER:CLII:MEVents <numeric_value>		
Value range:	0 to 1000000		
State: ALL	Option: B4	With query	**Note:** No default value, (N9)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Maximum values for erased frames

Syntax:	CALCulate:LIMit:BER:EFRames:MEVents <numeric_value>		
Value range:	0 to 50000		
State: ALL	Option: B4	With query	**Note:** No default value, (N9)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

7.3.3 Measurement Parameters for Selected BER Configuration

Level for TCH in the used timeslot

Syntax:	CONFigure:BER:POWer[:USED] <numeric_value>			
Value range:	(N4)			
State: ALL	Option: B4	With query	**Note:** No default value, (N7)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Level for TCH in the unused timeslots

Syntax:	CONFigure:BER:POWer:UNUSed <numeric_value>			
Value range:	-20 to +20 dB | ON | Level switched on OFF Level switched off			
State: ALL	Option: B4	With query	**Note:** No default value, (N5), (N7)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Number of frames to be sent

Syntax:	CONFigure:BER:FRAMestosend <numeric_value>			
Value range:	1 to 50000			
State: ALL	Option: B4	With query	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Maximum number of samples to be sent and test time

The maximum number of samples sent in the test is derived from the value for "Frames to send". These values are only reached in the test if the errors do not exceed the tolerances or if ASAMples is selected as an abort condition (CONFigure:BER:SCONdition).

Syntax:	CONFigure:BER:CLIB:MSAMples? CONFigure:BER:CLII:MSAMples? CONFigure:BER:EFRames:MSAMples? CONFigure:BER:TEST:TIME?			
Return:	78 to 3900000 (class IB) 132 to 6600000 (class II) 1 to 50000 (erased frames) 0.02 to 1000 (test time, unit: s)			
State: ALL	Option: B4	Query only	**Note:** The values are derived from "Frames to send" and thus cannot be set.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Hold-off time for BER measurement

Syntax:	`CONFigure:BER:HOLDoff:TIME <numeric_value>`			
Value range:	`0.1 to 100.0 s`			**Default:** `3.0 s`
State: ALL	**Option:** B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.00	**CMD52/55 with 8 Mbyte:** 3.00		

Abort condition for BER measurement

Syntax:	`CONFigure:BER:SCONdition <value>`			
Value range:	`ALIMits` | `ASAMples` | `FLIMit`	Abort when all limits have been reached Abort when all samples have been transmitted Abort on first limit violation		
State: ALL	**Option:** B4	With query	**Note:** No default value, (N13)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

BER measurement mode

Syntax:	`CONFigure:BER:MEASurement:MODE <value>`			
Value range:	`BER | RBER`			**Default:** `RBER`
State: ALL	**Option:** B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.14	**CMD52/55 with 8 Mbyte:** 3.00		

7.3.4 Measurement

Measured values of class Ib

Syntax: Perform new measurement and read result.	READ[:SCALar]:BER:CLIB[:BER]? READ[:SCALar]:BER:CLIB:EVENts? READ[:SCALar]:BER:CLIB:RBER?			
Read result only	FETCh[:SCALar]:BER:CLIB[:BER]? FETCh[:SCALar]:BER:CLIB:EVENts? FETCh[:SCALar]:BER:CLIB:RBER?			
Return:	BER and RBER: 0 to 100 (unit: %) Events: 0 to 1000000			
State: MCE	**Option:** B4	Query only	**Note:** No default values, (N8), (N13)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Measured values of class II

Syntax: Perform new measurement and read result.	READ[:SCALar]:BER:CLII[:BER]? READ[:SCALar]:BER:CLII:EVENts? READ[:SCALar]:BER:CLII:RBER?			
Read result only	FETCh[:SCALar]:BER:CLII[:BER]? FETCh[:SCALar]:BER:CLII:EVENts? FETCh[:SCALar]:BER:CLII:RBER?			
Return:	BER and RBER: 0 to 100 (unit: %) Events: 0 to 1000000			
State: MCE	**Option:** B4	Query only	**Note:** No default values, (N8), (N13)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Measured values of erased frames

Syntax: Perform new measurement and read result	READ[:SCALar]:BER:EFRames[:FER]? READ[:SCALar]:BER:EFRames:EVENts?			
Read result only	FETCh[:SCALar]:BER:EFRames[:FER]? FETCh[:SCALar]:BER:EFRames:EVENts?			
Return:	FER: 0 to 100 (unit: %) Events: 0 to 50000			
State: MCE	**Option:** B4	Query only	**Note:** No default values, (N8)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

CRC error

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ[:SCALar]:BER:CRC:ERRor?`
	
	`FETCh[:SCALar]:BER:CRC:ERRor?`			

Return:	`0 to (number of frames sent / 4)`			
State: MCE	**Option:** B4	Query only	**Note:** No default values, (N8), (N9)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00		

Total result of BER measurement

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ[:SCALar]:BER:TRESult?`
	
	`FETCh[:SCALar]:BER:TRESult?`			

Return:	`PASS` | Results valid, all configured frames sent; all tolerances observed `FAIL` | Results valid, but not all frames sent and/or tolerances observed `INV` | Measurement results invalid `TLOW` | BS signal level too low, results are not valid `IMP` No measurement possible, results are not valid			
State: MCE	**Option:** B4	Query only	**Note:** No default values, (N8), (N9)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

7.4 Continuous BER

7.4.1 Measurement Parameters for Continuous BER Measurement

BER measurement mode

Syntax:	CONFigure:BER:CONTinuous:MEASurement:MODE <value>			
Value range:	BER | RBER			**Default:** RBER
State: ALL	**Option:** B4	With query	**Note:** (N12)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20

Number of frames for average-value measurement

Syntax:	CONFigure:BER:CONTinuous:AVERage <numeric_value>			
Value range:	1 to 499			**Default:** 20
State: ALL	**Option:** B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20

Level for TCH in used timeslot

Syntax:	CONFigure:BER:CONTinuous:POWer[:USED] <numeric_value>			
Value range:	(N3)			
State: ALL	**Option:** B4	With query	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20

Level for TCH in unused timeslots

Syntax:	CONFigure:BER:CONTinuous:POWer:UNUSed <numeric_value>			
Value range:	-20 to +30 dB | ON | OFF	Level switched on Level switched off		
State: ALL	**Option:** B4	With query	**Note:** No default value, (N4)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20

7.4.2 Measurement

Start of measurement

Syntax:	PROCedure:BER:CONTinuous:STARt		
State: MCE	**Option:** B4	No query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Stop of measurement

Syntax:	PROCedure:BER:CONTinuous:STOP		
State: MCE	**Option:** B4	No query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Averaging indicator

Syntax:	SENSe:BER:CONTinuous:AVERage:INDicator?		
Return:	0 to 100 (unit: %)		
State: MCE	**Option:** B4	Query only	**Note:** Continuous BER measurement must be started.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Measured values of class Ib

Syntax:	SENSe:BER:CLIB[:BER]? SENSe:BER:CLIB:RBER?		
Return:	0 to 100 (unit: %)		
State: MCE	**Option:** B4	Query only	**Note:** No default values; the continuous BER measurement must be started.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Measured values of class II

Syntax:	SENSe:BER:CLII[:BER]? SENSe:BER:CLII:RBER?		
Return:	0 to 100 (unit: %)		
State: MCE	**Option:** B4	Query only	**Note:** No default values; the continuous BER measurement must be started.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Measured value of erased frames

Syntax:	SENSe:BER:EFRames[:FER]?			
Return:	0 to 100 (unit: %)			
State: MCE	**Option:** B4	Query only	**Note:** No default value; the continuous BER measurement must be started.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20		

State of BER measurement

Syntax:	SENSe:BER:CONTinuous:STATus?			
Return:	ACT | NACT | TLOW | INV	Measurement active Measurement not active BS signal too low, results invalid Results not valid		
State: MCE	**Option:** B4	Query only	**Note:** No default value; the continuous BER measurement must be started.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20		

7.4.3 BER Search Routine

Syntax:	PROCedure:BER:SEARch:CLII <numeric_value>			
Value range:	0.1 to 15.0 %	**Default:** 5 %		
State: MCE	**Option:** B4	No query	**Note:** Start level, type of measurement and average value are set with the continuous BER measurement commands.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20		

7.5 Power

7.5.1 Tolerances

Resetting to default values

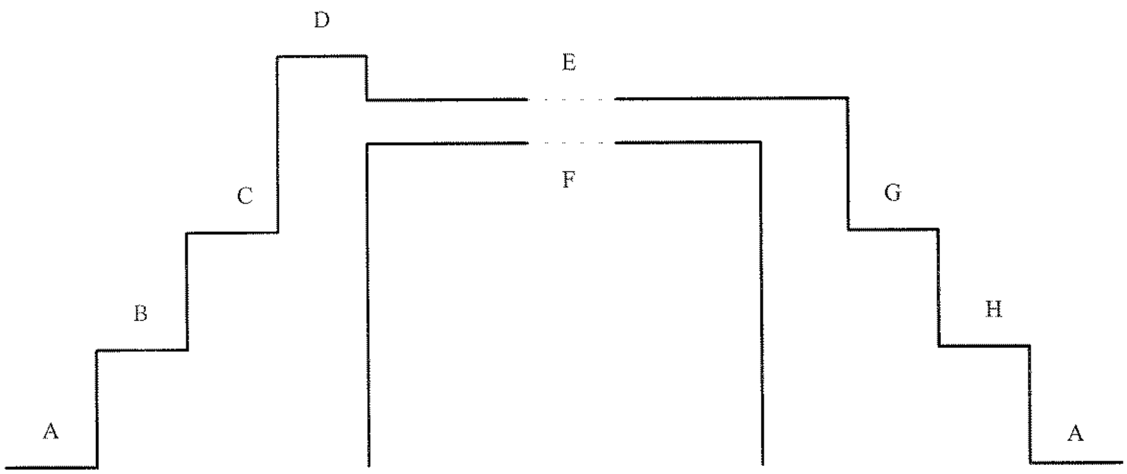
Syntax:	CALCulate:LIMit:POWer[:TEMPlate]:CLEar			
State: ALL	**Option:** B4	No query	**Note:** Sets tolerances for the current network.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Tolerances for average power in the power time template

Syntax:	CALCulate:LIMit:POWer[:TEMPlate]:TOLerance1[:DATA] <numeric_value> CALCulate:LIMit:POWer[:TEMPlate]:TOLerance2[:DATA] <numeric_value> CALCulate:LIMit:POWer[:TEMPlate]:TOLerance3[:DATA] <numeric_value> CALCulate:LIMit:POWer[:TEMPlate]:TOLerance4[:DATA] <numeric_value>			
Value range:			Deviation from expected value	**Default:**
	GSM and UIC:			
	CALC:LIM:POW:TOL1	0.0 to +8.0 dB	with maximum power control level	+2.0 dB
	CALC:LIM:POW:TOL2	0.0 to +8.0 dB	up to power control level 15	+3.0 dB
	CALC:LIM:POW:TOL3	0.0 to +8.0 dB	as of power control level 16	+5.0 dB
	DCS1800 and DCS1900:			
	CALC:LIM:POW:TOL1	0.0 to +8.0 dB	with maximum power control level	+2.0 dB
	CALC:LIM:POW:TOL2	0.0 to +8.0 dB	up to power control level 8	+3.0 dB
	CALC:LIM:POW:TOL3	0.0 to +8.0 dB	as of power control level 9	+4.0 dB
	CALC:LIM:POW:TOL4	0.0 to +8.0 dB	as of power control level 14	+5.0 dB
State: ALL	**Option:** B4	With query	**Note:** Deviations always apply symmetrically about the expected value.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Tolerances for power time template

The level designations used in the power time template for command CALCulate:LIMit:POWer[:TEMPlate][:DATA] can be obtained from the following illustration:



Syntax:	CALCulate:LIMit:POWer[:TEMPlate][:DATA] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>		
Value range:	-100.0 to 0.0 dBm	Absolute level at A	**Default:** GSM: -36.0 dBm DCS1800: -47.0 dBm DCS1900: -47.0 dBm
	-100.0 to 0.0 dB	Relative level at A	GSM: -70.0 dB DCS1800: -70.0 dB DCS1900: -70.0 dB UIC: -59.0 dB
	-100.0 to 0.0 dB	Relative level at B	-30.0 dB
	-100.0 to 0.0 dB	Relative level at C	-6.0 dB
	0.0 to +20.0 dB	Relative level at D	+4.0 dB
	0.0 to +5.0 dB	Relative level at E	+1.0 dB
	-5.0 to 0.0 dB	Relative level at F	-1.0 dB
	-100.0 to 0.0 dB	Relative level at G	-6.0 dB
	-100.0 to 0.0 dB	Relative level at H	-30.0 dB
State: ALL	**Option:** B4	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:**	

Query for observance of tolerances for average power

Syntax:	Current (single-shot) measurement:
	`CALCulate:LIMit:POWer[:TEMPlate]:TOLerance:MATChing[:CURRent]?`
	Average value measurement (1):
	`CALCulate:LIMit:POWer[:TEMPlate]:TOLerance:MATChing:AVERage?`			

Return:	`MATC | NMAT | INV`			
State: MCE	**Option:** B4	Query only	**Note:** Provides results for the last measurement; (N10), (N12)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1) 2.50	**CMD52/55 with 8 Mbyte:** 3.00		

Query for observance of tolerances for power time templates

Syntax:	`CALCulate:LIMit:POWer[:TEMPlate]:MATChing[:CURRent]?`	Measurement of current (single) value
	`CALCulate:LIMit:POWer[:TEMPlate]:MATChing:AVERage?` (1)	Measurement of average value
	`CALCulate:LIMit:POWer[:TEMPlate]:MATChing:MAXimum?`	Measurement of maximum value (1)
	`CALCulate:LIMit:POWer[:TEMPlate]:MATChing:MINimum?`	Measurement of minimum value
Return:	`MATC` |	Within tolerance
	`NMAT` |	Out of tolerance
	`INV` |	No measurement result available
	`NRAM` |	No ramping
	`NTSC` |	No valid TSC found
	`OUT` |	Out of dynamic range
	`TEAR` |	Falling edge of ramp too early
	`THIG` |	Phase or frequency error of burst too high
	`TLAT` |	Rising edge of ramp too late
	`TLON` |	Burst too long
	`TSH` |	Burst too short
	`NACC`	No access burst (with access burst measurement only) (2)
State: MCE, MOD	**Option:** B4 | Query only	**Note:** Provides the result for the last measurement, (N10), (N12)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1) 2.50 (2) ---	**CMD52/55 with 8 Mbyte:** 3.00 (2) from 3.20

7.5.2 Test Parameters for Power Measurements

Number of bursts for measurement of average, minimum and maximum power

Syntax:	CALCulate:LIMit:POWer[:TEMPlate]:AVERage[:COUNt] <numeric_value>			
Value range:	1 to 2000			**Default:** 100
State: ALL	**Option:** B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.00		

Shifting the power ramp for burst measurements

Syntax:	CONFigure:RAMP:TIMing <value>			
Value range:	GSM | OFFSet	Weighting in line with GSM specifications Shift by 2/4 bit		**Default:** GSM
State: ALL	**Option:** B4	With query	**Note:** Applies to all burst measurements including access burst.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.50	**CMD52/55 with 8 Mbyte:** 3.20		

7.5.3 Power Measurements

Average burst power

Syntax:
Perform new measurement and read result
	`READ[:SCALar]:BURSt:POWer:AVERage[:CURRent]?`
	value
	`READ[:SCALar]:BURSt:POWer:AVERage:AVERage?`
	(1)
		Measurement of current (single)
		Measurement of average power

Read result only	`FETCh[:SCALar]:BURSt:POWer:AVERage[:CURRent]?`
	value
	`FETCh[:SCALar]:BURSt:POWer:AVERage:AVERage?`
	(1)
		Measurement of current (single)
		Measurement of average power

Return:	<value>	(unit: dBm)
State: MCE, MOD	**Option:** B4 · Query only	**Note:** No default values, (N10)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1) 2.50	**CMD52/55 with 8 Mbyte:** 3.00

Burst power

Syntax:
Perform new measurement and read result
	`READ:ARRay:BURSt:POWer[:CURRent]?`
	value
	`READ:ARRay:BURSt:POWer:AVERage?`
	`READ:ARRay:BURSt:POWer:MAXimum?`
	`READ:ARRay:BURSt:POWer:MINimum?`
		Measurement of current (single)
		Measurement of average power (1)
		Measurement of maximum power (1)
		Measurement of minimum power (1)

Read result only	`FETCh:ARRay:BURSt:POWer[:CURRent]?`
	value
	`FETCh:ARRay:BURSt:POWer:AVERage?`
	`FETCh:ARRay:BURSt:POWer:MAXimum?`
	`FETCh:ARRay:BURSt:POWer:MINimum?`
		Measurement of current (single)
		Measurement of average power (1)
		Measurement of maximum power (1)
		Measurement of minimum power (1)

Return:	<value> {, <value>}	(unit: dB)
State: MCE, MOD	**Option:** B4 · Query only	**Note:** No default values, (N10), (N11)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1) 2.50	**CMD52/55 with 8 Mbyte:** 3.00

Selecting a subrange of the total burst power

<table>
<tr><td>Syntax:</td><td colspan="4"><code>CONFigure:BURSt:POWer:OUTPut:RANGe <numeric_value> [, <numeric_value>]</code></td></tr>
<tr><td>Value range:</td><td colspan="3">Start position: <code>-10.0 to 157.0</code> (in steps of 0.25)
Number of measured values: <code>1 to 669</code></td><td>Default: <code>-10.0</code>
<code>669</code></td></tr>
<tr><td>State: ALL</td><td>Option: B4</td><td>With query</td><td colspan="2">Note:
• These settings are valid until the instrument is RESET (or switched off).
• If the number of results exceeds the number of values available after the start position, it is automatically corrected to the maximum upon the <u>next readout of results.</u>
Caution: The corrected value is active until it is explicitly changed.</td></tr>
<tr><td>Available as of software version:</td><td colspan="4">CMD50/53 and CMD52/55 with 4 Mbyte: 2.00 CMD52/55 with 8 Mbyte: 3.00</td></tr>
</table>

7.6 Phase and Frequency Errors

7.6.1 Tolerances

Resetting to default values

Syntax:	`CALCulate:LIMit:PHFR:CLEar`		
State: ALL	**Option:** B4	No query	**Note:** Sets the tolerances for the current network.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Tolerances for phase and frequency error (single and maximum-value measurement)

Syntax:	`CALCulate:LIMit:PHFR:TOLerance[:DATA] <numeric_value>, <numeric_value>, <numeric_value>`		
Value range:	`0.0 to 100.0 deg` (peak phase error) `0.0 to 25.0 deg` (RMS phase error) GSM: `0 to 200 Hz` (frequency error) DCS1800: `0 to 400 Hz` DCS1900: `0 to 400 Hz` UIC: `0 to 200 Hz`	**Default:** `20.0 deg` `5.0 deg` GSM: `90 Hz` DCS1800: `180 Hz` DCS1900: `180 Hz` UIC: `90 Hz`	
State: ALL	**Option:** B4	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Tolerances for phase and frequency error (average value measurements)

Syntax:	`CALCulate:LIMit:PHFR:TOLerance:AVERage[:DATA] <numeric_value>, <numeric_value>, <numeric_value>`		
Value range:	`0.0 to 100.0 deg` (peak phase error) `0.0 to 25.0 deg` (RMS phase error) GSM: `0 to 200 Hz` (frequency error) DCS1800: `0 to 400 Hz` DCS1900: `0 to 400 Hz` UIC: `0 to 200 Hz`	**Default:** `20.0 deg` `5.0 deg` GSM: `90 Hz` DCS1800: `180 Hz` DCS1900: `180 Hz` UIC: `90 Hz`	
State: ALL	**Option:** B4	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00	

Query for observance of tolerances

Syntax:	CALCulate:LIMit:PHFR:TOLerance:MATChing? value CALCulate:LIMit:PHFR:TOLerance:MATChing:AVERage? (1) CALCulate:LIMit:PHFR:TOLerance:MATChing:MAXimum? value (1)	Measurement of current (single) Measurement of average value Measurement of maximum
Return:	MATC | NMAT | INV, MATC | NMAT | INV, MATC | NMAT | INV	(peak phase error) (RMS phase error) (frequency error)

State: MCE, MOD	**Option:** B4	Query only	**Note:** Returns the result for the last measurement; (N10), (N12)

Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1) 1.70	**CMD52/55 with 8 Mbyte:** 3.00

7.6.2 Test Parameters for Phase and Frequency Error Measurements

Number of bursts for average- and maximum-value measurements

Syntax:	`CALCulate:LIMit:PHFR:AVERage[:COUNt] <numeric_value>`			
Value range:	`1 to 2000`			**Default:** `10`
State: ALL	**Option:** B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70		**CMD52/55 with 8 Mbyte:** 3.00	

Decoding

Syntax:	`CONFigure:DECoding:MODE <value>`			
Value range:	`STANdard` | `GATBits`	Standard mode Taking guard and tail bits into consideration		**Default:** `STAN`
State: MOD	**Option:** B4	With query	**Note:** Setting is valid for all phase measurements including those of the BURST ANALYSIS menu.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80		**CMD52/55 with 8 Mbyte:** 3.00	

Offset for frequency error measurement

Syntax:	`CONFigure:PHFR:FREQuency:OFFSet <numeric_value>`			
Value range:	`-200000 to +200000 Hz`			**Default:** `0`
State: ALL	**Option:** B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10		**CMD52/55 with 8 Mbyte:** 3.00	

7.6.3 Phase Error Measurement

Total phase error of burst

Syntax: Perform new measurement and read result	RMS:
	`READ[:SCALar]:BURSt:PHASe:ERRor:RMS?`
	`READ[:SCALar]:BURSt:PHASe:ERRor:RMS:AVERage?` value (1)
	`READ[:SCALar]:BURSt:PHASe:ERRor:RMS:MAXimum?` value (1)
	
	Peak:
	`READ[:SCALar]:BURSt:PHASe:ERRor:PEAK?`
	`READ[:SCALar]:BURSt:PHASe:ERRor:PEAK:AVERage?` value (1)
	`READ[:SCALar]:BURSt:PHASe:ERRor:PEAK:MAXimum?` value (1)
				Measurement of single value
				Measurement of average
				
				Measurement of maximum
				
				Measurement of single value
				Measurement of average
				
				Measurement of maximum	

Read result only	RMS:
	`FETCh[:SCALar]:BURSt:PHASe:ERRor:RMS?`
	`FETCh[:SCALar]:BURSt:PHASe:ERRor:RMS:AVERage?` value (1)
	`FETCh[:SCALar]:BURSt:PHASe:ERRor:RMS:MAXimum?` value (1)
	
	Peak:
	`FETCh[:SCALar]:BURSt:PHASe:ERRor:PEAK?`
	`FETCh[:SCALar]:BURSt:PHASe:ERRor:PEAK:AVERage?` value (1)
	`FETCh[:SCALar]:BURSt:PHASe:ERRor:PEAK:MAXimum?` value (1)
				Measurement of single value
				Measurement of average
				
				Measurement of maximum
				
				Measurement of single value
				Measurement of average
				
				Measurement of maximum	

Return:	<value> (unit: deg)				
State: MCE, MOD	**Option:** B4	Query only	**Note:** No default values, (N10)		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1) 1.70			**CMD52/55 with 8 Mbyte:** 3.00	

Phase error of burst (single-value measurement)

Syntax: Perform new measurement and read result	`READ:ARRay:BURSt:PHASe:ERRor?`		
Read result only	`FETCh:ARRay:BURSt:PHASe:ERRor?`		
Return:	<value> {, <value>} (unit: deg)		
State: MCE, MOD	**Option:** B4	Query only	**Note:** No default values, (N10), (N11)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Selecting a subrange of the burst phase error

<table>
<tr><td>Syntax:</td><td colspan="5">CONFigure:BURSt:PHASe:ERRor:OUTPut:RANGe <numeric_value> [, <numeric_value>]</td></tr>
<tr><td>Value range:</td><td colspan="4">Start position: 0.5 to 147.25 (in steps of 0.25)
Number of measured values: 1 to 589</td><td>Default: 0.5
589</td></tr>
<tr><td>State: ALL</td><td>Option: B4</td><td>With query</td><td colspan="3">Note:
• These settings are valid until the instrument is RESET (or switched off).
• If the number of measurement results exceeds the number of values available after the start position, it is automatically corrected to the maximum possible number <u>upon the next readout of results.</u>.
Note: The corrected value is active until it is explicitly changed.</td></tr>
<tr><td>Available as of software version:</td><td colspan="5">CMD50/53 and CMD52/55 with 4 Mbyte: 2.00 CMD52/55 with 8 Mbyte: 3.00</td></tr>
</table>

7.6.4 Frequency Error Measurement

Total frequency error of burst

Syntax: Perform new measurement and read result	`READ[:SCALar]:BURSt:FREQuency:ERRor?` `READ[:SCALar]:BURSt:FREQuency:ERRor:AVERage?` value (1) `READ[:SCALar]:BURSt:FREQuency:ERRor:MAXimum?` value (1)	Measurement of single value Measurement of average Measurement of maximum
Read result only	`FETCh[:SCALar]:BURSt:FREQuency:ERRor?` `FETCh[:SCALar]:BURSt:FREQuency:ERRor:AVERage?` value (1) `FETCh[:SCALar]:BURSt:FREQuency:ERRor:MAXimum?` value (1)	Measurement of single value Measurement of average Measurement of maximum
Return:	<value> (unit: Hz)	
State: MCE, MOD	**Option:** B4 | Query only	**Note:** No default values, (N10)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1) 1.70	**CMD52/55 with 8 Mbyte:** 3.00

7.7 Timing Measurement

Syntax: Perform new measurement and read result	`READ[:SCALar]:BURSt:TIMing:ERRor?`
Read result only	`FETCh[:SCALar]:BURSt:TIMing:ERRor?`
Return:	<value> (unit: Bit)
State: MCE	**Option:** B4 | Query only | **Note:** No default values, (N10)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.00 **CMD52/55 with 8 Mbyte:** 3.00

7.8 Timing Advance Measurement

Setting the timing advance

Syntax:	`PROCedure:SET:TIMing:ADVance[:NOMinal] <numeric_value>`			
Value range:	`0 to 63`			
State: MCE	**Option:** B4	With query	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.03	**CMD52/55 with 8 Mbyte:** 3.00		

Timing advance measurement

Syntax: Perform new measurement and read result	`READ[:SCALar]:TIMing:ADVance?` `READ[:SCALar]:TIMing:ADVance:ERRor?`	Actual value Deviation from nominal value		
Read result only	`FETCh[:SCALar]:TIMing:ADVance?` `FETCh[:SCALar]:TIMing:ADVance:ERRor?`	Actual value Deviation from nominal value		
Return:	<value> (unit: Bit)			
State: MCE	**Option:** B4	Query only	**Note:** No default values	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.03	**CMD52/55 with 8 Mbyte:** 3.00		

7.9 Access Burst

Query for observance of tolerances for average power

Syntax:	CALCulate:LIMit:ACCess:POWer[:TEMPlate]:TOLerance:MATChing?			
Return:	MATC | NMAT | INV			
State: MCE	**Option:** B4	Query only	**Note:** Provides the result for the last measurement, (N10), (N12)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20

Query for observance of tolerances for power time templates

Syntax:	CALCulate:LIMit:ACCess:POWer[:TEMPlate]:MATChing?			
Return:	MATC | NMAT | INV | NRAM | NTSC | OUT | TEAR | THIG | TLAT | TLON | TSH | NACC	Within tolerance Out of tolerance No measurement result available No ramping No valid TSC found Out of dynamic range Falling edge of ramp too early Phase or frequency error burst too high Rising edge of burst too late Burst too long Burst too short No access burst		
State: MCE	**Option:** B4	Query only	**Note:** Provides the result for the last measurement, (N10)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20

Average burst power

Syntax: Perform new measurement and read result Read result only	READ[:SCALar]:ACCess:BURSt:POWer:AVERage? FETCh[:SCALar]:ACCess:BURSt:POWer:AVERage?			
Return:	<value> (unit: dBm)			
State: MCE	**Option:** B4	Query only	**Note:** No default values, (N10)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20

Total burst power

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ:ARRay:ACCess:BURSt:POWer?`
	
	`FETCh:ARRay:ACCess:BURSt:POWer?`			

Return:	<value> {, <value>} (unit: dB)			
State: MCE	**Option:** B4	Query only	**Note:** No default values, (N10)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20		

Selecting a subrange of the total burst power

Syntax:	`CONFigure:ACCess:BURSt:POWer:OUTPut:RANGe <numeric_value> [, <numeric_value>]`			
Value range:	Start position: `-10.0 to 97.0` (in steps of 0.25) Number of values: `1 to. 429`	**Default:** `-10.0` `429`		
State: ALL	**Option:** B4	With query	**Note:** • These settings are valid until the instrument is RESET (or switched off). • If the number of measurement results exceeds the number of values available after the start position, it is automatically corrected to the maximum possible number upon the next readout of results.. **Note:** The corrected value is active until it is explicitly changed.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20		

Timing error

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ[:SCALar]:ACCess:BURSt:TIMing:ERRor?`
	
	`FETCh[:SCALar]:ACCess:BURSt:TIMing:ERRor?`			

Return:	<value> (unit: Bit)			
State: MCE	**Option:** B4	Query only	**Note:** No default values, (N10)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20		

7.10 Spectrum Measurement

7.10.1 Tolerances

Resetting to default values

Syntax:	`CALCulate:LIMit:SPECtrum:MODulation:CLEar` `CALCulate:LIMit:SPECtrum:SWITching:CLEar`		
State: ALL	**Option:** B43	No query	**Note:** Sets tolerances for the currently used network.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00	

Absolute tolerances for spectrum (modulation)

Syntax:	`CALCulate:LIMit:SPECtrum:MODulation:ABSolute[:DATA]` `<numeric_value>, <numeric_value>`		
Value range:	`-100.0 to 5.0 dBm` Frequencies up to 600 kHz `-100.0 to 5.0 dBm` Frequencies above 600 kHz	**Default:** `-36.0 dBm` `-56.0 dBm`	
State: ALL	**Option:** B43	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00	

Relative tolerances for spectrum (modulation)

Syntax: `CALCulate:LIMit:SPECtrum:MODulation:RELative[:DATA] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>`

Value range:

Value range				Default
-100.0 to 5.0 dB	ON	OFF	Relative level at 100 kHz	+0.5 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 200 kHz	-30.0 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 250 kHz	-33.0 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 400 kHz	-60.0 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 600 kHz	-60.0 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 800 kHz	-60.0 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 1000 kHz	-60.0 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 1200 kHz	-60.0 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 1400 kHz	-60.0 dB
-100.0 to 5.0 dB	ON	OFF	Relative level at 1600 kHz	-60.0 dB

State: ALL	**Option:** B43	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00	

Absolute tolerances for spectrum (switching)

Syntax:	CALCulate:LIMit:SPECtrum:SWITching:ABSolute[:DATA] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>				
Value range:	-100.0 to 5.0 dBm | ON | OFF -100.0 to 5.0 dBm | ON | OFF -100.0 to 5.0 dBm | ON | OFF -100.0 to 5.0 dBm | ON | OFF	Absolute level at 400 kHz Absolute level at 600 kHz Absolute level at 1200 kHz Absolute level at 1800 kHz			**Default:** -23.0 dBm -26.0 dBm -32.0 dBm -36.0 dBm
State: ALL	**Option:** B43	With query	**Note:** Setting the absolute tolerances to ON or OFF will also set the corresponding relative tolerances to ON or OFF.		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00			

Relative tolerances for spectrum (switching)

Syntax:	CALCulate:LIMit:SPECtrum:SWITching:RELative[:DATA] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>				
Value range:	-100.0 to 5.0 dB | ON | OFF -100.0 to 5.0 dB | ON | OFF -100.0 to 5.0 dB | ON | OFF -100.0 to 5.0 dB | ON | OFF	Relative level at 400 kHz Relative level at 600 kHz Relative level at 1200 kHz Relative level at 1800 kHz			**Default:** -60.0 dB -69.0 dB -75.0 dB -79.0 dB
State: ALL	**Option:** B43	With query	**Note:** For the MS test, only the 1st tolerance is checked (with offset 400 kHz); the other tolerances are evaluated only in the BTS test. The query always provides all four values. Setting the relative tolerances to ON or OFF will also set the corresponding absolute tolerances to ON or OFF.		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00			

Query for observance of tolerances for spectrum (modulation)

Syntax:	CALCulate:LIMit:SPECtrum:MODulation:MATChing?		
Return:	MATC | NMAT | INV		
State: MCE, MOD	**Option:** B43	Query only	**Note:** Provides the result for the last measurement, (N12)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.70	**CMD52/55 with 8 Mbyte:** 3.00	

Query for observance of tolerances for spectrum (switching)

Syntax:	CALCulate:LIMit:SPECtrum:SWITching:MATChing?		
Return:	MATC | NMAT | INV		
State: MCE, MOD	**Option:** B43	Query only	**Note:** Provides the result for the last measurement, (N12)
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.70	**CMD52/55 with 8 Mbyte:** 3.00	

7.10.2 Test Parameters for Spectrum Measurements

Number of bursts to be measured

Syntax:	`CONFigure:SPECtrum:MODulation:AVERage[:COUNt] <numeric_value>` `CONFigure:SPECtrum:SWITching:AVERage[:COUNt] <numeric_value>`			
Value range:	1 to 2000			**Default:** Modulation: 500 Switching: 10
State: IDLE	**Option:** B43	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70		**CMD52/55 with 8 Mbyte:** 3.00	

Noise correction

Syntax:	`CONFigure:SPECtrum:SWITching:NOISe:CORRection <value>`			
Value range:	ON | OFF	Correction performed No correction		**Default:** ON
State: ALL	**Option:** B43	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.00		**CMD52/55 with 8 Mbyte:** 3.00	

7.10.3 Measurements

Measurement of absolute power of spectrum (modulation and switching)

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ[:SCALar]:SPECtrum:MODulation:POWer?`
	`READ[:SCALar]:SPECtrum:SWITching:POWer?`
	
	`FETCh[:SCALar]:SPECtrum:MODulation:POWer?`
	`FETCh[:SCALar]:SPECtrum:SWITching:POWer?`			

Return:	<value> (unit: dBm)			
State: MCE, MOD	**Option:** B43	Query only	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00		

Performing the spectrum measurement (modulation)

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ:ARRay:SPECtrum:MODulation?`
	
	`FETCh:ARRay:SPECtrum:MODulation?`			

Return:	<value> {, <value>} (unit: dB)			
State: MCE, MOD	**Option:** B43	Query only	**Note:** No default values; all values are relative to the absolute power of the spectrum; the values returned are spectral lines in the following order: -11 to 0 to +11 (23 values)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00		

Performing the spectrum measurement (switching)

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ:ARRay:SPECtrum:SWITching?`
	
	`FETCh:ARRay:SPECtrum:SWITching?`			

Return:	<value> {, <value>} (unit: dBm)			
State: MCE, MOD	**Option:** B43	Query only	**Note:** No default values; the values returned are spectral lines in the following order: -4 to 0 to +4 (9 values)	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.70	**CMD52/55 with 8 Mbyte:** 3.00		

7.11 IQ Spectrum Measurements

7.11.1 Test Parameters for IQ Spectrum Measurements

Signal setting

Syntax:	`CONFigure:IQSPectrum:MODE <value>`			
Value range:	CW | BURSt	Continuous signal Pulsed signal		**Default:** BURS
State: IQSP, IDLE	**Option:** B4, K43, SW trigger	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00		

Bandwidth

Syntax:	`CONFigure:IQSPectrum:BANDwidth[:RESolution] <value>`			
Value range:	B4 | B10 | B20 | B50 | B100	Bandwidth 4 kHz Bandwidth 10 kHz Bandwidth 20 kHz Bandwidth 50 kHz Bandwidth 100 kHz		**Default:** B4
State: IQSP, IDLE	**Option:** B4, K43	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00		

Average value

Syntax:	`CONFigure:IQSPectrum:AVERage[:COUNt] <value>`			
Value range:	C1 | C2 | C5 | C10 | C20 | C50 | MaxHOLd	Averaging over 1 burst Averaging over 2 bursts Averaging over 5 bursts Averaging over 10 bursts Averaging over 20 bursts Averaging over 50 bursts Max. hold		**Default:** C1
State: IQSP, IDLE	**Option:** B4, K43	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10	**CMD52/55 with 8 Mbyte:** 3.00		

7.11.2 Measurements

Spectrum measurement

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ:ARRay:IQSPectrum?`
	
	`FETCh:ARRay:IQSPectrum?`

Return:	<value> {, <value>} (unit: dB; maximum 301 values)
State: IQSP	**Option:** B4, K43 | Query only | **Note:** No default value
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10 **CMD52/55 with 8 Mbyte:** 3.00

Selection of spectrum subrange

Syntax:	`CONFigure:IQSPectrum:OUTPut:RANGe <numeric_value>,<numeric_value>`	
Value range:	`-150 to +150 kHz` Start frequency `1 to 301` Number	**Default:** `-150 kHz` `301`
State: IQSP, IDLE	**Option:** B4, K43 | With query | **Note:** • This setting is valid until the instrument is RESET (or switched off). • If the number of measurement results exceeds the number of values available after the start position, results are automatically corrected to the maximum possible number upon the next readout of results. **Note:** The corrected value is active until it is explicitly changed.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10 **CMD52/55 with 8 Mbyte:** 3.00	

Measurement of reference power

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ[:SCALar]:IQSPectrum:POWer[:REFerence]?`
	
	`FETCh[:SCALar]:IQSPectrum:POWer[:REFerence]?`

Return:	<value> (unit: dBm)
State: IQSP	**Option:** B4, K43 | Query only | **Note:** No default value
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.10 **CMD52/55 with 8 Mbyte:** 3.00

7.12 RF Monitor

7.12.1 Test Parameters for RF Monitor Measurements

Measurement bandwidth

Syntax:	CONFigure:RFMonitor:BANDwidth <value>				
Value range:	B30 | Bandwidth 30 kHz B100 Bandwidth 100 kHz				**Default:** B100
State: Setting: IDLE, RFM Query: ALL		**Option:** B42	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---			**CMD52/55 with 8 Mbyte:** 3.20	

Beginning and end of measurement range

Syntax:	CONFigure:RFMonitor:FREQuency:STARt <numeric_value> CONFigure:RFMonitor:FREQuency:STOP <numeric_value>				
Value range:	GSM: 800.0 to 1000.0 MHz (in steps of 0.2 MHz) DCS1800: 1697.6 to 1897.6 MHz (in steps of 0.2 MHz) DCS1900: 1816.0 to 2016.0 MHz (in steps of 0.2 MHz) UIC: 800.0 to 1000.0 MHz (in steps of 0.2 MHz)				**Default:** Start (MHz) Stop (MHz) GSM: 800.0 1000.0 DCS1800: 1697.6 1897.6 DCS1900: 1816.0 2016.0 UIC: 800.0 1000.0
State: Setting: IDLE, RFM Query: ALL		**Option:** B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---			**CMD52/55 with 8 Mbyte:** 3.20	

Reference level for measurement results

Syntax:	CONFigure:RFMonitor:POWer:REFerence <numeric_value>				
Value range:	-60.0 to +47.0 dBm				**Default:** +43.0 dBm
State: Setting: IDLE, RFM Query: ALL		**Option:** B4	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---			**CMD52/55 with 8 Mbyte:** 3.20	

Measurements per channel

Syntax:	`CALCulate:LIMit:RFMonitor:AVERage[:COUNt] <numeric_value>`				
Value range:	`1 to 10`				**Default:** `1`
State: Setting: IDLE, RFM Query: ALL	**Option:** B4	With query			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20	

7.12.2 Measurement

Measurement

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ:ARRay:RFMonitor?`
	
	`FETCh:ARRay:RFMonitor?`			

Return:	<value> {, <value>} (unit: dB)			
State: RFM	**Option:** B4	Query only	**Note:** No default values; max. 1001 measured values are supplied (depending on measurement range).	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---		**CMD52/55 with 8 Mbyte:**	3.20

7.13 Other Measurements

Offset of current measurement

Syntax:	CALCulate:CURRent[:DC]:ZEROoffset			
State: ALL	**Option:** None	No query	**Note:** The currently measured average current is used as a zero offset (see CONF:CURR:OFFS); with CONF:CURR:OFFS OFF the offset calculation can be disabled.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.35	**CMD52/55 with 8 Mbyte:** 3.00		

Syntax:	CONFigure:CURRent[:DC]:OFFSet <numeric_value>			
Value range:	-10 to +10 A | ON | OFF	**Default:** 0 A and OFF		
State: ALL	**Option:** None	With query	**Note:** Equation: <result> = <measured value> - <offset>	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 2.35	**CMD52/55 with 8 Mbyte:** 3.00		

Current measurement

Syntax: Perform new measurement and read result	READ[:SCALar]:CURRent[:DC]? (Average) READ[:SCALar]:CURRent[:DC]:MAXimum? (Maximum) READ[:SCALar]:CURRent[:DC]:MINimum? (Minimum)			
Read result only	FETCh[:SCALar]:CURRent[:DC]? (Average) FETCh[:SCALar]:CURRent[:DC]:MAXimum? (Maximum) FETCh[:SCALar]:CURRent[:DC]:MINimum? (Minimum)			
Return:	<value> (unit: A)			
State: ALL	**Option:** None	Query only	**Note:** No default values	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Voltage measurement

Syntax: Perform new measurement and read result	READ[:SCALar]:VOLTage[:DC]?			
Read result only	FETCh[:SCALar]:VOLTage[:DC]?			
Return:	<value> (unit: V)			
State: ALL	**Option:** None	Query only	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Frequency for peak power measurement

Syntax:	`CONFigure:POWer:PEAK:FREQuency <numeric_value>`			
Value range:	GSM: `800.0 to 1000.0 MHz` (in steps of 0.2 MHz) DCS1800: `1697.6 to 1897.6 MHz` (in steps of 0.2 MHz) DCS1900: `1816.0 to 2016.0 MHz` (in steps of 0.2 MHz) UIC: `800.0 to 1000.0 MHz` (in steps of 0.2 MHz)	**Default:** GSM: `948.0 MHz` DCS1800: `1845.0 MHz` DCS1900: `1960.0 MHz` UIC: `948.0 MHz`		
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80	**CMD52/55 with 8 Mbyte:** 3.00		

Peak power measurement

Syntax:
Perform new measurement and read result
 	
Read result only
	`READ[:SCALar]:POWer?`
	
	`FETCh[:SCALar]:POWer?`			

Return:	<value> (unit: dBm)			
State: ALL	**Option:** None	Query only	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80	**CMD52/55 with 8 Mbyte:** 3.00		

8 Storing and Loading Instrument Setups

8.1 General Information

Selection of storage medium

Each command for storing, loading or naming a setup permits a storage medium to be specified as an option. This medium remains set until another one is explicitly selected.

Syntax:	MMEMory:TYPE <value>			
Value range:	INTernal | MEMCard			**Default:** INT
State: ALL	**Option:** (INTernal): none (MEMCard): B62	With query	**Note:** The selected storage medium is valid for all MMEM:SAVE and MMEM:REC commands.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80	**CMD52/55 with 8 Mbyte:** 3.00		

Storing a setup

Syntax:	MMEMory1:SAVE to MMEMory13:SAVE		
State: ALL	**Option:** None	No query	**Note:** Settings of the remote-control interface are not stored.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80	**CMD52/55 with 8 Mbyte:** 3.00	

Assigning a name to a stored setup

Syntax:	MMEMory1:SAVE:NAME <string> to MMEMory13:SAVE:NAME <string>	
Value range	Name of instrument setup	
State: ALL	**Option:** None	With query
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.80	**CMD52/55 with 8 Mbyte:** 3.00

Loading a stored setup

Syntax:	MMEMory1:RECall to MMEMory13:RECall		
State: ALL	**Option:** None	No query	**Note:** Settings of the remote-control interface are not changed.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80	**CMD52/55 with 8 Mbyte:** 3.00	

8.2 User-Specific Settings

Selecting the user

Syntax:	SYSTem:USER:SELect <value>			
Value range:	User1 to USer14			**Default:** US1
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80	**CMD52/55 with 8 Mbyte:** 3.00		

Assigning a user name

Syntax:	SYSTem:USER1:NAME <string> to SYSTem:USER14:NAME <string>		
Value range	User name		
State: ALL	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.80	**CMD52/55 with 8 Mbyte:** 3.00	

8.3 Reset Operations

Two types of reset are possible in manual operation:
- Reset without remote-control setting
- Reset with remote-control setting

The reset without remote-control setting can be remotely triggered using commands *RST or SYSTem:PRESet.
Reset with remote-control setting is not possible this way; in this case the following three commands must be called up:

*RST or SYSTem:PRESet
STATus:PRESet
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess

Reset

A reset using the following two commands is identical with the actions performed when the RESET key is pressed and to the selection of "reset without remote-control setting", ie remote control is not affected.

Syntax:	`*RST`		
State: ALL	**Option:** None	No query	**Note:** Sets the instrument to the default state (without considering an established call) but does not affect the remote-control settings.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Syntax:	`SYSTem:PRESet`		
State: ALL	**Option:** None	No query	**Note:** Sets the instrument to the default state (without considering an established call) but does not affect the remote-control settings.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.80	**CMD52/55 with 8 Mbyte:** 3.00	

Reset of remote-control interface

Syntax:	`STATus:PRESet`		
State: ALL	**Option:** None	No query	**Note:** Does not affect transfer parameters (address, etc.) or instrument setups.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

9 Layer-3 Message Log

Log selection

Syntax:	DIAGnostic:LOG[:SELected]:NAME <value>		
Value range:	NONE | No log (with query only) L3Log Layer-3 message log		**Default:** NONE
State: ALL	**Option:** None	With query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Activating/deactivating selected log

Syntax:	DIAGnostic:LOG[:SELected]:STATe <value>		
Value range:	ACTive | Log active NotACTive Log not active		**Default:** NACT
State: ALL	**Option:** None	With query	**Note:** With no log active, the command is not executed (and there is no reply to the query) but an error is entered into the error queue.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Storing selected log

Syntax:	DIAGnostic:LOG[:SELECTed]:STORe		
State: ALL	**Option:** None	No query	**Note:** With no log active, the command is not executed but an error is entered into the error queue.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

Querying file name and path of selected log

Syntax:	DIAGnostic:LOG[:SELected]:FILENAME?		
Return:	<string with path>, <string with file name>		
State: ALL	**Option:** None	Query only	**Note:** The path can be up to 129 characters long, the file name consists of max. 12 characters. With no log active, there is no reply but an error is entered into the error queue.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** ---	**CMD52/55 with 8 Mbyte:** 3.20	

9.1 Recording and Transfer of Message Log

9.1.1 Remarks

- The commands of the MMEMory subsystem used below are intended for internal use (via FTRANS) and therefore not included in the remote-control description. The syntax of these commands is given here only as far as it is necessary for the transfer of message logs.

- It should be pointed out that the representation of characters may be incorrect when a Windows program like TERMINAL.EXE is used (eg for \) or that characters are filtered out from the block data (eg TAB).

  These problems should not occur when DOS programs are used.

9.1.2 Selecting and Activating the Message Log

```
DIAG:LOG:NAME L3L
DIAG:LOG:STAT ACT
```

Note: Activating is only necessary when a new message log is to be recorded.
When the log is already available, omit the next two steps and proceed with 9.1.5.

9.1.3 Recording a Message Log

A test with signalling is performed until the desired messages have been sent between BTS and mobile on the RF interface.

9.1.4 Storing a Message Log

```
DIAG:LOG:STOR
```

9.1.5 Determining Path and File Name of Message Log

```
DIAG:LOG:FIL?
```

Two strings are supplied:	`<path>`	path of message log
	`<name>`	file name of log

9.1.6 Selecting Drive and Directory of Message Log

The character denoting the drive (<drive>) and the directory (<directory>) are extracted from <path> and set:

```
MMEM:MSIS "<drive>"
MMEM:CDIR "<directory>"
```

9.1.7 Querying the File Content

```
MMEM:DATA? "<name>"
```

The response is a block with data from the message log (for more detailed information on the block format refer to section 9.1.8 and IEEE 488.2).

9.1.8 Block Format to SCPI

Example: A block with 36 data bytes would be as follows:

```
#236abcdefghijklmnopqrstuvwxyz0123456789
```

- A block always begins with the character #.
- The second character is a numeral denoting the number of figures for the total block length (see example 2).
- These figures are sent next (see example 3 and 6) and then the actual information data (36 bytes).

9.1.9 Example

This example shows the sequence of commands for generating a message log and subsequent transfer to the CMD. In this example the complete file name (with path) of the log is C:\CMD\BIN\MESSAGE.LOG.

`DIAG:LOG:NAME L3L`	Selects Layer-3 message log
`DIAG:LOG:STAT ACT`	Activates message log

Performing a location update, for example:

`DIAG:LOG:STOR`	Stores Layer-3 message log
`DIAG:LOG:FIL?`	Queries path and file name; the response is: „C:\CMD\BIN", „MESSAGE.LOG"
`MMEM:MSIS "C:"`	Selects drive
`MMEM:CDIR "\CMD\BIN"`	Selects directory
`MMEM:DATA? "MESSAGE.LOG"`	Transfers message log; the response is a block as described under 9.1.8.

10 Miscellaneous

10.1 Internal Device Status

Current state

Syntax:	STATus:DEVice?			
Return:	IDLE | MOD | IQSP | MIDL | MCE | MSYN | RFG | RFM	Idle (initial state) Module test (1) IQ spectrum (2) MS test: Idle MS test: Call established MS test: Synched RF generator (3) RF monitor (4)		**Default:** IDLE
State: ALL	**Option:** None	Query only		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50 (1), (3) 1.60 (2) 2.10 (4) ---	**CMD52/55 with 8 Mbyte:** 3.00 (4) 3.20		

10.2 Signalling Asynchronous Events

The CMD event register is used to signal events the CMD executes without having explicitly received a request via remote control. The controller can query the events via the remote control.

CMD enters the following events in the CMD event register by setting the respective bit:

Event	CMD event register
Call from mobile	Bit 0
Release from mobile	Bit 1
Synchronisation lost	Bit 2
Location update	Bit 3
Reference frequency not synchronized	Bit 6
Short message from mobile	Bit 8

Setting a bit in the CMD event register causes a bit to be set in the operation status register and then in the status byte and thus - with the IEC/IEEE bus - leads to a service request (provided that the respective enable registers tolerate the events).

For more details on the hierarchy of SCPI registers refer to SCPI manual 1993.0, volume 1, page 9-4.

CMD Event Register

Syntax:	STATus:OPERation:CMD[:EVENt]?				
Return:	0 to 15				**Default:** 0
State: ALL	**Option:** None	Query only			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00		

CMD Operation Condition Register

Syntax:	STATus:OPERation:CMD:CONDition?				
Return:	0 to 15				**Default:** 0
State: ALL	**Option:** None	Query only			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00		

CMD Event Register Enable

Syntax:	STATus:OPERation:CMD:ENABle <numeric_value>				
Value range:	0 to 32767				**Default:** 32767
State: ALL	**Option:** None	With query	**Note:** MAX and MIN not permissible.		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00		

10.3 Operating Mode

Autoranging

Syntax:	CONFigure:AUTorange:STATe <value>				
Value range:	ON | Autoranging active OFF Autoranging not active				**Default:** ON
State: IDLE	**Option:** None	With query			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.80		**CMD52/55 with 8 Mbyte:** 3.00		

10.4 Query of Options

Syntax:	SYSTem:OPTions?			
Return:	List of available options (as Bx, x being the option number), separated by commas. Options not fitted are not indicated. Example: If options B1, B4, B41, B6, B61 and B9 are provided, the following is output: B1,,B4,B41,,,,B6,B61,,,,,,,B9,,,			
State: ALL	**Option:** None	Query only	**Note:** No default value	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00	

10.5 Remote Control

Screen display of remote-control commands and responses

Syntax:	DISPlay:ENABle <value>			
Value range:	ON | Remote-control commands and responses are displayed OFF Commands and responses are not displayed			**Default:** ON
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60		**CMD52/55 with 8 Mbyte:** 3.00	

IEC/IEEE-bus address

Syntax:	SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <numeric_value>			
Value range:	0 to 30			**Default:** 1
State: ALL	**Option:** None	With query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00	

11 Prescribed Commands

11.1 Mandatory Commands

Clear Status

Syntax:	`*CLS`		
State: ALL	**Option:** None	No query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Standard Event Status Enable

Syntax:	*ESE <numeric_value>		
Value range:	`0 to 255`		**Default:** `0`
State: ALL	**Option:** None	With query	**Note:** MAX and MIN not permissible.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Standard Event Status Register

Syntax:	`*ESR?`		
Return:	`0 to 255`		
State: ALL	**Option:** None	Query only	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Identification Query

Syntax:	`*IDN?`		
Return:	`ROHDE&SCHWARZ,CMDzz,ssssss/sss,x.xx yy.yy.yy` (`zz` is the instrument model, ie 50, 52, 53, 54, 55, 57 or 59 `ssssss/sss` is the serial number, eg B. 101183/005 `x.xx` is the software version, eg V 1.00 `yy.yy.yy` is the date, eg 18.10.93)		
State: ALL	**Option:** None	Query only	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Individual Status Query

Syntax:	*IST?		
Return:	0 | 1		
State: ALL	**Option:** None	Query only	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Operation Complete

Syntax:	*OPC		
Return:	1 (return only in the case of query)		
State: ALL	**Option:** None	With query	**Note:** Also influences the OPC bit in the event status register.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Parallel Poll Enable Register Enable

Syntax:	*PRE <numeric_value>		
Value range:	0 to 65535 Query: 0 to 32767 (MSB is always 0)		**Default:** 0
State: ALL	**Option:** None	With query	**Note:** MAX and MIN not permissible
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Power-on Status Clear

Syntax:	*PSC <numeric_value>		
Value range:	-32767 to 32767		**Default:** 1
State: ALL	**Option:** None	With query	**Note:** MAX and MIN not permissible.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Reset

Syntax:	*RST		
State: ALL	**Option:** None	No query	**Note:** Sets the instrument to the default state (irrespective of any link setup).
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Service Request Enable

Syntax:	`*SRE <numeric_value>`				
Value range:	`0 to 255`				**Default:** `0`
State: ALL	**Option:** None	With query	**Note:** MAX and MIN not permissible.		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00			

Status Byte Query

Syntax:	`*STB?`		
Return:	`0 to 255`		
State: ALL	**Option:** None	Query only	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Selftest

Syntax:	`*TST?`		
Return:	`0 to 255`		
State: ALL	**Option:** None	Query only	**Note:** Value 0 indicates that no error was found.
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Wait-to-Continue

Syntax:	`*WAI`		
State: ALL	**Option:** None	No query	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

11.2 Optional Commands

Query of options

Syntax:	*OPT?		
Return:	Identical with SYST:OPT?		
State: ALL	**Option:** None	Query only	**Note:** No default value; identical with SYST:OPT?
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.60	**CMD52/55 with 8 Mbyte:** 3.00	

11.3 STATus Subsystem

Operation Event Register

Syntax:	STATus:OPERation[:EVENt]?			
Return:	0 to 32767			**Default:** 0
State: ALL	**Option:** None	Query only	**Note:** Bit 8 is used as summary bit for the CMD event register.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Operation Condition Register

Syntax:	STATus:OPERation:CONDition?		
Return:	0 to 32767		**Default:** 0
State: ALL	**Option:** None	Query only	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00	

Operation Event Register Enable

Syntax:	STATus:OPERation:ENABle <numeric_value>			
Value range:	0 to 65535 Query: 0 to 32767 (MSB is always 0)			**Default:** 0
State: ALL	**Option:** None	With query	**Note:** MAX and MIN not permissible. ; Bit 8 is used for the CMD event register.	
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50	**CMD52/55 with 8 Mbyte:** 3.00		

Questionable Event Register

Syntax:	STATus:QUEStionable[:EVENt]?				
Return:	0 to 32767			**Default:** 0	
State: ALL	**Option:** None	Query only			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:**	3.00	

Questionable Condition Register

Syntax:	STATus:QUEStionable:CONDition?				
Return:	0 to 32767			**Default:** 0	
State: ALL	**Option:** None	Query only			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:**	3.00	

Questionable Event Register Enable

Syntax:	STATus:QUEStionable:ENABle <numeric_value>				
Value range:	0 to 65535 Query: 0 to 32767 (MSB is always 0)			**Default:** 0	
State: ALL	**Option:** None	With query	**Note:** MAX and MIN not permissible		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:**	3.00	

Reset of instrument

Syntax:	STATus:PRESet			
State: ALL	**Option:** None	No query		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:**	3.00

Status queue

Syntax:	STATus:QUEue[:NEXT]?				
Return:	see SCPI, chapter. 20.8 (page 20-6)			**Default:** 0, "no error"	
State: ALL	**Option:** None	Query only			
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:**	3.00	

11.4 SYSTem Subsystem

Next message from error queue

Syntax:	`SYSTem:ERRor?`			
Return:	see SCPI, chapter 21.7 (page 21-10)			**Default:** `0, "no error"`
State: ALL	**Option:** None	Query only		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00	

SCPI version

Syntax:	`SYSTem:VERSion?`			
Return:	see SCPI, chapter 21.18 (page 21-28)			**Default:** `1993.0`
State: ALL	**Option:** None	Query only		
Available as of software version:	**CMD50/53 and CMD52/55 with 4 Mbyte:** 1.50		**CMD52/55 with 8 Mbyte:** 3.00	

12 Remarks

(N1)

-) The transmitter power is adapted, if required (see also (N4)).

-) The input may be overdriven if an external amplifier is connected.

(N2)

-) The level is automatically adapted (see (N4)).

-) Only one input and output can be active at a time, ie the one not selected is inactive.

Example:
With I1O1 selected, RF In Out is selected as input and output, RF In 2 and RF Out 2 are not available in this case.

(N3)

RXLEV, RXQUAL and POWER LEVEL are polled by the mobile automatically and at regular intervals during signalling and thus updated.
The measurement for SENSe:POWer:MS? also runs automatically as soon as the connection is set up.

(N4)

-) The value is valid irrespective of the output and is automatically adapted to the output on changing to the MIDL state, which may cause the value range to be shifted.

-) The value applies to the currently set timeslot of the TCH.

-) For the value range refer to section 2, Manual Operation.

(N5)

The level for the unused timeslots is to be indicated with reference to the level for the used timeslot. However, it cannot exceed the absolute limit values (see (N4)).

(N6)

CONFigure:RFGen:SELect selects a generator setting which permits values to be configured (using CONFigure:RFGen:...).
SOURce:RFGen:SELect is used to load the values of the selected setting (and to adapt them to the output or output circuit, if required). SOURce:RFGen:... permits the values of the selected generator setting to be changed (they are lost if a different setting is selected).

(N7)

CONFigure:BER:SELect selects a BER measurement; for the selected measurement the settings can be changed and a measurement performed.
If a new BER measurement is selected, the measured values of the previous measurement are maintained (and can still be fetched with FETCh). However, the total result (FETCh:BER:TRESult) is set to INValid.
When the new measurement is started, the measured values are updated (and the results of the previous measurement are lost).

(N8)

Using any READ command, a new measurement is started and the desired value returned. Then, all results of this measurement can be read one after the other by means of FETCh queries without performing a new measurement. (FETCh[:SCALar]:BER:TRESult? provides a statement on the validity of the measured values).

(N9)

Tolerances are only taken into account if the abort condition for the BER measurement is set to FLIMit or ALIMits (CONFigure:BER:SCONdition).

(N10)

After calling a READ command, all scalar measurement results (average power, RMS and peak phase error and frequency error) are calculated and the desired value is returned; the remaining measurement results can be fetched using FETCh or CALCulate. The field values cannot be obtained.
However, if the measurement is made via READ:ARRay, the scalar values are available in addition to the selected field values. The measurements of the field values of the power (READ:ARRay:BURSt:POWer?) and the phase error (READ:ARRay:BURSt:PHASe:ERRor?) exclude each other, ie after READ:ARRay:BURSt:POWer? the phase error **cannot** be fetched with FETCh:ARRay:BURSt:PHASe:ERRor?
The timing is measured when the power field values are measured, but **not** when the phase error is measured.

(N11)

The values are calculated in ¼-bit steps and are provided in the range from bit index -10.0 to bit index +157.0 (power) or +0.5 to +147.25 (phase error) (referred to the useful part of the burst); this results in 669 power values and 588 phase error values.
The access burst measurement yields power values for bit indices from -10.0 to 97.0, ie 429 values. Phase and frequency error are not calculated for access bursts.
This range can be limited using commands
CONFigure:BURSt:PHASe:ERRor:OUTPut:RANGe,
CONFigure:BURSt:POWer:OUTPut:RANGe and CONFigure:ACCess:BURSt:POWer:OUTPut:RANGe.

(N12)

The results obtained in a tolerance query have the following meaning:

MATC: The measured value is within the configured limit values
NMAT: The measured value is not within the configured limit values
INV: No measurement result available

(N13)

After the start of the BER measurements CMD simultaneously calculates BER and RBER values. BER and RBER results may be called up separately.

For the abort conditions of the BER measurement, it can be specified separately for all seven settings whether BER or RBER limit values are used.

13 List of Commands

Annex D3

```
{**********************************************************************}
program MobileTest;

  {
  This is a program to demonstrate the use of the CMD52/55 in Remote mode.
  The program executes a test for a GSM Mobile.
  After a call is established the CMD starts RX and TX and AF measurements

  }

uses   NICard, Crt;

var    InString : string;

{**********************************************************************}

 begin
   ClrScr;

{ Initialisation of the GPIB Interface; e.g. IEEE Adress }
   InitCMD;


{ This commmand clears in the CMD:  - the Error Queue,
                                    - the STB and ESR status bytes
                                    - the CMD Event register
                                    - old commands in the input buffer }
   WriteCMD ('*CLS');

{ If the CMD is already initialized for Mobile Test('MIDL' or 'MSYN'state)
  from the last run then leave the initialisation part }

   InString:= ReadCMD('STATUS:DEVICE?');
   if (InString <> 'MIDL') and (InString <> 'MSYN') then
```

```
{********************** Initialisation of the CMD ***********************}

   begin
     Writeln('** Initialisation in progress');
     Writeln;

{ Reset all parameters of the CMD to the default values }
     WriteCMD ('*RST');

{ Set CMD to switch on state ( ='IDLE'); is not necessary after *RST }
     WriteCMD ('PROCEDURE:SELECT NONE');

{ Switch ON and OFF the display of the CMD;
  ON is usefull for evaluation; OFF makes the CMD faster }
     WriteCMD ('DISPLAY:ENABLE ON');

{ At switch over to local, the CMD stays in his current menu }
     WriteCMD ('CONFIGURE:LOCAL:STAT CURRENT');

{ Choose the used rf connector on the front panel;
  in this case the left one for input and output }
     WriteCMD ('ROUTE:IOCONNECTOR I1O1');

{ 0.5dB Cabel attenuation for connector one }
     WriteCMD ('SOURCE1:CORRECTION:LOSS 0.5');

{ Choose your type of network ('GSM');
  'DCS1800' is only available on CMD55 }
     WriteCMD ('CONFIGURE:NETWORK GSM');

{ Configuration of rf parameters to start up a call }

   { broadcast channel }
     WriteCMD ('CONFIGURE:CHANNEL:CCCH:ARFCN 50');
   { traffic channel }
     WriteCMD ('CONFIGURE:CHANNEL:TCH:ARFCN  25');
   { Rf output level of the CMD }
     WriteCMD ('CONFIGURE:CHANNEL:TCH:POWER -80dbm');
   { Powerlevel of the mobile ( 5 = 33dBm ) }
     WriteCMD ('CONFIGURE:POWER:MS 5');

{ Configuration of the Biterror Rate measurement }

   { One can select and change 7 different BER settings }
     WriteCMD ('CONFIGURE:BER:SELECT BER1');
   { CMD RF level during BER }
     WriteCMD ('CONFIGURE:BER:POWER -102dbm');
   { Holdoff time in seconds for BER. This is a delay before starting the
     measurement to let the mobile settle to the RF level of the BER test.
     The value depends on the mobile }
     WriteCMD ('CONFIGURE:BER:HOLDOFF:TIME 0.5');
   { Number of tested speech frames }
     WriteCMD ('CONFIGURE:BER:FRAMESTOSEND 128');
```

```
  { Stop condition for BER measurement
    FLIM = Stop on first limit. ASAM = Stop after all frames are sent }
     WriteCMD ('CONFIGURE:BER:SCONDITION FLIM');
  { Limit for Error Bits Class Ib }
     WriteCMD ('CALCULATE:LIMIT:BER:CLIB:MEVENTS 10');
  { Limit for Error Bits Class II }
     WriteCMD ('CALCULATE:LIMIT:BER:CLII:MEVENTS 100');
  { Limit for Erased Frames }
     WriteCMD ('CALCULATE:LIMIT:BER:EFRAMES:MEVENTS 2');

{ Number of bursts for the max and average phase/frequency
  measurements }
     WriteCMD ('CALCULATE:LIMIT:PHFR:AVERAGE 20');

{ Number of averaging bursts for spectrum measurements }
     WriteCMD ('CONFIGURE:SPECTRUM:MODULATION:AVERAGE 50');
     WriteCMD ('CONFIGURE:SPECTRUM:SWITCHING:AVERAGE 5');

{ Setup level and frequency of the af generator }
     WriteCMD ('CONFIGURE:AFGEN:FREQUENCY 500Hz');
     WriteCMD ('CONFIGURE:AFGEN:VOLTAGE 500mV');

{ Switch CMD to MS-Test (Status ='MIDL'); }
     WriteCMD ('PROCEDURE:SELECT MAN');

{ Read Error Queue if there is any entry }
     InString:= ReadCMD('SYSTEM:ERROR?');
     If InString <> '0,"No error"' then
     begin
       Writeln('** Error during initialisation : ',InString );
       Exit;  { Exit program };
     end;

   end; { End of initialisation }
```

```
{********************** Establish a Call ********************************}

   Writeln('!! Please switch mobile on !!');
   Writeln('** Wait for service **');

{ Wait until Location Update from mobile is done or }
   repeat

     { terminate program by pressing any key }
     if KeyPressed then Exit;

   { Read CMD Event Register }
   until ReadCMD('STATUS:OPERATION:CMD?') = '8';

   Writeln;
   Writeln('** Location Update was O.K. **');

   Writeln('!! Hook off when mobile rings !!');
   Writeln;

{ CMD makes a call to mobile }
   WriteCMD ('PROCEDURE:CALL:TOMS');

{ If CMD status is not MCE (= Mobile Call Established)
  then leave the program  }
   if ReadCMD('STATUS:DEV?') <> 'MCE' then
   begin
     Writeln('** Call to Mobile failed:');
     Exit;
   end;

   Writeln('** Call to Mobile is O.K:');
   Writeln;
```

```
{****************** Burstanalysis of a single burst ********************}

  repeat
    { Start measurement }
    InString:= ReadCMD('READ:BURST:POWER:AVERAGE?');

    { terminate program by pressing any key }
    if KeyPressed then Exit;

  { Repeat the measurement if there is an invalid result }
  until InString <> 'NAN';
  Writeln('-- Average Burst Power     [dBm] = ',InString);

  InString:= ReadCMD('FETCH:BURST:FREQUENCY:ERROR?');
  Writeln('-- Frequency Error         [Hz]  = ',InString);

  InString:= ReadCMD('FETCH:BURST:PHASE:ERROR:PEAK?');
  Writeln('-- Phase Error Peak        [°]   = ',InString);

  InString:= ReadCMD('FETCH:BURST:PHASE:ERROR:RMS?');
  Writeln('-- Phase Error RMS         [°]   = ',InString);

  InString:= ReadCMD('CALCULATE:LIMIT:POWER:MATCHING?');
  Writeln('-- Limit of Power Time Template  = ',InString);

  InString:= ReadCMD('CALCULATE:LIMIT:POWER:TOLERANCE:MATCHING?');
  Writeln('-- Limit of Power Level          = ',InString);

  InString:= ReadCMD('CALCULATE:LIMIT:PHFR:TOLERANCE:MATCHING?');
  Writeln('-- Limit of Phase-Peak,-RMS,Frequency Error = ',InString);

{****************** Peak Power Measurement ****************************}

  InString:= ReadCMD('READ:POWER?');
  Writeln('-- Peak Power              [dBm] = ',InString);
```

```
{******************* BER Measuremrent ***********************************}

  { Select one of the 7 different BER settings }
   WriteCMD ('CONFIGURE:BER:SELECT BER1');
   repeat
     { Start measurement }
     InString:= ReadCMD('READ:BER:TRESULT?');

     { Stop the test if the call is no more established }
     if ReadCMD('STATUS:DEVICE?') <> 'MCE' then Exit;

     { terminate program by pressing any key }
     if KeyPressed then Exit;

   { Repeat the measurement if there is an invalid result }
   until (InString = 'PASS') or (InString = 'FAIL');
   Writeln('-- Limit Bit Error Rate          = ',InString);

   InString:= ReadCMD('FETCH:BER:CLII?');
   Writeln('-- ClassII Bit Error Rate    [%] = ',InString);

   InString:= ReadCMD('FETCH:BER:EFRAMES?');
   Writeln('-- Erased Frame Rate         [%] = ',InString);

{***************** Readout of RX-Level and RX-Quality *******************}

   { Change the output level of the CMD }
   WriteCMD ('PROCEDURE:SET:POWER:CMD -90');

   { Wait until the mobile has measured and reported the new receive level }
   Delay(2000);   { =2 sec. delay ; mobile dependent }

   InString:= ReadCMD('SENSE:SIGNALLING:RXLEV?');
   Writeln('-- Receive level reported from Mobile   = ',InString);

   InString:= ReadCMD('SENSE:SIGNALLING:RXQUAL?');
   Writeln('-- Receive quality reported from Mobile = ',InString);

{******** Channel Change **************************************************}

   { Change the traffic channel }
   WriteCMD ('PROCEDURE:SET:ARFCN 100');
```

```
{******** Max and average phase/frequency error for 10 bursts ************}

   repeat until keypressed;
   repeat
     { Start measurement }
     InString:= ReadCMD('READ:BURST:FREQUENCY:ERROR:AVERAGE?');

     { terminate program by pressing any key }
     if KeyPressed then Exit;

   { Repeat the measurement if there is an invalid result }
   until InString <> 'NAN';
   Writeln('-- Average Frequency Error [Hz]  = ',InString);

   InString:= ReadCMD('FETCH:BURST:FREQUENCY:ERROR:MAXIMUM?');
   Writeln('-- Maximum Frequency Error [Hz]  = ',InString);

   InString:= ReadCMD('FETCH:BURST:PHASE:ERROR:PEAK:MAXIMUM?');
   Writeln('-- Maximum Phase Error Peak [°]  = ',InString);

   { Fetch the average power of the last of ten bursts }
   InString:= ReadCMD('FETCH:BURST:POWER:AVERAGE?');
   Writeln('-- Burst Power              [dBm] = ',InString);

{******** Power Level Change ********************************************}

   { Change the power level of the mobile }
   WriteCMD ('PROCEDURE:SET:POWER:MS 15');

{************ Spectrum due to Modulation Measuremrent *******************}
   repeat
     { Start measurement }
     InString:= ReadCMD('READ:SPECTRUM:MODULATION:POWER?');

     { terminate program by pressing any key }
     if KeyPressed then Exit;
   { Repeat the measurement if there is an invalid result }
   until InString <> 'NAN';

   InString:= ReadCMD('CALCULATE:LIMIT:SPECTRUM:MODULATION:MATCHING?');
   Writeln('-- Limit of Spectrum Modulation  = ',InString);
```

```
{************ Spectrum due to Switching Measuremrent ********************}
   repeat
     { Start measurement }
     InString:= ReadCMD('READ:SPECTRUM:SWITCHING:POWER?');

     { terminate program by pressing any key }
     if KeyPressed then Exit;
   { Repeat the measurement if there is an invalid result }
   until InString <> 'NAN';

   InString:= ReadCMD('CALCULATE:LIMIT:SPECTRUM:SWITCHING:MATCHING?');
   Writeln('-- Limit of Spectrum Switching    = ',InString);

{********************** Audio Generator   *******************************}

   { Switch on audio generator; has to be done after evry new call }
   WriteCMD ('SOURCE:AFGEN:STATE ON');

{********************** Audio Measurement ******************************}

   repeat
     { Start measurement }
     InString:= ReadCMD('READ:AFMEAS:VOLT?');

     { terminate program by pressing any key }
     if KeyPressed then Exit;

   { Repeat the measurement if there is an invalid result }
   until InString <> 'NAN';
   Writeln('-- AF Voltage                [V] = ',InString);

   InString:= ReadCMD('FETCH:AFMEAS:DISTORTION?');
   Writeln('-- AF Distortion            [%]  = ',InString);

   InString:= ReadCMD('FETCH:AFMEAS:COUNT?');
   Writeln('-- AF Count                 [Hz] = ',InString);

{************ CMD release the call **************************************}

   WriteCMD ('PROCEDURE:RELEASE:TOMS');

{ Read CMD Status  }
   InString:= ReadCMD('STATUS:DEVICE?');
   If InString = 'MSYN' then
     Writeln('** Call release O.K. ')
   else
     Writeln('** Call release FAIL ');

{************ End of Program *********************************************}
 end.
```

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2.2.2 Output Frequencies and Level

Out 1

Specification: see table

Output frequency (MHz)	Specification (Hz)	Output level nom. (dBm)	Specification (dB)	Result
10.0	± 10	8.0	± 3	

Out 2

Specification: see table

Output frequency (MHz)	Specification (Hz)	Output level nom. (dBm)	Specification (dB)	Result
13.000 000	± 10	10.5	± 2.5	
0.270 833	± 3	---	---	

2.2.3 Impedances

Specification: see table

Input	Impedance nom. (Ω)	Specification (Ω)	Impedance act. (Ω)
REF IN	100	± 20	
REF OUT 1	50	± 10	
REF OUT 2	50	± 10	

3 Internal Diagnosis and Battery

3.1 Diagnosis Line

Input	Specification	Result
0.1 V	± 5 mV	

3.2 Battery

Specification	Result
3.1...4.0 V	

4 DC Measurement

4.1 Voltage

Specification: see table

Nominal Voltage (V)	Specification (V)	Measured Voltage (V)
0.0	± 0.010	
0.1	± 0.012	
-0.1	± 0.012	
30.0	± 0.610	

4.2 Current

Specification: see table
Measurement uncertainty:

Current (mA)	Specification (mA)	Burst	Actual Value (mA)
Common Mode			
Rejection Ratio (30 V input voltage)	± 10	off	
0	± 10	off	
100	± 13	off	
- 100	± 13	off	
10000	± 220	off	

5 Transmitter

5.1 Frequency Accuracy

Measurements done with synchronisation to external reference.

Specification: ± 2 Hz
Measurement uncertainty:

	Synthesizer 1	Synthesizer 2
Output Frequency (MHz)	Divergence (Hz)	Divergence (Hz)
GSM		
800.0		
890.2		
914.8		
935.2		
959.8		
1000.0		
DCS-1800		
1710.2		
1784.8		
1805.2		
1879.8		
PCS-1900		
1850.2		
1909.8		
1930.2		
1989.8		

5.2 Level Accuracy

5.2.2 Synthesizer 1; RF IN/OUT Absolute

Specification: see table
Measurement uncertainty:

Output frequency (MHz)	Level nom. (dBm)	Specification (dB)	Level act. (dBm)	Divergence (dB)
GSM				
800.067	-35.0/-33.0	± 2.5		
890.267	-35.0/-33.0	± 1.0		
903.067	-35.0/-33.0	± 1.0		
914.867	-35.0/-33.0	± 1.0		
935.267	-35.0/-33.0	± 1.0		
948.067	-35.0/-33.0	± 1.0		
959.867	-35.0/-33.0	± 1.0		
1000.067	-35.0/-33.0	± 2.0		
DCS-1800				
1710.267	-35.0	± 1.0		
1755.067	-35.0	± 1.0		
1784.867	-35.0	± 1.0		
1805.267	-35.0	± 1.0		
1850.067	-35.0	± 1.0		
1879.867	-35.0	± 1.0		
PCS-1900				
1850.267	-37.0	± 1.0		
1870.067	-37.0	± 1.0		
1909.867	-37.0	± 1.0		
1930.267	-37.0	± 1.0		
1950.067	-37.0	± 1.0		
1989.867	-37.0	± 1.0		

5.2.3 Synthesizer 1; RF IN/OUT Relative

Note: Some levels may be omitted.

Measurement uncertainty:

GSM f = 903.067 MHz

Reference level:
nominal (-35.0/-33.0 ± 5.0) dBm
actual
Specification for relative level: ± 1.0 dB

Worst case analysis for absolute level including tolerances of 5.2.2
Specification: see table

Level relative to reference (dB)	Rel. level act. (dB)	Abs. level nom. (dBm)	Specification abs. level (dB)	Abs. level for worst case (dBm)
-20.0/-22.0		-55.0	± 1.5	
-50.0/-52.0		-85.0	± 1.5	
-59.0/-61.0		-94.0	± 1.0	
-60.0/-62.0		-95.0	± 1.0	
-63.0/-65.0		-98.0	± 1.0	
-67.0/-69.0		-102.0	± 1.0	
-69.0/-71.0		-104.0	± 1.0	
-85.0/-87.0		-120.0	± 1.5	

GSM f = 948.067 MHz

Reference level:
nominal (-35.0/-33.0 ± 5.0) dBm
actual
Specification for relative level: ± 1.0 dB

Worst case analysis for absolute level including tolerances of 5.2.2
Specification: see table

Level relative to reference (dB)	Rel. level act. (dB)	Abs. level nom. (dBm)	Specification abs. level (dB)	Abs. level for worst case (dBm)
-20.0/-22.0		-55.0	± 1.5	
-50.0/-52.0		-85.0	± 1.5	
-59.0/-61.0		-94.0	± 1.0	
-60.0/-62.0		-95.0	± 1.0	
-63.0/-65.0		-98.0	± 1.0	
-67.0/-69.0		-102.0	± 1.0	
-69.0/-71.0		-104.0	± 1.0	
-85.0/-87.0		-120.0	± 1.5	

DCS-1800 **f = 1755.067 MHz**

Reference level:			
nominal	(-35.0 ± 5.0) dBm		Worst case analysis for absolute
actual			level including tolerances of 5.2.2
Specification for relative level:	± 1.0 dB		Specification: see table

Level relative to reference (dB)	Rel. level act. (dB)	Abs. level nom. (dBm)	Specification abs. level (dB)	Abs. level for worst case (dBm)
-20.0		-55.0	± 1.5	
-50.0		-85.0	± 1.5	
-59.0		-94.0	± 1.0	
-60.0		-95.0	± 1.0	
-63.0		-98.0	± 1.0	
-67.0		-102.0	± 1.0	
-69.0		-104.0	± 1.0	
-85.0		-120.0	± 1.5	

DCS-1800 **f = 1850.067 MHz**

Reference level:			
nominal	(-35.0 ± 5.0) dBm		Worst case analysis for absolute
actual			level including tolerances of 5.2.2
Specification for relative level:	± 1.0 dB		Specification: see table

Level relative to reference (dB)	Rel. level act. (dB)	Abs. level nom. (dBm)	Specification abs. level (dB)	Abs. level for worst case (dBm)
-20.0		-55.0	± 1.5	
-50.0		-85.0	± 1.5	
-59.0		-94.0	± 1.0	
-60.0		-95.0	± 1.0	
-63.0		-98.0	± 1.0	
-67.0		-102.0	± 1.0	
-69.0		-104.0	± 1.0	
-85.0		-120.0	± 1.5	

Option CMD-B19

PCS-1900 f = 1870.067 MHz

Reference level:				
nominal	(-37.0 ± 5.0) dBm	Worst case analysis for absolute		
actual		level including tolerances of 5.2.2		
Specification for relative level:	± 1.0 dB	Specification: see table		
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**
-18.0		-55.0	± 1.5	
-48.0		-85.0	± 1.5	
-57.0		-94.0	± 1.0	
-58.0		-95.0	± 1.0	
-61.0		-98.0	± 1.0	
-64.0		-102.0	± 1.0	
-67.0		-104.0	± 1.0	
-83.0		-120.0	± 1.5	

PCS-1900 f = 1950.067 MHz

Reference level:				
nominal	(-37.0 ± 5.0) dBm	Worst case analysis for absolute		
actual		level including tolerances of 5.2.2		
Specification for relative level:	± 1.0 dB	Specification: see table		
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**
-18.0		-55.0	± 1.5	
-48.0		-85.0	± 1.5	
-57.0		-94.0	± 1.0	
-58.0		-95.0	± 1.0	
-61.0		-98.0	± 1.0	
-64.0		-102.0	± 1.0	
-67.0		-104.0	± 1.0	
-83.0		-120.0	± 1.5	

5.2.4 Synthesizer 1; RF OUT2 Absolute

Specification: see program
Measurement uncertainty:

Output frequency (MHz)	Level nom. (dBm)	Specification (dB)	Level act. (dBm)	Divergence (dB)
GSM				
800.067				
890.267				
903.067				
914.867				
935.267				
948.067				
959.867				
1000.067				
DCS-1800				
1710.267				
1755.067				
1784.867				
1805.267				
1850.067				
1879.867				
PCS-1900				
1850.267				
1870.067				
1909.867				
1930.267				
1950.067				
1989.867				

5.2.5 Synthesizer 1; RF OUT2 Relative

Levels and Specification: see program

Measurement uncertainty:

GSM f = 903.067 MHz

Reference level:				
nominal	± 5.0 dBm		Worst case analysis for absolute	
actual			level including tolerances of 5.2.4	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

GSM f = 948.067 MHz

Reference level:				
nominal	± 5.0 dBm		Worst case analysis for absolute	
actual			level including tolerances of 5.2.4	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

DCS-1800 f = 1755.067 MHz

Reference level:				
nominal	± 5.0 dBm		Worst case analysis for absolute	
actual			level including tolerances of 5.2.4	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

DCS-1800 f = 1850.067 MHz

Reference level:				
nominal	± 5.0 dBm		Worst case analysis for absolute	
actual			level including tolerances of 5.2.4	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

Option CMD-B19

PCS-1900   f = 1870.067 MHz

Reference level:				
nominal	± 5.0 dBm		Worst case analysis for absolute	
actual			level including tolerances of 5.2.4	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

PCS-1900   f = 1950.067 MHz

Reference level:				
nominal	± 5.0 dBm		Worst case analysis for absolute	
actual			level including tolerances of 5.2.4	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

5.2.6 Synthesizer 2; RF IN/OUT Absolute

Specification: see table
Measurement uncertainty:

Output frequency (MHz)	Level nom. (dBm)	Specification (dB)	Level act. (dBm)	Divergence (dB)
GSM				
800.067	-37.0/-35.0	± 2.5		
890.267	-37.0/-35.0	± 1.0		
903.067	-37.0/-35.0	± 1.0		
914.867	-37.0/-35.0	± 1.0		
935.267	-37.0/-35.0	± 1.0		
948.067	-37.0/-35.0	± 1.0		
959.867	-37.0/-35.0	± 1.0		
1000.067	-37.0/-35.0	± 2.0		
DCS-1800				
1710.267	-37.0	± 1.0		
1755.067	-37.0	± 1.0		
1784.867	-37.0	± 1.0		
1805.267	-37.0	± 1.0		
1850.067	-37.0	± 1.0		
1879.867	-37.0	± 1.0		
PCS-1900				
1850.267	39.0	± 1.0		
1870.067	39.0	± 1.0		
1909.867	39.0	± 1.0		
1930.267	39.0	± 1.0		
1950.067	39.0	± 1.0		
1989.867	39.0	± 1.0		

5.2.7 Synthesizer 2; RF IN/OUT Relative

Note: Some levels may be omitted

Measurement uncertainty:

GSM f = 903.067 MHz

Reference level:				
nominal	(-37.0/-35.0 ± 5.0) dBm		Worst case analysis for absolute	
actual			level including tolerances of 5.2.6	
Specification for relative level:	± 1.0 dB		Specification: see table	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**
-18.0/-20.0		-55.0	± 1.5	
-48.0/-50.0		-85.0	± 1.5	
-57.0/-59.0		-94.0	± 1.0	
-58.0/-60.0		-95.0	± 1.0	
-61.0/-63.0		-98.0	± 1.0	
-64.0/-66.0		-102.0	± 1.0	
-67.0/-69.0		-104.0	± 1.0	
-83.0/-85.0		-120.0	± 1.5	

GSM f = 948.067 MHz

Reference level:				
nominal	(-37.0/-35.0 ± 5.0) dBm		Worst case analysis for absolute	
actual			level including tolerances of 5.2.6	
Specification for relative level:	± 1.0 dB		Specification: see table	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**
-18.0/-20.0		-55.0	± 1.5	
-48.0/-50.0		-85.0	± 1.5	
-57.0/-59.0		-94.0	± 1.0	
-58.0/-60.0		-95.0	± 1.0	
-61.0/-63.0		-98.0	± 1.0	
-64.0/-66.0		-102.0	± 1.0	
-67.0/-69.0		-104.0	± 1.0	
-83.0/-85.0		-120.0	± 1.5	

DCS-1800 **f = 1755.067 MHz**

Reference level:			
nominal	(-37.0 ± 5.0) dBm	Worst case analysis for absolute	
actual		level including tolerances of 5.2.6	
Specification for relative level:	± 1.0 dB	Specification: see table	

Level relative to reference (dB)	Rel. level act. (dB)	Abs. level nom. (dBm)	Specification abs. level (dB)	Abs. level for worst case (dBm)
-18.0		-55.0	± 1.5	
-48.0		-85.0	± 1.5	
-57.0		-94.0	± 1.0	
-58.0		-95.0	± 1.0	
-61.0		-98.0	± 1.0	
-64.0		-102.0	± 1.0	
-67.0		-104.0	± 1.0	
-83.0		-120.0	± 1.5	

DCS-1800 **f = 1850.067 MHz**

Reference level:			
nominal	(-37.0 ± 5.0) dBm	Worst case analysis for absolute	
actual		level including tolerances of 5.2.6	
Specification for relative level:	± 1.0 dB	Specification: see table	

Level relative to reference (dB)	Rel. level act. (dB)	Abs. level nom. (dBm)	Specification abs. level (dB)	Abs. level for worst case (dBm)
-18.0		-55.0	± 1.5	
-48.0		-85.0	± 1.5	
-57.0		-94.0	± 1.0	
-58.0		-95.0	± 1.0	
-61.0		-98.0	± 1.0	
-64.0		-102.0	± 1.0	
-67.0		-104.0	± 1.0	
-83.0		-120.0	± 1.5	

Option CMD-B19

PCS-1900 f = 1870.067 MHz

Reference level:		
nominal	(-39.0 ± 5.0) dBm	Worst case analysis for absolute
actual		level including tolerances of 5.2.6
Specification for relative level:	± 1.0 dB	Specification: see table

Level relative to reference (dB)	Rel. level act. (dB)	Abs. level nom. (dBm)	Specification abs. level (dB)	Abs. level for worst case (dBm)
-16.0		-55.0	± 1.5	
-46.0		-85.0	± 1.5	
-55.0		-94.0	± 1.0	
-56.0		-95.0	± 1.0	
-59.0		-98.0	± 1.0	
-63.0		-102.0	± 1.0	
-65.0		-104.0	± 1.0	
-81.0		-120.0	± 1.5	

PCS-1900 f = 1950.067 MHz

Reference level:		
nominal	(-39.0 ± 5.0) dBm	Worst case analysis for absolute
actual		level including tolerances of 5.2.6
Specification for relative level:	± 1.0 dB	Specification: see table

Level relative to reference (dB)	Rel. level act. (dB)	Abs. level nom. (dBm)	Specification abs. level (dB)	Abs. level for worst case (dBm)
-16.0		-55.0	± 1.5	
-46.0		-85.0	± 1.5	
-55.0		-94.0	± 1.0	
-56.0		-95.0	± 1.0	
-59.0		-98.0	± 1.0	
-63.0		-102.0	± 1.0	
-65.0		-104.0	± 1.0	
-81.0		-120.0	± 1.5	

5.2.8 Synthesizer 2; RF OUT2 Absolute

Specification: see program
Measurement uncertainty:

Output frequency (MHz)	Level nom. (dBm)	Specification (dB)	Level act. (dBm)	Divergence (dB)
GSM				
800.067				
890.267				
903.067				
914.867				
935.267				
948.067				
959.867				
1000.067				
DCS-1800				
1710.267				
1755.067				
1784.867				
1805.267				
1850.067				
1879.867				
PCS-1900				
1850.267				
1870.067				
1909.867				
1930.267				
1950.067				
1989.867				

5.2.9 Synthesizer 2; RF OUT2 Relative

Levels and Specification: see program

Measurement uncertainty:

GSM f = 903.067 MHz

Reference level: nominal ± 5.0 dBm; actual		Worst case analysis for absolute level including tolerances of 5.2.8		
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

GSM f = 948.067 MHz

Reference level: nominal ± 5.0 dBm; actual		Worst case analysis for absolute level including tolerances of 5.2.8		
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

DCS-1800 **f = 1755.067 MHz**

Reference level: nominal ± 5.0 dBm; actual			Worst case analysis for absolute level including tolerances of 5.2.8	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

DCS-1800 **f = 1850.067 MHz**

Reference level: nominal ± 5.0 dBm; actual			Worst case analysis for absolute level including tolerances of 5.2.8	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

Option CMD-B19

PCS-1900 f = 1870.067 MHz

Reference level: nominal ± 5.0 dBm actual			Worst case analysis for absolute level including tolerances of 5.2.8	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

PCS-1900 f = 1950.067 MHz

Reference level: nominal ± 5.0 dBm actual			Worst case analysis for absolute level including tolerances of 5.2.8	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Specification abs. level (dB)**	**Abs. level for worst case (dBm)**

5.2.10 Synthesizer 1; Dynamic Attenuation Test

	Result
Dynamic Test	

Static Test; RF IN/OUT

Note: Some levels may be omitted.

Measurement uncertainty:

Reference level:			
nominal	(-35.0 ± 1.5) dBm		
actual			
Specification for relative level:	± 1.5 dB	Specification: ± 1.0 dB	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Abs. level for worst case (dBm)**
-59.0		-94.0	
-69.0		-104.0	
-59.0		-94.0	
-69.0		-104.0	

Static Test; RF OUT2

Note: Some levels may be omitted.

Measurement uncertainty:

Reference level:			
nominal	(-35.0 ± 1.5) dBm		
actual			
Specification for relative level:	± 1.5 dB	Specification: ± 1.0 dB	
Level relative to reference (dB)	**Rel. level act. (dB)**	**Abs. level nom. (dBm)**	**Abs. level for worst case (dBm)**
-59.0		-94.0	
-69.0		-104.0	
-59.0		-94.0	
-69.0		-104.0	

5.3 Harmonics

Measurement uncertainty:

Output frequency (MHz)	RF IN/OUT		RF OUT 2
	Specification: <-65 dBm	Specification: <-67 dBm	Specification: see program
	Synthesizer 1 Harmonics (dBm)	Synthesizer 2 Harmonics (dBm)	Synthesizer 1 Harmonics (dBm)
1600.0			
2000.0			

5.4 Nonharmonics

Specification at df > 20 kHz: see table
Measurement uncertainty:

Output frequency (MHz)	Synthesizer 1		Synthesizer 2	
	Specification	Nonharmonics	Specification	Nonharmonics
800.0	< -35 dBc		< -35 dBc	
900.0	< -35 dBc		< -35 dBc	
1000.0	< -35 dBc		< -35 dBc	
1710.2	< -35 dBc		< -35 dBc	
1800.0	< -35 dBc		< -35 dBc	
1879.8	< -35 dBc		< -35 dBc	
2697.8	< -19 dBm		< -21 dBm	
1348.8	< -19 dBm		< -21 dBm	
1850.2	< -35 dBc		< -35 dBc	
1900.0	< -35 dBc		< -35 dBc	
1989.8	< -35 dBc		< -35 dBc	
2816.0	< -28 dBm		< -28 dBm	
1408.0	< -28 dBm		< -28 dBm	

5.5 Phase Noise

Specification: < - 100 dBc/Hz at df > 300 kHz
< - 65 dBc/Hz at df > 20 kHz

Measurement uncertainty:

	Synthesizer 1		Synthesizer 2	
	df > 300 kHz	df > 20 kHz	df > 300 kHz	df > 20 kHz
Output frequency (MHz)	Phase noise (dBc/Hz)	Phase noise (dBc/Hz)	Phase noise (dBc/Hz)	Phase noise (dBc/Hz)
800.0				
1000.0				
1710.2				
1879.8				
1850.2				
1989.8				

5.6 Frequency Hopping Settling Time

Specification: < 2 ms
Measurement uncertainty:

	Synthesizer 1	Synthesizer 2
Channels	Settling time (ms)	Settling time (ms)
1 <---> 2		
123 <---> 124		
512 <---> 513		
884 <---> 885		

5.9 Phase and Frequency Error Analysis

Instrument setting: internal measurement (loopback test)

Measurement uncertainty: same as CMD

Specification: Phase error RMS: <= 4 deg
Phase error peak: <= 12 deg

5.9.1 Synthesizer 1

Specification:

Output frequency (MHz)	Specification Output power (see program)	Output power (dBm)	Phase error RMS (deg)	Phase error Peak (deg)
890.2				
959.8				
1710.2				
1879.8				
1850.2				
1989.8				

5.9.2 Synthesizer 2

Specification:

Output frequency (MHz)	Specification Output power (see program)	Output power (dBm)	Phase error RMS (deg)	Phase error Peak (deg)
890.2				
959.8				
1710.2				
1879.8				
1850.2				
1989.8				

6 Receiver

6.1 Power Measurement

6.1.1 Continuous Wave; RF IN/OUT

Note: some levels may be omitted

Specification: see program
Measurement uncertainty:

Input power nom. (dBm)	Input frequency (MHz)	Instrument setting	Specification (dB)	Measured power (dBm)
GSM				
0.0/-10.0	890.2	Peak/Bypass		
0.0/-10.0	959.8	Peak/Bypass		
10.0/0.0	800.0	Peak/Bypass		
10.0/0.0	800.0	Demod/Bypass		
10.0/0.0	890.2	Peak/Bypass		
10.0/0.0	890.2	Demod/Bypass		
10.0/0.0	890.2	Track and Hold		
10.0/0.0	1000.0	Peak/Bypass		
10.0/0.0	1000.0	Demod/Bypass		
20.0/10.0	890.2	Peak/Bypass		
20.0/10.0	959.8	Demod/Bypass		
30.0/20.0	890.2	Peak/Bypass		
30.0/20.0	959.8	Peak/Bypass		
47.0/37.0	890.2	Peak/Bypass		
47.0/37.0	959.8	Peak/Bypass		
---/40.0	890.2	Peak/Bypass		
---/40.0	959.8	Peak/Bypass		

Input power nom. (dBm)	Input frequency (MHz)	Instrument setting	Specification (dB)	Measured power (dBm)
DCS-1800				
0.0/-10.0	1710.2	Peak/Bypass		
0.0/-10.0	1879.8	Peak/Bypass		
4.0/-6.0	1710.2	Peak/Bypass		
4.0/-6.0	1710.2	Demod/Bypass		
4.0/-6.0	1710.2	Track and Hold		
4.0/-6.0	1784.8	Peak/Bypass		
4.0/-6.0	1784.8	Demod/Bypass		
4.0/-6.0	1805.2	Peak/Bypass		
4.0/-6.0	1805.2	Demod/Bypass		
4.0/-6.0	1879.8	Peak/Bypass		
4.0/-6.0	1879.8	Demod/Bypass		
16.0/6.0	1710.2	Peak/Bypass		
16.0/6.0	1879.8	Peak/Bypass		
33.0/23.0	1710.2	Peak/Bypass		
33.0/23.0	1879.8	Peak/Bypass		
38.0/28.0	1710.2	Peak/Bypass		
38.0/28.0	1879.8	Peak/Bypass		
41.0/31.0	1710.2	Peak/Bypass		
41.0/31.0	1879.8	Peak/Bypass		
44.0/34.0	1710.2	Peak/Bypass		
44.0/34.0	1879.8	Peak/Bypass		
47.0/37.0	1710.2	Peak/Bypass		
47.0/37.0	1879.8	Peak/Bypass		
---/40.0	1710.2	Peak/Bypass		
---/40.0	1879.8	Peak/Bypass		

Input power nom. (dBm)	Input frequency (MHz)	Instrument setting	Specification (dB)	Measured power (dBm)
PCS-1900				
0.0/-10.0	1850.2	Peak/Bypass		
0.0/-10.0	1989.8	Peak/Bypass		
4.0/-6.0	1850.2	Peak/Bypass		
4.0/-6.0	1850.2	Demod/Bypass		
4.0/-6.0	1850.2	Track and Hold		
4.0/-6.0	1909.8	Peak/Bypass		
4.0/-6.0	1909.8	Demod/Bypass		
4.0/-6.0	1930.2	Peak/Bypass		
4.0/-6.0	1930.2	Demod/Bypass		
4.0/-6.0	1989.8	Peak/Bypass		
4.0/-6.0	1989.8	Demod/Bypass		
16.0/6.0	1850.2	Peak/Bypass		
16.0/6.0	1989.8	Peak/Bypass		
33.0/23.0	1850.2	Peak/Bypass		
33.0/23.0	1989.8	Peak/Bypass		
38.0/28.0	1850.2	Peak/Bypass		
38.0/28.0	1989.8	Peak/Bypass		
41.0/31.0	1850.2	Peak/Bypass		
41.0/31.0	1989.8	Peak/Bypass		
44.0/34.0	1850.2	Peak/Bypass		
44.0/34.0	1989.8	Peak/Bypass		
47.0/37.0	1850.2	Peak/Bypass		
47.0/37.0	1989.8	Peak/Bypass		
---/40.0	1850.2	Peak/Bypass		
---/40.0	1989.8	Peak/Bypass		

6.1.2 Continuous Wave; RF IN 2

Note: some levels may be omitted

Specification: see program
Measurement uncertainty:

Input power nom. (dBm)	Input frequency (MHz)	Specification (dB)	Measured power (dBm)
GSM			
0.0	800.067		
0.0	890.067		
0.0	914.867		
0.0	935.267		
0.0	959.867		
0.0	1000.067		
-17.0	890.067		
-17.0	959.867		
-37.0	890.067		
-37.0	959.867		

Input power nom. (dBm)	Input frequency (MHz)	Specification (dB)	Measured power (dBm)
DCS-1800			
0.0	1710.267		
0.0	1784.867		
0.0	1805.267		
0.0	1879.867		
-17.0	1710.267		
-17.0	1879.867		
-37.0	1710.267		
-37.0	1879.867		

Input power nom. (dBm)	Input frequency (MHz)	Specification (dB)	Measured power (dBm)
PCS-1900			
0.0	1850.267		
0.0	1909.867		
0.0	1930.267		
0.0	1989.867		
-17.0	1850.267		
-17.0	1989.867		
-37.0	1850.267		
-37.0	1989.867		

6.2 Log. Amplifier (Option B42)

6.2.1 Filter and Attenuator

Instrument setting: internal measurement

	Filter	Attenuator
Filter Bandwidth (kHz)	Result	Result
30.0		
100.0		

6.2.3 Dynamic

Specification: see table
Measurement uncertainty:

Input	Input level nom. (dBm)	Specification (dBm)	Measured power (dBm)
GSM			
(f = 903 MHz)			
RF IN/OUT	10.0/0	8.0 .... 12.0	
RF IN/OUT	-36.0/-46.0		
RF IN/OUT	off	<= - 60	
RF IN 2	-10.0	-12.0 .... -8.0	
RF IN 2	0.0		
RF IN 2	-72.0		
RF IN 2	off	<= - 75	
RF IN 2	-37.0	-39.0 .... -35.0	
RF IN 2	-83.0		
RF IN 2	off	<= - 95	
DCS-1800			
(f = 1755 MHz)			
RF IN/OUT	0.0/-10.0	-2.0 .... 2.0	
RF IN/OUT	-36.0/-46.0		
RF IN/OUT	off	<= - 60	
RF IN 2	-10.0	-12.0 .... -8.0	
RF IN 2	-72.0		

6.4 Down Converter SAW Filter

Specification: see program
Measurement uncertainty:

	Input frequency (MHz)	Input level (dBm)	Specification	Actual value
Dynamic				
	948.06	-10.0		
	948.0	-10.0		
	948.0	-40.0		
	948.0	-60.0		
	948.0	-100.0		
Filter				
	947.865	-10.0		
	948.135	-10.0		
	947.5	-10.0		
	948.5	-10.0		
	947.3	-10.0		
	948.7	-10.0		

8 AF Processing

8.1 AF Unit Quick Check

Result

8.2 AF Generator

Specification: see table
Measurement uncertainty:

Output frequency (Hz)	Output level (mV)	Specification (mV)	Actual value
1000	0.1	± 0.015	
1000	1.0	± 0.05	
50	1000.0	± 50.0	
1000	1000.0	± 50.0	
10000	1000.0	± 50.0	
1000	5000.0	± 250.0	
1000	0.1	± 0.015	

Output frequency (Hz)	Distortion (%)	Actual value
1000	< 0.5	
1000	< 0.5	

8.3 AF Voltmeter and AF Counter

Specification: see table
Measurement uncertainty:

Input frequency (Hz)	Input level (mV)	Specification Voltmeter (mV)	Actual value	Specification Counter (Hz)	Actual value	Specification Distortion (%)	Actual value
50	0.1	± 0.05		---		---	
10000	0.1	± 0.05		---		---	
50	10.0	± 0.5		± 2		---	
10000	10.0	± 0.5		± 2		---	
1000	100.0	± 5.0		± 2		< 0.5	
1000	1000.0	± 50.0		± 2		< 0.5	
1000	10000.0	± 500.0		± 2		< 0.5	

8.4 IF Counter

Specification: see table
Measurement uncertainty:

Input frequency	Input level	Specification Counter	Actual value
10.0 kHz	100.0 mV	± 2 Hz	
60 MHz	7 dBm	± 2 Hz	

9 ABIS

Test	Result
Symmerical	
Asymmerical	
Asymmerical	

10 Final Tests And Measurements With Mobile

10.1 Location Update, Setup

Mode	Test	Result
GSM	Location Update	
GSM	Setup	
DCS 1800	Location Update	
DCS 1800	Setup	

10.2 Call From CMD --> Mobile

Mode	Test	Result
GSM	Connection	
GSM	Measurements	
DCS 1800	Connection	
DCS 1800	Measurements	

10.3 Call From Mobile --> CMD

Mode	Test	Result
GSM	Connection	
GSM	Measurements	
DCS 1800	Connection	
DCS 1800	Measurements	

Supplements to Operating Manual CMD52 / CMD55 (SW version V3.30)

General

Designations of the various GSM bands have been adapted to the modified international designations.

Old designation	New designation
GSM	GSM900
DCS1800	GSM1800
PCS1900 or DCS1900	GSM1900

Besides the P-band (channel numbers 1 to 124), E-GSM (channel numbers 975 to 1023 and 0) is now also supported in GMS900 signalling operation. If CMD-K80 is built in, R-GSM (channel numbers 955 to 974) is also supported.

Remote-Control Command (only with CMD55)

In the remote-control mode the original settings remain unchanged. Settings **GSM900**, **GSM1800, GSM1900, G900, G180** and **G190** are also permissible. When the network is polled, the previous return values will continue to be output for the sake of compatibility.

on 2.4.6.9 Configuration Menu NETWORK DEFINITION

Dual-Band Handover (only with CMD55)

In this menu, the HANDOVER type may now be defined under page 2. The key HANDOVER NETWORK defines the bands between which handover is allowed to take place. If two GSM bands are selected, channel switchover into the other band (by means of an assignment command) can be performed, ie the mobile continues its search for the control channel in the original GSM band. During signalling operation, channel switchover is effected by entering the appropriate channel number.

The following settings are possible for the individual networks:

Network	Position	Meaning
GSM900	GSM900	Chan. switchover possible within the GSM900 band only.
	GSM900/GSM1800	Channel switchover in GSM900 and GSM1800 bands is possible provided it is permitted by the linked-up mob. 1)
	GSM900/GSM1900	Channel switchover in GSM900 and GSM1900 bands is possible provided it is permitted by the linked-up mob. 1)
GSM1800	GSM1800	Chan. switchover possible within the GSM1800 band only.
	GSM900/GSM1800	Channel switchover in GSM900 and GSM1800 bands is possible provided it is permitted by the linked-up mob. 1)
GSM1900	GSM1900	Chan. switchover possible within the GSM1900 band only.
	GSM900/GSM1900	Channel switchover in GSM900 and GSM1900 bands is possible provided it is permitted by the linked-up mob. 1)

Notes

1) If the speech channel is on a different band, no control channel is transmitted.

The key HANDOVER CHECK switches on and off the handover check for the connected mobile between GSM900 and GSM1800. The OFF position saves time in the remote-control mode.

If CMD-U20 is built in, the key HANDOVER MODE defines whether the control channel in the original band is to be maintained or suppressed after handover to another band. The control channel in the original band can be maintained only if the CMD level accuracy is reduced (control and traffic channel). To obtain accurate BER measurements the full level accuracy should be selected. In the setting with control channel, mutual interference might occur depending on the selected channel numbers for the control and traffic channel. Therefore, not all channel number combinations are permissible in this setting.

Advice of Charge

Softkeys E1 to E7 may be used for setting the parameters for information on charges. If 0 (default) is indicated for all parameters, no information on charges is transmitted to the mobile.

Remote-Control Commands

Parameters for advice of charge

Syntax:	CONFigure:SIGNalling:AOC:EPARameter <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>			
Range:	0 to 8191	for each E parameter (E1 to E7)		**Default:** all 0
Status: Setting: IDLE, MSYN Polling: ALL	**Option:** none	With query	**Notes:** If all E parameters are set to 0, advice of charge will not be signalled to the mobile.	
Available from sw version:	**CMD50/53 and CMD52/55 with 4 MB:**---	**CMD52/55 with 8 MB:**3.30		

Networks for dual-band handover

Syntax:	CONFigure:SIGNalling:HANDover:NETWORK <value>			
Range:	GSM900: SING | D180 | D190 |	Handover not permitted, only channel switchover in GSM Handover possible between GSM900 and GSM1800 Handover possible between GSM900 and GSM1900		**Default:** D180
	GSM1800: SING | D180 |	Handover not permitted, only chan. switchover in GSM1800 Handover possible between GSM900 and GSM1800		D180
	GSM1900: SING | D190 |	Handover not permitted, only chan. switchover in GSM1900 Handover possible between GSM900 and GSM1900		SING
Status: Setting: IDLE Polling: ALL	**Option:** CMD55 only	With query	**Notes:** • Dual-band handover is not supported for the UIC network. • In the adjacent-channel list and for channel switchover (dual-band handover) channels allowing dual-band handover are excepted by the networks.	
Available from sw version:	**CMD50/53 and CMD52/55 with 4 MB:**---	**CMD52/55 with 8 MB:**3.30		

Checking the dual-band handover with GSM900/GSM1800

Syntax:	CONFigure:SIGNalling:HANDover:CHECK <value>			
Range:	ON | OFF	with handover check of the mobile without handover check of the mobile		**Default:** ON
Status: Setting: IDLE Polling: ALL	**Option:** CMD55 only	With query	**Notes:** • Dual-band handover is not supported for the UIC network. • The selected setting is taken into account when a handover between GSM900 and GSM1800 is selected.	
Available from sw version:	**CMD50/53 and CMD52/55 with 4 MB:** - --	**CMD52/55 with 8 MB:**3.30		

Dual-band handover mode of the CMD-U20

Syntax:	CONFigure:SIGNalling:HANDover:MODE <value>			
Range:	BCCH | LEVel	with control channel after handover (reduced level accuracy) without control channel after handover (full level accuracy)		**Default:** ON
Status: Setting: IDLE Polling: ALL	**Option:** U20	With query	**Anm.:** • Dual-band handover is not supported for the UIC network. • BER measurements should be performed in the LEVel position.	
Available from sw version:	**CMD50/53 and CMD52/55 with 4 MB:** - --	**CMD52/55 with 8 MB:**3.30		

on 2.4.6.10 Configuration Menu BA LIST

E-GSM channels (975 to 1023 and 0) may now also be entered in the GSM900 band. If CMD-K80 is buitl in, the R-GSM channels (955 to 974) may also be entered.

If a handover between the two bands has been selected in the NETWORK DEFINITION menu, the channel number of the other band may also be entered.

Scrolling through the channel list is done by means of softkeys PREV. PAGE and NEXT PAGE.

on 2.4.5.1 Menu BURST ANALYSIS

In the BURST ANALYSIS menu, the softkey TRAINING SEQUENCE serves for selecting the training sequence to be used. If OFF is selected for this key, the burst analysis function is made available also for signals without training sequence, which means that bursts without training sequence can also be analyzed.

As in this case no training sequence is available for positioning the burst, a level value from the rising slope of the burst is used in the POWER TRIGGER MODE. In the FREE RUN TRIGGER MODE, the burst can be positioned anywhere.

When measuring spectrum due to modulation, exact positioning of the burst is necessary. This measurement cannot therefore be performed in the FREE RUN TRIGGER MODE, if the training sequence is deactivated.

To go back to evaluation with training sequence, ON is selected for TRAINING SEQUENCE or the desired training sequence number entered.

Remote-Control Command

Training sequence codes

Syntax:	CONFigure:CHANnel:BANalysis:TSC <numeric_value>		
Range:	0 to 7 | ON | (1) OFF (1)		**Default:** 0
Status: ALL	**Option:** none	With query	
Available from software version:	**CMD50/53 and CMD52/55 with 4 MB:** 1.60 (1) -.--	**CMD52/55 with 8 MB:** 3.00 (1) 3.21	

on 2.4.3.1 Menu POWER RAMP

If the burst analysis is set to module test without training sequence, only a single burst can be analyzed at a time. This is why in this mode the softkeys DISPLAY MODE and NO. OF BURSTS are not active. As in this case no training sequence is available for positioning the burst, the ramp position can be shifted during measurements using the spinwheel or entering a number under SHIFT RAMP. If the measurement has stopped (POWER RAMP key no longer selected), the SHIFT RAMP value cannot be varied.

Remote-Control Command

Shifting the power ramp during burst measurements without training sequence

<table>
<tr><td>Syntax:</td><td colspan="5">CONFigure:BANalysis:NTSC:RAMP:TIMing <numeric_value></td></tr>
<tr><td>Range:</td><td colspan="4">-50 to +50 (in steps of 1/4 bit)</td><td>Default: 0</td></tr>
<tr><td>Status: ALL</td><td>Option: B4</td><td>With query</td><td colspan="3">Note: Only effective in module test after CONF:CHAN:BAN:TSC OFF, and then for all burst measurements.</td></tr>
<tr><td colspan="2">Available from software version:</td><td colspan="2">CMD50/53 and CMD52/55 with 4 MB: ---</td><td colspan="2">CMD52/55 with 8 MB:3.21</td></tr>
</table>

on 2.4.3.2 Menu PHASE FREQUENCY

If the burst analysis is set to module test without training sequence, only a single burst can be analyzed at a time. This is why in this mode only the CURRENT values for frequency and phase error are output.

new Menu OTHER CONFIGURATION PARAMETERS

In addition to settings ON and OFF for AUTORANGING, setting TOL is now also available. In this setting, the test assembly is set so that higher power variations are accepted prior to performing a new autoranging. This setting is useful if the DUT is coupled via an antenna. It has to be noted that the test accuracy and the dynamic range in setting TOL deteriorate and no longer correspond to the specified data-sheet parameters. Moreover, it is possible that measurements performed in setting TOL are erroneous while correct measurements are possible in the other settings. For this reason, setting TOL should only be used if the coupling is subject to strong variations.

In remote control, the tolerant autoranging is set via the setting value TOL.

Supplement to Operating Manual CMD52 / CMD55
(software version V3.31 and higher)

Configuration Menu TOLERANCE

The following settings can now be selected with the RAMP TIMING key and the rotary knob:

GSM:	GSM-conforming positioning (default).
½ BIT OFFSET:	Positioning shifted by ½ bit.
PREVIOUS TEMPLATE:	Ramp timing like in software versions < V3.30 (offset by ¼ bit at template positions B-C, C-D, end of F and H-A compared with position GSM).

Remote-control command CONFigure:RAMP:TIMing <value>:
Besides settings GSM and OFFSET setting PREV is now also available.